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THE NEW POLITICAL GEOGRAPHY OF INNER ASIA

OWEN LATTIMORE

INNER ASIA may be described as a group of regions that have neither a frontage on the sea nor navigable rivers leading to the sea. Under this definition northern, but not southern Iran, and western, but not eastern, Manchuria may be regarded as Inner Asian regions. Most of Inner Asia either touches or stands astride of the Soviet frontier in Asia—the longest frontier in the world, stretching from Turkey to Korea. Tibet, lying distant from Russia, is a notable exception to this rule.

An important characteristic of Inner Asia is that most of its political frontiers do not mark the edges of territories inhabited by peoples who differ from each other in language, economic activity, social organization, and in the kind of group loyalty that is founded on a feeling of kinship. They divide kindred peoples from each other and place them under different political sovereignties. As a consequence there is an important difference in the political geography of the frontier zone as between Inner Asian regions and other regions; in Western Europe, for example, where different peoples have lived in adjoining territories for many centuries. This contrast is shown diagrammatically for the French–German frontier in Figure 1, and for the Russian–Mongol–Chinese frontier in Figure 2.

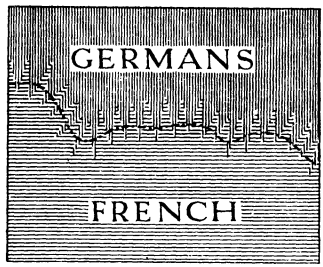


Figure 1

Both sketches are drawn to illustrate a phenomenon of great importance in political geography: the fact that the difference between two neighbouring peoples is usually nowhere near as sharp as the line drawn on the map. Normally, the frontier "line" is in fact a legal abstraction; what exists on the ground is not a line but a zone—but there can be more than one kind of zone.

A man going on foot from France to Germany, walking not more than 20 or 30 miles a day, finds himself at first among people who, allowing for provincial differences, may be called "standard" Frenchmen. As he goes along, he finds a gradual increase in the intermingling of those characteristics that, taken as a group or complex, we call "German" and those we call "French"; first a larger number of loan-words in the local dialect, then more bilingual people; a gradual increase, in territory politically French, of house-types and cultivation practices that are usually associated with Germany, and so on. At or near the frontier line of the map he finds the maximum intermingling of French and German; then, as he goes on, a shading off through Germans with decreasing marks of French influence, until he is among "standard" Germans.[1]

[1] For some observations on phenomena of this kind, made by a man going on foot from the fringes of Germanic Europe toward Latin Europe, see Hilaire Belloc, 'The path to Rome,' London, 1902.

In the mingling that takes place on such a frontier there is a tendency toward the formation of a frontier people, having not only identifiable geographical location but recognizable political characteristics, different from those of the two adjoining "standard" peoples. These peculiarities are registered in our vocabularies in such terms as 'Borderers,' 'Marchmen' and 'Grenzleute,' echoing the fact that historically the political loyalties of frontier populations have on occasion been of decisive importance. The man of the border may at times be even more intensely and fiercely loyal than most of the "standard" people with whose country he identifies himself; but perhaps more important, if one judges the characteristics of a frontier population by its group behaviour rather than by the behaviour of outstanding individuals, is the phenomenon of equivocal loyalty and the tendency to go with the winning side.

Figure 2, which is based on the fact that for a long time there was a nominal linear frontier between China and Russia, and which therefore disregards, for the purposes of the present stage of the discussion, the separate political sovereignty of Outer Mongolia, illustrates a different kind of frontier zoning. Among the French–German marchmen there can be distinguished a group which combines the maximum of both "Frenchness" and "Germanness." On the Russian–Mongol–Chinese frontier this is replaced by a group that shows the minimum of either "Russianness" or "Chineseness." The traveller from China to Russia leaves "standard" Chinese behind him as he enters Inner Mongolia. He passes through a zone of Chinese colonists showing at first very faint and then somewhat increasing Mongol influences; then a zone of maximum Chinese–Mongol combination; then a zone of Mongols showing progressively decreasing Chinese influence in the way of houses instead of tents, practice of agriculture, knowledge of the Chinese language, and use of Chinese loan-words in the local Mongol dialect. When he reaches Outer Mongolia, he is in the zone of "full Mongolness." Speaking schematically, and disregarding for the moment very recent Russian influence in Outer Mongolia, he has in this zone left everything Chinese behind but has not yet encountered anything Russian. As he goes on north however and approaches and enters Buryat Mongolia, he passes through zones of increasing Russian influence, maximum Russian–Mongol combination, decreasing Mongol influence, until he finally reaches a fully Russian territory.

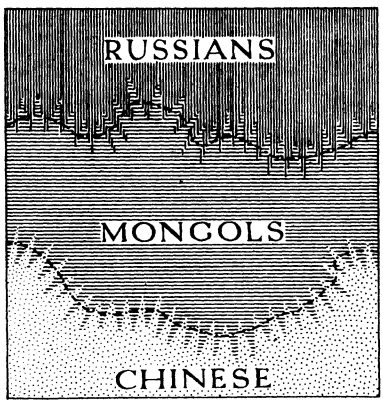


Figure 2

This schematic zoning of the Russian–Mongol–Chinese frontier is repeated in Sinkiang, where again there is a zone of minimum Russian and Chinese influence.[1] The triumph of the Chinese Communists has brought about one

[1] Most of the Russian frontier with Manchuria, except for the Barga region, which

major change which now distinguishes the Soviet frontier with Sinkiang and Mongolia from the Russian frontiers with Afghanistan, Iran and Turkey. Whereas the Mongols of Outer and Inner Mongolia and the Turco-Mongol peoples of Sinkiang were until then sandwiched between Russian and anti-Russian, Communist and anti-Communist governments, they are now enclosed between governments that are controlled by Communists and closely allied with each other.

West of Sinkiang, the old pattern still stands. Afghanistan is a multi-national state, its northern fringes inhabited by minority peoples. The Kirghiz of the Wakhan Pamir of Afghanistan are identical with the Kirghiz of the Russian Pamirs. The Afghan Tajiks are identical with the Tajiks of adjoining Soviet Tajikistan. Farther west, the Turkish-speaking groups on the northern frontier of Afghanistan are more similar to the Turkish-speaking peoples of adjoining Soviet Uzbekistan and Turkmenistan than they are to the majority groups of Afghanistan, which speak Persian and Pashtu.

In Inner Asia the tendency toward equivocal loyalty and the tendency to try to go with the winning side at moments of crisis is enhanced by the fact that the divided frontier people has no sense of kinship with either of the major nationalities between which it is divided. This condition underlies what has been called the "axiom of frontier administration that a tribe or group of tribes situated between two comparatively powerful States must be under the influence of one or other of these " [1]—for where the sense of kinship does not operate, other forces, such as military power, class interest, or the opportunity for an individual career act all the more strongly.

The former stabilization of the frontiers

This "multiple" zoning of Inner Asian frontiers is accounted for by the expansion toward each other of the Russian and Manchu Empires in the seventeenth and eighteenth centuries, the expansion of the Russians toward Iran, Afghanistan and India, culminating in the nineteenth century, and the projection of the power of Great Britain toward the inland frontiers of China and the Inner Asian frontiers of Russia, also in the nineteenth century—a projection based partly on India and partly, as in the case of Iran, on naval power. The mutual suspicions excited by expansion were most acute in the nineteenth century. Then, at the turn into the twentieth century, there came a remarkable stabilization, remarkable because it resulted in very nearly the maximum satisfaction to Russia, China and Great Britain alike.

Four principal events deserve to be called the pillars of this stabilization. First, by the Anglo-Russian Pamir Boundary settlement of 1895, the Russian and British Empires were separated by allocating to Afghanistan a narrow corridor of territory joining up with territory which both were willing to recognize as Chinese, thus extending previous agreement on the delimitation

in both political and physical geography is an eastward extension of Mongolia, does not belong to Inner Asia and will therefore not be discussed here. Most of this frontier is marked by the Amur and Ussuri rivers, and shares the general characteristics of river frontiers. The tribal remnants of peoples that are neither Russian nor Chinese are here not numerous enough to form a screen between Russians and Chinese.

[1] Quoted, without identification, from "an eminent statesman," by Sir Kenneth Wigram, "Defence in the North-west Frontier Province," *Journal of the Royal Central Asian Society*, Vol. 24, 1937, p. 74.

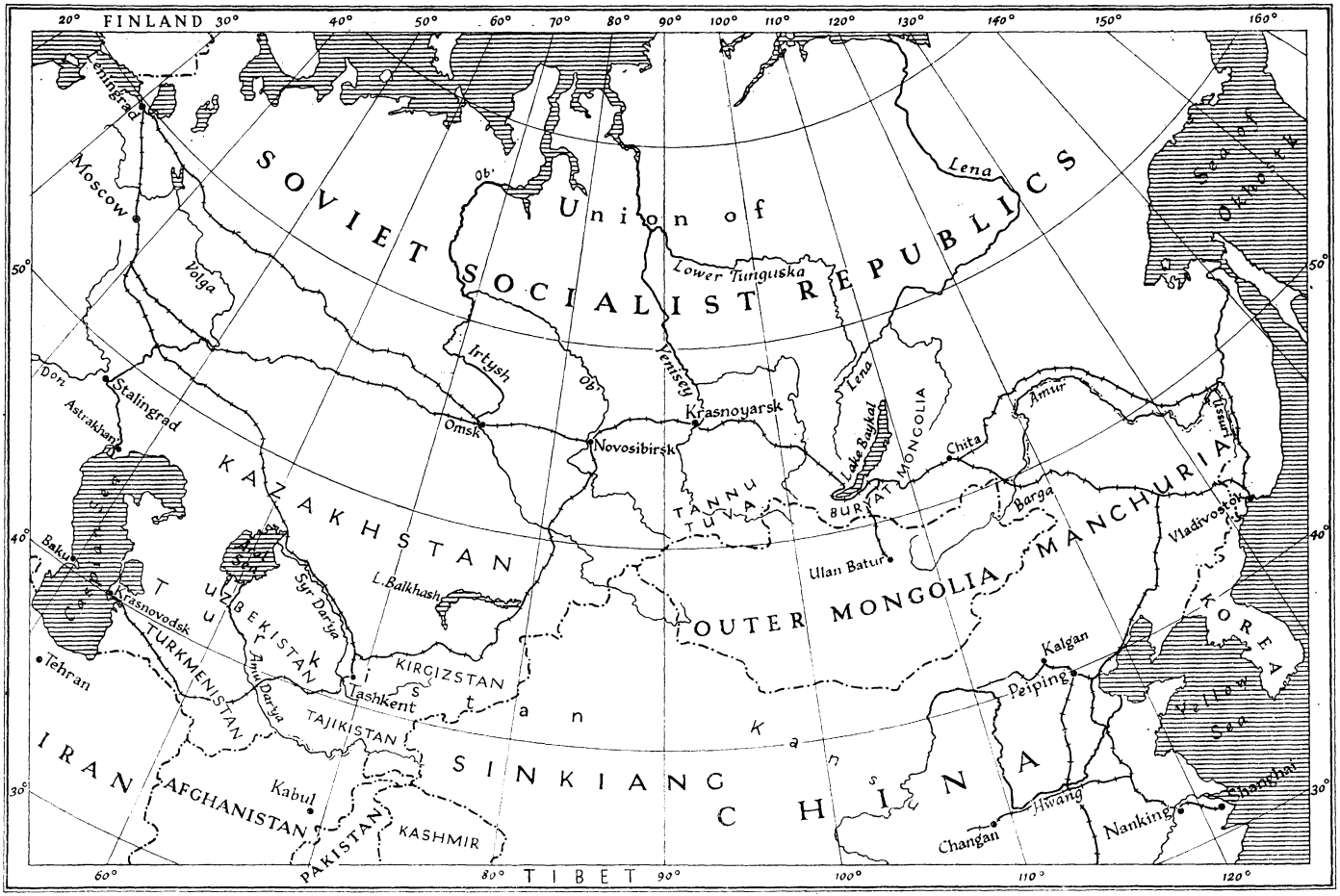
of the northern frontier of Afghanistan. Secondly, the Younghusband Expedition to Lhasa in 1903–4 initiated a firm outline of British policy in Tibet: the British in India to have direct access to Tibetan authorities; in negotiations between Britain and China concerning matters of direct Indian-Tibetan interest, the British recognized the right of the Tibetans to have participating representatives; while the British, of their own volition, would not convert access to Tibet into occupation of Tibet. Thirdly, by the important Anglo-Russian Convention of 1907, both countries agreed not to penetrate Tibet and rivalry over Afghanistan was eliminated. Persia (Iran) was divided into a northern zone in which Britain would seek no concessions and oppose no concessions made to Russia, a middle zone in which both countries might seek concessions, and a southern zone to be dominated by Britain. Finally, in 1911, in connection with the Chinese Revolution and the parallel revolution in Outer Mongolia against both Manchu and Chinese rule, the Russians inaugurated an Outer Mongolian policy that was a remarkable parallel to the British policy in Tibet. I do not know of any comparative study of these two policies, but such a study would be a contribution of great value to our understanding of the conditions in which an empire deliberately ceases to expand. The Russian policy included the right of direct access to Outer Mongolia, Outer Mongolian representation in discussions between Russia and China about Mongolia, no annexation, and discouragement of pan-Mongolianism—that is to say, no detachment of Chinese-ruled Inner Mongolia for the purpose of attaching it to Outer Mongolia. This policy was reinforced by secret agreements with Japan (since published), deliminating the Japanese sphere of influence in eastern Inner Mongolia.[1]

It was in the midst of this process of stabilization, and before it had been completed, that Sir Halford Mackinder first drafted his concept of a world political geography based on stabilization of the balance between sea-power and the "heartland" through the midst of which runs the Russian frontier in Asia. His thinking, throughout the rest of his long life, continued to be directed toward stabilization; the great shifts of power consequent on the First and Second World Wars could, he believed, still be readjusted to continue the general stabilization achieved at the turn of the century.[2]

A pregnant sentence in Mackinder's first outline of his theory, in 1904, is the key to the counter-theories of Haushofer and the German geopoliticians. Mackinder wrote: ". . . it may be well expressly to point out that the substitution of some new control of the inland area for that of Russia would not tend to reduce the geographical significance of the pivot position." Because of his concern for the balance between land-power and sea-power he did not like the idea that the Chinese might some day control this pivot area; that, he thought, "might constitute the yellow peril to the world's freedom just

[1] Ernest B. Price, 'Russo–Japanese treaties of 1907–1916 concerning Manchuria and Mongolia,' Baltimore, 1933.

[2] The principal references are: (Sir) Halford J. Mackinder, "The geographical pivot of history," *Geogr. J.* 23 (1904) 4; 'Democratic ideals and reality,' London, 1919, reprinted with text unaltered, New York, 1942; "The round world and the winning of the peace," *Foreign Affairs*, New York, July, 1943, reprinted in slightly different form in 'Compass of the world,' ed. H. W. Weigert and V. Stefansson, New York, 1944.


FINLAND
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Moscow
SOVIET SOCIALIST REPUBLICS
Union of
Volga
Ob'
Lena
Sea of Okhotsk
Lower Tunguska
Irtysh
Ob
Yenisey
Don
Stalingrad
Astrakhan
Omsk
Novosibirsk
Krasnoyarsk
Lake Baykal
BURYAT MONGOLIA
Chita
Amur
Ussuri
KAZAKHSTAN
TANNU TUVA
Caspian Sea
Baku
Aral Sea
Syr Darya
L. Balkhash
Ulan Bator
Barga
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because they would add an oceanic frontage to the resources of the great continent." [1]

Haushofer's ideas consisted largely in taking the very factors on which Mackinder counted as the props of stability and using them to upset, in Germany's favour, Mackinder's postulated stabilization between Britain and Russia. Mackinder, in his 1904 paper, wrote that "The oversetting of the balance of power . . . would permit the use of vast continental resources for fleet-building, and the empire of the world would then be in sight. This might happen if Germany were to ally herself with Russia." It was precisely such a combination of Germany and Russia that Haushofer wanted; his geopolitics inspired Hitler's cry: "If I had the Ukraine"—though Hitler substituted the ambition of conquering Russia for Haushofer's hope of alliance with Russia.[2]

Our problem to-day is to compare the new political geography of Inner Asia with that effected by the stabilization of half a century ago and to determine, if possible, whether the changes that have taken place since the Second World War are still susceptible to Mackinder's ideas of a kind of stabilization that is modified, but not swept away, by change.

Mackinder founded his superstructure of political geography on a stabilization of strategic and economic geography. The Anglo-Russian agreement on the Pamirs had been preceded by years of exploration which had provided the reassuring knowledge that, at this back door of India, there were no routes through the great mountain masses for wheeled artillery or large modern armies with heavy equipment. The stabilization in Tibet was based on the realization that Tibet was a similar barrier, and contained no numerous and warlike frontier tribes; simply by not advancing into Tibet, India could be saved the expense of maintaining on her north-east frontier the military establishment necessary on the north-west. The stabilization in Iran was based on the frank allocation to Russia of a zone in the north strategically dominated by the Russian Army, a zone in the south where control was assured by British sea-power, and a neutral zone between. The stabilization in Mongolia was based on the assurance that the Russians wanted Mongolia to remain a wide buffer, not to be actively developed, and did not propose to use it as a forward area for the preparation of an advance against Japan's sphere of influence in south Manchuria.

Economically, the situation of half a century ago was one of virtual stagnation. Though they differed in the modes in which they gathered strength within themselves and expanded, the empires of Russia, China and Britain all encountered geographical limits of diminishing returns, and in Inner Asia these limits roughly coincided.

Chinese expansion was limited by the ability to absorb non-Chinese populations. Throughout their history, the Chinese have been willing to accept as Chinese any barbarian who would drop his language and learn Chinese, wear Chinese clothes, farm like a Chinese and accept the other

[1] Writing on the eve of the Russo-Japanese War, Mackinder was able to think of the Chinese only in terms of their being "organized by the Japanese."

[2] For a useful discussion of the ideas of Mackinder and Haushofer in comparison and contrast, see Hans W. Weigert, 'Generals and geographers,' New York, 1942.

conventions of being a Chinese. Toward the south, the Chinese were able to expand to an almost indefinite depth because they found in their southern territories tribes which, in agriculture and the evolution of their social systems, were still in phases through which the Chinese themselves had already passed. Such peoples could be absorbed by a process of accelerated evolution, in contact with the Chinese culture, to the levels prevailing among the Chinese. They could, in fact, be called "not yet Chinese," to distinguish them from the non-Chinese peoples of Inner Asia.[1]

As they expanded toward Inner Asia, the Chinese encountered kinds of terrain that could not be mastered by the characteristic Chinese techniques, confronting them with the alternative of either changing their direction of specialization, thus becoming less Chinese, or ceasing to expand. The inhabitants of the Tibetan heights and the Mongolian plateau engaged in farming in a limited number of sheltered valleys only. Most of them lived by "extensive" economic practices (herding, with a fringe of hunting), and trade among them depended on relatively long caravan journeys, in contrast to the "intensive" Chinese practices of irrigation wherever possible, multiple cropping, and short distances to market between towns and their surrounding countryside. The two forms of society, one dispersed and the other concentrated, were alternative, and could not be amalgamated. Accordingly, when Tibetan highlanders or Turco-Mongol herdsmen invaded China they abandoned their old practices, took up those of the Chinese, and rapidly "became Chinese," in all respects, including language; but when Chinese moved into typically Tibetan or Mongol terrain, it was they who "became barbarians," and with equal rapidity.

Sinkiang was a partial exception. The structure of a Sinkiang oasis, with its walled town or towns and irrigated, closely cultivated fields was comparable to the Chinese "cellular" [2] unit of town and surrounding countryside. It is not surprising therefore that while the Chinese were content with indirect control, supervision and manipulation of local potentates in Tibet and Mongolia, the tendency in Sinkiang was toward direct administration under the Chinese civil service.

These comparisons explain why Chinese expansion toward the south and south-west never reached a zone of diminishing returns, as it did in Tibet, Turkistan and Mongolia. It is true that over a long period of history Chinese armies have at various times campaigned successfully deep in Outer Mongolia and far into what is now Russian Central Asia; but such campaigns were primarily for the purpose of breaking up threatening concentrations of tribal power in the trans-frontier, not for the purpose of acquiring new territory, administering it directly, and integrating it closely with China. It was all too obvious that to go beyond the zone of diminishing returns did not result in an accretion of strength or wealth, but in a drain on the economy of China proper. In the seventeenth and eighteenth centuries, when the Manchus established overlordship in Outer Mongolia, Sinkiang and Tibet, they were

[1] *Cf.* Owen Lattimore, 'Inner Asian frontiers of China,' 2nd ed., New York, 1951, p. 56.

[2] In 'Inner Asian frontiers of China,' cited above, pp. 39–40, I called these units "compartments."

able to mobilize very great striking forces; but there is no evidence that, even if they had not encountered the expanding power of Russia, they would have attempted to push their own expansion farther. They halted roughly along what had been, throughout Chinese history, the classical line of maximum expansion.

Like the Manchu-Chinese Empire, the Russian Empire did not spread beyond its ocean shores. Alaska, the one exception, was given up. As in the Chinese Empire, the power of the state stood within one vast, continuous land-mass and, theoretically, could be applied as autocratically at the confines of empire as at the heart. The economic and social texture of the two empires however was different. Russian agriculture was much more extensive than that of the Chinese; irrigation was insignificant, and the use of forest products and livestock much greater. Walled cities there were; but there was not the same concentrated landscape of frequent walled towns, each with a closely settled, closely cultivated area grouped tightly around it; and, on the contrary, the vast feudal estate in the struggling Russian countryside was far more frequent than in all but a few outlying areas of China.

The mode of growth was also different. The Russians "incorporated" where the Chinese "absorbed." For many centuries there was an ebb and flow of conquests between South Russia and the Inner Asian steppes. When the Slavs were defeated, Turco-Tatar-Mongol khans had the upper hand; but they admitted Slav chieftains and nobles to the lower ranks of their own nobility. When the final conquests went in favour of the Russians, they in turn took into their service chieftains of the Asian steppes. Whichever way the tide turned, there was no race prejudice; there was intermarriage both among commoners and among nobles. An outcome of this long process was that class politics became more obvious and familiar than race prejudice through the phenomenon of the man or family of the ruling class who went over to the winning side in time, in order to avoid losing everything, instead of fighting to the end.

From the early Cossack expansion of the sixteenth century to the final Russian conquests in Inner Asia in the nineteenth century, the outcome was a state in which the ordinary, unprivileged person, whether he spoke Russian or Turkish, was a subject rather than a citizen, while the privileged classes were privileged regardless of language, religion or other cultural characteristics. By the time the Russian Revolution broke out, therefore, the lines of cleavage between Russians and non-Russians were less sharp than those between privileged and unprivileged, and the Tsarist forces in Inner Asia were largely defeated, not by national movements against Russian rule, but by a kind of civil war in which the privileged non-Russians stood, on the whole, on the Tsarist side, while the unprivileged non-Russians either stood aside from the struggle, as far as they could, or made common cause with the Russian revolutionaries.

Economically, however, the Russian Empire was weakly bound together. As in the case of China, the economics of transportation were important, though in a somewhat different way. There had been a considerable growth of capitalism and industrialization in Russia in the nineteenth century, but it was retarded by sluggish transportation. With the exploitation of overseas

empires and with investment by Europe in North and South America, the cheap carrying of bulk cargoes by water between nations and between continents greatly increased the margin of profit and the rate of capital accumulation and fresh investment in Western Europe. The handlers of capital investment in turn became the most active driving force within the society as a whole—the real "political enterprisers" as well as the men of financial enterprise. In Russia, capital enterprise did not spread with an equal liveliness all over the country; capitalists tended to stay close to the favour and patronage of the court and the great landed aristocracy; and because they sought wealth through patrons they did not acquire within the society the kind of power that would have enabled them to do without patronage. Even when railways were pushed out into the Inner Asian territories acquired in the second half of the nineteenth century, they served industrialization poorly—or rather, the industrialists were slow to use them competently. The moving of cotton from Turkistan to the textile mills of Western Russia and Russian Poland, and of finished cotton goods back to Turkistan, all by rail, was far less profitable than the British importation of cotton and export of textiles by ocean transport.

Largely because of the clumsiness inherent in the Russian combination of patronized capitalism and Tsarist autocracy, the Russian land-contained expansion also had its zone of diminishing returns, and it so happened that this zone coincided largely with the zones of diminishing returns of the Chinese and British Empires. It has long been a convention to describe the Russian potential of expansionism in Asia as illimitable, under Tsarist and Soviet rule alike; but there can be no doubt that Pavlovsky is right in distinguishing, from the eighteenth century right up to the period of the Second World War, between a "colonial" or "activist" group and the "cautious and conservative statesmen" who sought to limit expansion.[1] In the rivalry between these two groups the distinction was worked out, over a period of more than two centuries, between annexable territories and those which, lying in the farther zone of diminishing returns, should not be annexed. It was thus that the trans-Baykal, up to the Amur, and the Maritime Province, east of the Ussuri, were step by step annexed—the final annexation, in 1944, being Tannu-Tuva or Urianghai. As a remarkable instance of the Russian tenacity in holding to a long-term aim of policy, it is to be noted that from the early eighteenth century they had maintained a distinction, in all their dealings with the Manchu-Chinese empire, between Tannu-Tuva and Mongolia. With equal consistency, the "conservatives" always succeeded in maintaining that Mongolia and Sinkiang were not to be annexed.

British expansion towards Inner Asia also had its zone of diminishing returns, eventually reached in mid-Iran, Afghanistan, the Pamir–Karakoram heights, and Tibet. The process of British empire building was accumulative. Its territories were acquired separately, by the combined strategic and economic use of sea-power, and one of its structural principles was that the integration between each part and the centre, in Britain, should be stronger than the integration between the separate parts. India was penetrated from

[1] Michel N. Pavlovsky, 'Chinese-Russian relations,' New York, 1949, especially pp. 28, 32, 45–46, 58.

the sea, and its rail and road net attached the hinterland to the seaports and to international trade. In its economic development, the constantly recurring problem was to find the point at which the overland cost of bringing raw materials, semi-processed, or processed commodities from the hinterland to the ports and into world trade became so high as to offset the cheapness of ocean transport and the economic efficiency of industrial Britain.

It is not astonishing that the economic boundaries thus discovered coincided with the mountains that made convenient strategic frontiers. The turbulent North-west Frontier with Afghanistan provided the Indian Army and part of the British Army with constant training; but if it had been necessary to back the Pamir frontier and the Tibetan frontier with comparable forces, India would have been bankrupted. Hence the desirability of maintaining Tibet as an empty buffer zone between India and China was greater than the desirability of prospecting for minerals there; and hence, also, the desirability of a standstill agreement with Russia in the Pamirs and in Iran.[1]

The present position

Since the First and Second World Wars, all the conditions of stability and stagnation in the frontier regions described above have been destroyed. Around the maritime margin of Asia there is no longer a strong structure of British, Dutch, French and Japanese imperial power, in which the United States participated, as far as China was concerned, under the Open Door principle. The United States, while not itself holding concessions in the Treaty Ports, benefited as much as any other country from such privileges as extra-territoriality, the operation of banks and other enterprises free of Chinese Government control or regulation, in the Treaty Ports, and navigation, including the movement of naval vessels, in the territorial waters and up the rivers of China.

Fifty years ago the strength of this structure around Asia was so great that it gave to such capitals as London, Paris, The Hague, Tokyo and Washington —especially when they were willing to act in conjunction—something closely approximating to a power of decree within Asia. No such power now exists. Even though fighting is now going on in Korea, Indo-China and Malaya, we should delude ourselves if we expected the outcome, in any of these three cases, to be a re-establishment of the power of full control. In each case a holding action is being fought, the best outcome of which must be soberly accepted as no more than an improved position for modifying, by negotiated agreement, the former situation.

Changes in the heart of the continent correspond to those around the margin. India, as an independent republic, cannot base its policies either in Tibet or in the controlled states of Bhutan, Sikkim and Nepal, on the same concepts that underlay British policy. These territories have become part of a "live" and extremely sensitive zone between India, a newly independent

[1] The foregoing comparisons between the Chinese, Russian and British types of empire were first sketched by me in an address before the American Historical Association in Washington, D.C., 29 December 1948, never published in full but cited in condensed form in *Atlantic Monthly*, Boston, March 1949, and in 'Situation in Asia,' Boston, 1949, pp. 14–18.

country, and China, a country under a totally new kind of government in both its domestic policies and its international relations. India and China, as new kinds of state arising in post-war Asia, must necessarily review the whole question of their common land frontiers. The post-war redistribution of power would make such a review necessary regardless of the forms of government in India and China, as is shown by the fact that the succession state of Pakistan has been forced by comparable necessities to take up afresh the entire question of its hinterland frontiers.

Even more sweeping is the change in the old frontier structure between China and Russia. Mongolia and Sinkiang are no longer buffers between China and Russia, nor are they zones of diminishing returns in the expansion of China or Russia. They have become, instead, zones through which communication between China and Russia is imperatively necessary. At present, the only line of rail communication is from Siberia through Manchuria into North China. But, since it must be a major policy aim of the governments of both China and Russia to attach themselves to each other more closely, we must expect in the near future that the Manchurian line will be backed by a second line (not yet announced), through Outer Mongolia from Ulan Batur (already connected with Siberia by rail) to Kalgan, and by a third line, already announced, still deeper in the hinterland, from the Turk-Sib Railway through Sinkiang and Kansu into Western China.

From 1911 to 1920 Outer Mongolia was a satellite of Tsarist Russia, independent in fact of China. From then on, first as a "constitutional monarchy" and then, after the death of the Living Buddha, as the Mongolian People's Republic, it was equally a satellite of Soviet Russia and still more independent of China. Throughout this period there was inevitably a strong element of anti-Chinese feeling in Outer Mongolia: the Mongols retreated into closer association with Russia because of their greater fear of China and, later, of Japan. With attachment to each other now the overriding aim of both China and Russia, it is obvious that no taint of anti-Chinese political feeling will be allowed among the Mongols. The new relationship between China and Russia makes rather unreal the recurring speculation that Outer Mongolia will be annexed as a member of the Soviet Union. Any one of a number of alternative devices could be adopted; one, for instance, might be the reorganization of Mongolia, Sinkiang and Tibet as Federated Republics within a Chinese Union of Republics. The major consideration is that both Chinese and Russians can adopt policies that are locally pro-Mongol, or pro-Sinkiang, as long as local feelings of separate cultural and linguistic identity are clearly subordinated to the overriding need of China and Russia to communicate with, and attach themselves, to each other.

We are accustomed to the concept that economic developments have social and political consequences. In the case of China and Russia however great economic consequences may be expected from the political decision on a strong alliance. The railway history of China is a history of gradual penetration of the hinterland, developing the flow of trade toward the seaports. Sun Yat-sen dreamt of lines through Mongolia and Inner Asia, but in practice the large and immediate return on lines subordinate to coastally oriented trade meant that nothing was done about lines into the deep

hinterland, requiring heavy capital outlay for a possibly long-deferred return.

Present conditions are different. Economically and strategically, China is making a right-angled turn away from the coast and toward Inner Asia. China's only known large oil deposits lie in Kansu and Sinkiang. There are also other mineral deposits in the deep hinterland. The development of industrial complexes is, theoretically, more profitable than the extraction of a single raw material; but much of the north-western territory is either desert or agriculturally poor and thinly populated. It is to be expected that the Chinese, and the Russian planners and technicians working with them, will go a long way toward a policy of moving population to build up industrial centres in the deep hinterland, as an alternative to moving raw materials by expensive overland transportation to the thickly populated coastal provinces.

These considerations enable us to view more clearly the conditions of the Inner Asian frontiers farther to the west, between the Soviet Union and Afghanistan (Soviet territory does not quite touch Pakistan or India, because of the Afghan corridor), and the Soviet Union and Iran and Turkey. Here there still persists that division between communist and non-communist governments that has been wiped out in the zone between China and Russia. Here also there is still the overlap, between different sovereignties, of minority peoples numerically weak but strategically situated.

In this region foreign intervention against the Soviet revolution ceased in 1920, and though local anti-revolutionary resistance continued for a couple of years, especially in inaccessible desert and mountain regions, the strategic frontiers were thenceforth clearly dominated by the Soviet Union. By the end of the Second World War, the degree of dominance had become more indisputable.

Within this period, economic and industrial development on the Soviet side of the frontier underlay the growth of strategic power. In Turkey there were also changes that made the country quite different from what it had been before 1914, both in its foreign policy and in the internal structure of political loyalties. In Iran and Afghanistan however virtual stagnation continued.

Thus in analysing the change from an assumption of permanence to an atmosphere of wariness along the vast chain of Inner Asian frontiers, we must clearly take into account the political effect on men's minds not only of changing ratios of strategic power but of change or lack of change in their daily lives. On the one hand in Soviet territory and to a significant degree in Turkey there were changes in traditional occupations and the opening up of new opportunities. In a changing society, the individual could climb to positions of prestige, which gave him social satisfaction and promoted a willingness to support the kind of state offering these opportunities. On the other hand we must evaluate the opposition generated by loss of status and well-being among those adversely affected by these changes, and the tenacious support of the old order, in countries like Iran and Afghanistan, of those whose interests were vested in it.

There is a considerable literature on the development of Soviet Inner Asia. For the sake of brevity I select a single example, an American study

published in Britain, representative of the wide range of knowledge available and of the traditional academic standard of trying to set out all the relevant facts before drawing conclusions.[1]

This paper should be consulted for the details, but the general conclusions may be briefly summarized here. Russians have made the top economic decisions and have held the chief executive and technical posts, despite the theory of linguistic and cultural autonomy. Similarly, though education and social services have been extensively developed, non-Soviet nationalisms have been restrained. The basic principles have been the movement of industries closer to raw materials or fuel and power, and intensive economic development as a means to full communication. Railway construction has been especially notable, and major industrial developments include coal, oil, electricity, and non-ferrous metals. Cultivation has increased more than the cultivating population, indicating a marked rise in the productivity of labour, probably due to collectivization and mechanization. The increase of livestock has fallen behind the planned figures. This may perhaps be because pastoral nomads are more difficult to collectivize than settled farmers; if so, that is an important conclusion, which however the author does not draw.

The author concludes (i) that the Soviet planning system makes it possible to pump capital into backward areas, thus achieving the same result as the import of capital would have had under a capitalist system; (ii) that the Inner Asia standard of living is below that of European Russia, itself lower than that of Western Europe, but the average level of well-being has certainly risen; (iii) as a result, a small but important percentage of the native inhabitants have probably become "very loyal and very convinced Communists"; (iv) that the population shifts could not have been accomplished without some degree of compulsion; (v) that, as Inner Asia lags behind European Russia, an essentially colonial relationship still exists, from which the Soviet system provides no way out by evolution.

The author finally raises the "open question" how far and how fast Central Asia could have developed under a healthy capitalist system. He does not answer the question, but says that capital would have had to come from outside, and that "considerable Government subsidies would probably have been necessary for such intensive development under capitalism."

Future changes in the new political geography of Inner Asia largely depend on this "open question." An economic and social revolution carried out according to plan and backed by force causes great displacements of population, much suffering, and a bitter resentment that sometimes breaks out into revolt and sometimes is quenched in unsuccessful conspiracies; but there are also some who benefit. If those who benefit hold the key positions they can win out, even if they are a minority; and later, if the benefits spread, there is a shift of numbers toward the support of changes that have been brought about. This phenomenon is not limited to planned economies and collectivized societies. There was something similar in the combination of rural

[1] Paul B. Henze, "The economic development of Soviet Central Asia to the eve of World War II. An examination of Soviet methods as applied to a semi-colonial area," *Royal Central Asian Journal*, 1949, pp. 278–96, and 1950, pp. 28–44.

displacement and the creation of an overworked, underpaid urban proletariat in the English industrial revolution. There is also something similar in the problems of such countries as India and Pakistan to-day.

No political change in fact can take the form of simply building additions to an old structure. There is always, to some degree, a destruction and discarding of parts of the old structure. In the execution of any programme of action such as the British Colombo Plan, the American Point Four programme, or United Nations Technical Assistance, the critical point is not the complete and sudden creation of industrialism in unindustrialized countries, but the initiating of a momentum that convinces enough people—not necessarily a majority—that the right road has been found; that things are sufficiently improved this year, in comparison with last year, to justify the belief that they will be still better next year.

In Inner Asia, the new political geography can best be defined by the frontier between revolutionary and evolutionary methods. Because of this frontier, it is no longer sufficient to describe Soviet Inner Asia as a still colonial or quasi-colonial area peripheral to a centre of gravity west of the Urals. For one thing, a large part of Inner Asia is no longer peripheral, but intermediate between centres of gravity in Russia and China; a change that will certainly influence its development in new ways. In both Soviet and non-Soviet Inner Asia, moreover, the question of "lag" is not a simple but a double question. The fact that Soviet Inner Asia has not yet caught up with the overall Soviet standard is obviously important; but it is probably even more important to know whether the lag between the non-Soviet periphery and its centres of gravity is greater than that between the Soviet periphery and its centre or centres. It very probably is: and therein lies the critical definition of the political geography of Inner Asia and the critical problem both of the non-Soviet West and of non-Soviet Asia. New processes of stabilization, to take the place of those that underlay the thinking of Mackinder, can only be created by deliberately initiating, on the non-Soviet side of the frontier, changes that match in their potential of growth the changes going on in Soviet territory. Only a counterbalance of change can satisfactorily replace the stabilization of inertia of half a century ago.

DISCUSSION

Evening Meeting, 14 January 1952

Before the paper the PRESIDENT (Mr. J. M. WORDIE) said: Our lecturer, Dr. Owen Lattimore, is head of the Institute of International Relations at Johns Hopkins University, Baltimore. That Institute was founded by Walter Hines Page, the distinguished American who was the United States Ambassador to Great Britain during the First World War.

Dr. Lattimore has travelled extensively in Inner Asia, and especially in Mongolia. He first explored there in 1926 and 1927 when he made a journey from Pekin to India, then westward into Sinkiang, where he was joined by his wife. Together they passed through Kashgar and into northern India. After a long life spent in those parts, mingling travel with scientific observation and forming shrewd ideas about the country, its people and its politics, he was awarded in 1942 the Patron's Medal.

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THE EXPEDITION TO CHO OYU

ERIC SHIPTON

WHEN WE RETURNED to England in December 1951 with the information that there was a practicable route up the southern side of Mount Everest, it was thought that this discovery would be followed immediately by a British attempt to climb the mountain by that route in the Spring of 1952. However, it was found that the Swiss had made a previous application to the Government of Nepal for permission to send an expedition for that purpose, and that their preparations were already almost complete. A proposal to launch a joint Anglo-Swiss expedition under joint leadership was thought by the Himalayan Committee to be impracticable, and it was decided to defer the British attempt until 1953.

I put forward a suggestion that the 1952 season might profitably be used by sending an expedition to attempt the ascent of Cho Oyu, a 26,800-foot mountain lying some 20 miles west of Everest. Apart from the interest of the ascent itself, the expedition would, if it succeeded in reaching any great height on the mountain, serve several most important purposes: to test the ability of a number of mountaineers to climb to great heights, and to provide a nucleus of men with experience of working at extreme altitudes for an Everest team; to carry out experiments in the use of oxygen apparatus; to study physiological problems of high altitude climbing, such as acclimitization and deterioration, diet and liquid consumption; and to test clothing and equipment. At least the expedition would provide the party with valuable training and experience of Himalayan conditions. The Committee accepted the proposal.

My reason for selecting Cho Oyu as an objective was that, while searching for the Menlung La in November, Ward and I had seen what appeared to be a practicable line of ascent from the south-west. I took some stereoscopic photographs of the mountain from this angle, and when these were examined in England they seemed to confirm our observations on the ground. At the time, of course, we had no idea that we would ever have the chance of climbing Cho Oyu, and therefore for us the existence of a practicable way of climbing it from the south was of academic interest only. For this reason and because at the time we had a more interesting job on hand, we did not make a closer reconnaissance of the route in question.

Owing to the negotiations concerning Everest, the decision to send an

expedition to Cho Oyu was not taken until about the middle of January, and only six weeks remained before the departure of the expedition to make all the necessary preparations. But the organization was not difficult. Almost the only money available was the residue of that earned by the Everest Reconnaissance Expedition, though later *The Times* contributed a further £1000. Lack of funds therefore enforced both extreme economy and simplicity, and only the bare necessities could be taken. A single afternoon sufficed for drawing up a list of all our requirements in the matter of food and equipment. Fortunately, too, H. E. Riddiford, who had been a member of the Reconnaissance Expedition, was in England on a visit and undertook the work of assembling stores and equipment, and of dealing with the great volume of correspondence which even the simplest expedition seems to evoke.

Besides myself, eight climbers were invited to join the expedition: T. D. Bourdillon, E. P. Hillary, H. E. Riddiford, G. Lowe, R. C. Evans, A. Gregory, C. Secord and R. Colledge. The generosity of the Royal Society enabled Dr. G. Pugh, of the Medical Research Council, to be attached to carry out research into the problems of high altitude physiology. A party of ten in the Himalaya is grossly unwieldly and inconvenient, and I was somewhat appalled at the prospect. But obviously the chief objects of the expedition would best be served by giving as many climbers as possible a chance to prove themselves fit for inclusion in the Everest team.

When I visited Zurich in January the leaders of the Swiss expedition expressed grave concern at the prospect of two large expeditions operating in the same area at the same time. I was satisfied, however, that their fears were groundless, and undertook to travel to Namche by a different route so as to avoid competition over transport, and to arrive there later so as to afford them a free hand in the recruitment of Sherpas.

The expedition assembled at Jainagar, rail head in the Darbhunga district of North Bihar, at the end of March. Beyond this point there is no road capable of taking mechanical transport and we had to walk across the 30 miles of flat, sandy country separating Jainagar from the foothills, while our baggage was carried in ten bullock carts. This peculiar caravan set out across the Nepalese frontier, which lies immediately to the north of Jainagar, on March 31. It was terribly hot and the deep sand made very heavy going. In spite of this we soon became impatient of the funereal pace of the bullock carts and strode recklessly ahead at 2½ miles per hour. A multiplicity of interesting paths crossed the featureless land, and our choice of route differed from that of the bullock cart drivers and the Sherpas. So, when night fell, we found ourselves separated from our transport. Tired, hungry and thirsty, we found inadequate shelter in a grass shack. Thus the party received an early lesson in the hazards of Himalayan travel.

The next morning we were offered an elephant to help us on our way. This we gladly accepted, but when it came to the point, it was found that the creature had gone on another mission, and we were forced to continue on our feet. However, in the middle of the afternoon, just as the foothills were beginning to loom ahead through the dust-haze, we overtook our missing caravan, and early in the evening of April 1 we reached the village of Chisapani.

Here we spent the whole of the following day recruiting coolies to carry our

baggage to Okhaldhunga. We had about ninety 60-lb. loads, and at first it seemed as though this task would take us many days. But by noon news of our arrival had spread to the surrounding villages and men soon started to arrive. Moreover, most of them demanded to be given double loads (120 lb.) for double pay, a very fair request; so by evening we had recruited an ample carrying force.

For the next two or three days we marched through the Swalliks, that curious range of low hills, geologically distinct from the main range, which runs for hundreds of miles along the foot of the Himalaya. It was rough country, intersected by innumerable dry watercourses and covered with dense jungle, restless with the shrill noise of wild life. On April 6 we reached the banks of the Sun Kosi, which we crossed on a primitive ferry, and entered a long valley leading up into the heart of the main range.

For most of us these were carefree days of sheer enjoyment. The porters, though they went extraordinarily well in spite of their heavy loads, could not be expected to manage more than the distance that could be covered in five hours' steady walking. We started soon after dawn (five o'clock) each day and marched for two or three hours in the cool of the morning; then we chose some shady spot by a stream to cook and eat an enormous breakfast. This pleasant occupation would last until eleven o'clock, when, the bulk of the day's march already done, we would walk on in a series of easy stages to the next camp, stopping frequently to plunge into a pool, to read or to ponder on the excellence of life. Each night we slept in the open.

For Dr. Pugh, however, it was a busy time, for he had already begun his physiological studies. He marched with his rucksack bristling with test tubes and glass retorts and coiled about with lengths of plastic tubing. With tireless application he counted our heart beats, measured our haemoglobin, and recorded our liquid intake, so that no phase of our changing metabolism should escape his notebook.

In spite of our leisurely progress we took only five days instead of the scheduled seven, to reach Okhaldhunga from Chesapani, and on April 7 we climbed 4000 feet up the steep hillside to the capital of the third administrative district of eastern Nepal. Here we spent a day recruiting another batch of coolies, and paying off the first.

Our way now led northward along the crest of a high ridge, which would have commanded splendid views of the surrounding country and of the great mountains but for a persistent dust-haze which reduced visibility to a few miles. One morning, however, it was clear enough to allow us a good view of the Everest massif; and on another, while we were descending a steep, forested slope, the lovely peaks south of the Tesi Lapcha showed for a while as spectral shapes above the tree tops.

We reached Namche Bazar on April 16, the march having taken (including two days' halt) seventeen days. The Swiss Expedition which had arrived three days earlier had left for their base camp that morning. Despite the fact that they had taken nearly two hundred porters with them from Namche, I did not anticipate any difficulty in recruiting sufficient for our modest needs. But I was astonished at the extraordinary eagerness among the local population to join our expedition. We locked our baggage in a go-down while we

were paying off the Okhaldhunga coolies. An impatient mob of Sherpas gathered outside, and, fearful lest they should fail to obtain employment, they battered open the door, seized loads indiscriminately and marched off with them, many in the wrong direction. We had to struggle hard to restore order, and it was a long time before we recovered all the loads.

On April 19 we left Namche and travelled for two marches up the Bhote Kosi to Chule, from where, on the twenty-first, some of us climbed a small peak of about 18,500 feet. On the twenty-second we moved on to Lunak, which we had selected as a centre from which to reconnoitre the approaches to Cho Oyu. It is situated by the side of the Nangpa Glacier at about 17,000 feet and consists of four stone huts, two of which were roofless. These meagre buildings offer the last shelter of any kind on the route across the Nangpa La (19,000 feet) to Tibet. By the middle of April there is usually a fair volume of traffic across this remarkable pass. But that year exceptionally heavy snowfalls in the late winter and early spring had hitherto prevented the passage. The first party to undertake it was six Buddhist monks who had accompanied us from Okhaldhunga to Namche and who reached Lunak two days behind us. These were followed by a large number of Tibetans, who had been spending the winter in Khombu, where the food is cheaper and more plentiful than in their own country, and who were now returning to their still frozen lands on the high plateau. It was astonishing to see these people—men, women, children and infants carried in baskets—setting forth in the falling snow on their long glacier trek with no clothes except what they wore, with no prospect of shelter at night, and carrying only a few sticks of juniper for fuel. A week later parties of Sherpas started the crossing, mostly to buy salt at Kyetrak, though some had business as far afield as Tingri and Shekar Dzong, and there were more monks bound for the pilgrimage to Rongbuk.

Based on Lunak we spent a fortnight doing small training climbs and reconnoitring the country. Movement was handicapped by winter snow which still blanketed the whole area. The weather, too, was very unusual. In place of the cloudless skies and bitter north-westerly gales which, from previous Everest expeditions, we had come to expect in this region at this time of year, we experienced mild, thundery weather, with variable winds which were predominantly southerly. There had also been unseasonable precipitation on the high peaks. For example, the views we obtained of the north-west face of Everest showed that it was covered with snow, instead of being bare and black as it always was when we reached the Rongbuk Base Camp in April. In May, the north-west wind became sufficiently established to sweep the mountain clear of this snow.

A close inspection of the south-west ridge of Cho Oyu, upon which our hopes of climbing that mountain were based, showed beyond any doubt that it was impossible even to effect a lodgement upon it. At the same time, by climbing a 21,000-foot peak above the Nangpa La, Hillary and Lowe confirmed the report made by Murray and Bourdillon the previous autumn, that the west face of the mountain was possible. This placed us in an awkward dilemma. To launch a serious attempt upon the west face it would be necessary to establish a base just beyond the pass and to stock it with a considerable

bulk of equipment and supplies. With Tibet in the hands of the Chinese Communist Army this would be an unwise procedure. For although the frontier between Tibet and Nepal has not, in this area, been officially demarcated, a Chinese Commander in the vicinity of Tingri, hearing, as he would undoubtedly hear, of our presence so close to the frontier, would almost certainly send a patrol to the pass to find out what was going on. So far as we could ascertain, there were no Chinese in the vicinity of Tingri at the time. But in the first place news of us might spread far beyond that town, and secondly travel on the plateau is comparatively rapid, and the situation might change entirely within a few days. The consequences of meeting with a Chinese patrol were obviously too serious to risk, and we decided forthwith to abandon anything like a full-scale attempt on Cho Oyu by this route.

We did, however, establish a light camp at 21,000 feet on the face, which was occupied on May 7 by Hillary, Lowe, Evans, Bourdillon, Gregory and Secord. It was hoped that if the climbing proved really easy, some of them might succeed, in the next few days, in climbing to a considerable altitude, even if they failed to reach the top. But at an altitude of 22,500 feet they encountered a formidable barrier of ice cliffs which ran right across the face. This barrier marked the point where the upper limestone cap of the mountain rested on the granite base of the main massif. It was obvious that it would take at least a fortnight to overcome this obstacle and establish a route over it, and this would necessitate the build-up of supplies on a scale which had already been decided against. So we reluctantly abandoned the attempt to climb Cho Oyu.

Failure in the main objective is not an uncommon experience of Himalayan expeditions. Luckily there is never any lack of secondary objectives. There were still some weeks left before the monsoon might be expected. The expedition was divided into three self-contained units, each with its allotted task. Dr. Pugh, with his apparatus, was established in a camp on the Menlung La, at an altitude of 20,000 feet, where he carried out a modified programme of physiological research, assisted by Bourdillon, Secord and Colledge. A series of controlled experiments was conducted with the use of oxygen at varying rates of flow. The results of these and other experiments have produced much data relevant to the solution of the problems of acclimatization and deterioration. When this work was completed, Bourdillon and Colledge climbed the central peak of the area, a beautiful mountain 22,400 feet high, which has been named Pangbuk. The party then travelled southwards and succeeded in crossing a new pass from the Menlung basin to the Rolwaling.

Before leaving the area west of Cho Oyu, Hillary and Lowe climbed three peaks in the vicinity, two of about 21,000 feet, and a third of 22,600 feet. They then returned to Namche, from where on May 19 they started up the valley of the Dudh Kosi with three weeks' food, to make an attempt to cross the Nup La. This they succeeded in doing. It took them four days to cut their way through the great ice-fall, a fine mountaineering achievement.

Meanwhile, Evans, Gregory and I explored a complicated knot of country lying between the Pangbuk, the Langmochi, the Menlung, and the upper Rolwaling valley systems. At first we tried to reach it by crossing a series of passes from the north, and then by an approach up the Langmochi from the

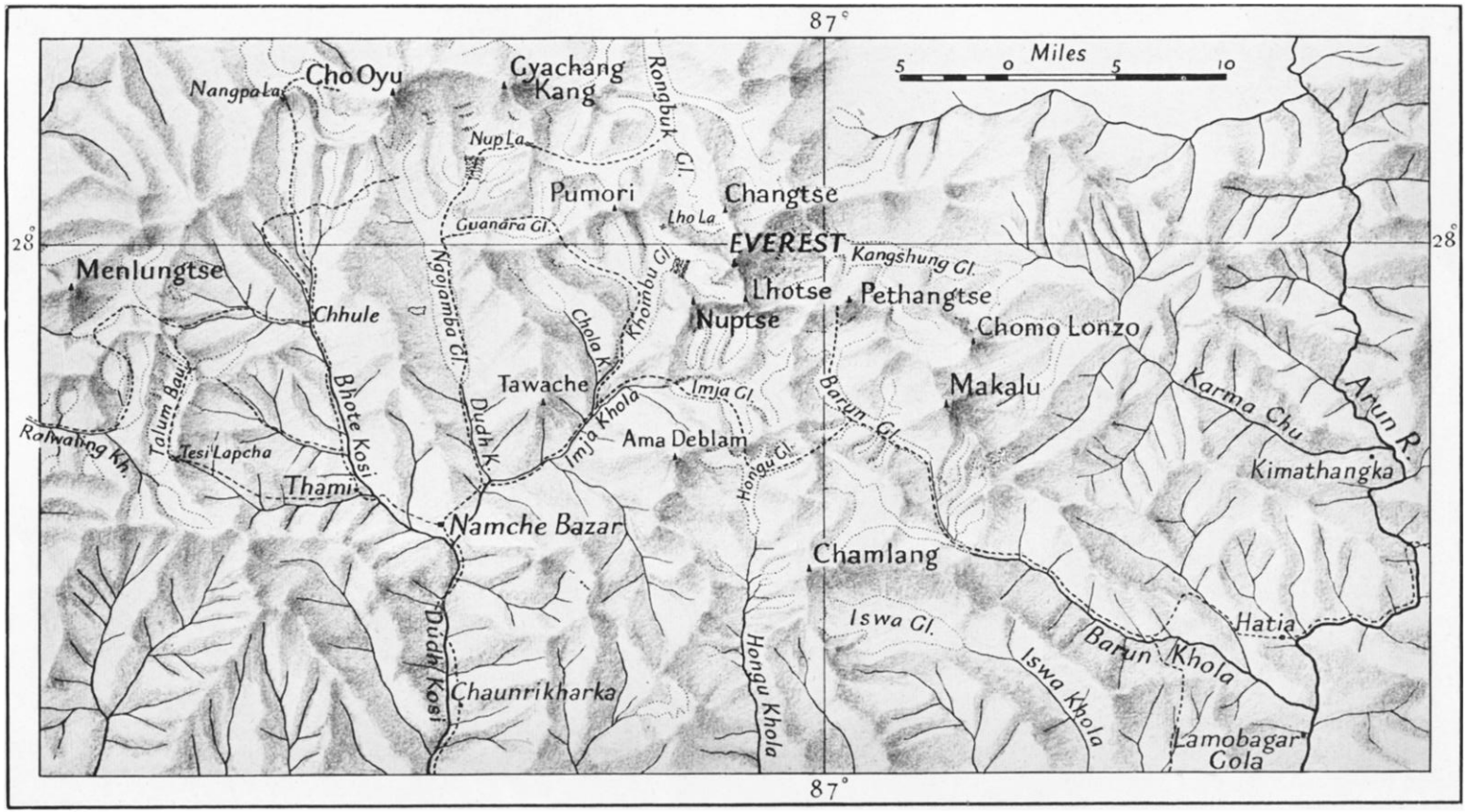
east. In both these attempts we failed to find a way through, which underlined the remarkable good fortune of Ward and myself in our discovery of the Menlung La the previous autumn. Finally we crossed the Tesi Lapcha and made our way northward up a glacier known as the Talam Bau to a curious ice plateau which turned out to be the hub of the area. While we were engaged on this work we climbed two peaks, one of 21,000 feet and the other of 21,600 feet. In all, the expedition succeeded in climbing eleven peaks of altitudes ranging from 20,000 feet to 22,600 feet, as well as a number of smaller mountains.

When we returned to Namche at the end of May, I decided to undertake, with Evans, Hillary and Lowe a journey to the east to explore the main range between Everest and Makalu, and from there to descend the unexplored valley of the Barun Kola to the Arun River. This was a project on which Hillary and I had set our hearts since our discovery, in the autumn of 1951, of two passes leading from the head of the Imja Kola to the Hongu, and thence across to the upper basin of the Barun. The chief uncertainty about the scheme lay in the descent of the Barun valley. The distance from the point at which we would reach it to its junction with the Arun is 25 miles. In that distance it penetrates an enormous mountain massif and its floor drops from 17,000 feet to 4000 feet above sea-level. The resulting gorge was likely to be formidable. My experience of Himalayan gorges had taught me that if they, or their upper valleys, are uninhabited and thus unfurnished with tracks, the work involved in forcing a way through them may be so laborious as to restrict progress to less than a mile a day. Thus the traverse of a gorge of such length might, if it proved to be trackless, take many weeks; to attempt such an undertaking during the height of the monsoon would be inviting serious trouble.

To save time in the early stages of the journey and to learn more about the great valley, I sent Evans and two Sherpas ahead on June 1 to extend our reconnaissance and to investigate the head of the Barun gorge. I had to remain in the vicinity of Namcha for some days to wind up the expedition and to await the return of Hillary and Lowe from the Nup La. I met them at Pangbochi on June 8, and we set out almost immediately up the Imja, taking six Sherpas with us. The crossing of the pass into the Hongu was a great deal easier than it had been the previous autumn, but we were carrying three weeks' food supplies, and we had a great deal of trouble getting our heavy baggage over.

We met Evans at a rendezvous by the big lake in the Hongu basin. He had very satisfactory news. He had crossed to the Barun, and had travelled down the glacier. He had found evidence that the valley below was used as a grazing ground for yaks. This relieved us of all anxiety regarding the descent of the gorge, for it meant that we would find tracks connecting the upper valley with the permanent habitations in the Arun valley, which would surely enable us to reach them within a week or so from the foot of Makalu. We would thus have plenty of time to spend on the exploration of the Barun Glacier and the main range.

Heavily laden with supplies we crossed the "Barun Col," about 20,000 feet, and camped on the glacier plateau beyond. From here on successive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Cho Oyu
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Rongbuk Gl.
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Guandra Gl.
EVEREST
Kangshung Gl.
Menlungtse
Lhotse
Pethangtse
Nuptse
Chomo Lonzo
Chhule
Ngojamba Gl.
Khoimbu Gl.
Chola Kh.
Tawache
Imja Gl.
Makalu
Barun Gl.
Karma Chu
Arun R.
Talum Bau
Bhote Kosi
Imja Khola
Ama Deblam
Honga Gl.
Kimathangka
Rawalung Kh.
Tesi Lapcha
Thami
Namche Bazar
Chamlang
Dudh Kosi
Iswa Gl.
Hatia
Barun Khola
Chaunrikharka
Hongu Khola
Iswa Khola
Lamobagar Gola

days we climbed two peaks of 22,550 feet and 21,800 feet. The views from these were exceptionally interesting and impressive; for we were now in an unexplored region surrounded by some of the greatest mountains on earth. An entirely new aspect of the Everest massif filled our north-western horizon, while eastwards our gaze lifted to the lofty spire of Makalu (27,750 feet) across the cloud-filled chasm of the Barun.

We saw that the ice plateau drained to the south-east into a glacier which flowed through a remarkable defile east of Chamlang (24,012 feet). I was very tempted to try to penetrate this glacier gorge, which was unlike anything I had seen before, but it might have taken a long time and our main interest lay farther north. Later we found that the glacier entered and flowed some miles down the Barun valley, a long way below the snout of the Barun glacier. It must be at least equal in volume to the latter.

On June 15, while Lowe and I were escorting the Sherpas across a subsidiary pass and down to the Barun glacier, Hillary and Evans climbed a third peak of 21,400 feet. We camped on the Barun glacier immediately below the huge western face of Makalu which, almost devoid of snow, looked from here like a vast stone quarry. The next day we travelled 5 miles up the Barun glacier and on June 17 we succeeded in reaching a saddle on the crest of the main watershed overlooking the Kangshung glacier, which flows from the eastern face of Everest. In this way we connected up with the explorations of Howard Bury's reconnaissance expedition in 1921.

We camped at the foot of Pethangtse (22,080 feet) and we hoped to make the ascent of this beautiful peak, which is such a well-known feature seen from the north across the head of the Kangshung glacier. We found a good route up it, but before we could make the attempt the weather broke badly. Nearly a foot of snow fell in a few hours and by morning avalanches were falling from all steep slopes. The monsoon had broken in earnest.

We now entered a new and enchanting world. The climax to all the vivid experiences of mountain exploration comes with the descent, from the labyrinth of glaciers and ranges crossed, into the new country beyond. The tempo of life is quickened, and sensibility is supremely receptive. Life was so full that the next two weeks, as we made our way through rapidly changing environment of climate and scene, seemed to occupy more time than the whole of the rest of the expedition.

Some miles below the glacier we emerged from a gloomy defile into open country of great beauty. An eastward bend in the valley below, which was blocked by the intrusion of the "plateau glacier," and the defile above gave us the impression that we were in a wide basin, completely encircled by snow mountains and dominated by the south face of Makalu, a vast structure of ice-falls and hanging glaciers. Many square miles of rich pastureland, very green after the recent rains, formed its floor. Here we found a great variety of familiar alpine flowers which had been notably absent from the Khombu valleys, owing, I believe, to the lack there of calcareous rocks.

Our first contact with the inhabitants of this side of the range was typical. At the farther end of the "basin" we came to a sharp drop in the valley. Half a mile below us we saw two men engaged in building a hut. The Sherpas were behind us, and we sat down to wait for them, intending to creep up on

Plateau glacier flowing down into the middle Barun

the men together and get close enough to explain who we were before they had time to become alarmed. But the Sherpas, as soon as they saw them, rushed down the hill uttering cat-calls and piercing whistles. The men fled down the valley, leaping from boulder to boulder like a couple of deer. We tried to head them off, but they soon disappeared, moving at an astonishing speed. Their panic was very natural, seeing a crowd of strange creatures rushing down upon them from a vast range of mountains that everyone knew to be impassable. I was very angry with the Sherpas for their tactless handling of the situation, which I was afraid might spread terror far down the valley.

However, the men must have hidden themselves in a side nullah, for when eventually we reached the pastures below the "plateau glacier" we found encampments of shepherds quite undisturbed by reports of monsters descending from the snows, and we quickly established diplomatic relations, which were so essential for our welfare. We found that the people were Buddhists, but totally different racially from the Sherpas. We engaged a man to show us the way down the gorge and along the tiny forest tracks connecting the pastures of the middle Barun with the villages of the Arun valley, still several days' march away.

Below the end of the "plateau glacier" the valley fell steeply, and we soon found ourselves in dense forest. We were now entering a zone of far greater rainfall than that of Solu Khombu, and though giant rhododendron and fir predominated at about 12,000 feet the vegetation as a whole was totally different. In form the valley resembled a Norwegian fjord: it was broad and flanked by gigantic rock precipices decorated by innumerable waterfalls; but the bottom was wide and gently curved, showing that for many miles below the present level of ice glacier action had been at work so recently that the river had not had time to cut into the floor. It was not until we had descended to 9000 feet that the valley began to develop into a true Himalayan gorge.

At this point we separated from Evans, who was keen to extend the journey eastwards to the Lumba Sumba Himal, and across that range to Taplejung, and thence to Darjeeling. Unfortunately, none of the other three of us was able to spare the time to accompany him on this interesting journey. Hillary and Lowe had to catch a boat on July 18; while I was under some obligation to return as soon as possible to assist with the preparations for the 1953 Everest Expedition. The best two Sherpas went with Evans.

We now turned southwards, climbed steeply from the dense, tropical forest of the Barun gorge and crossed into the head of the Kasuwa Kola. Although the intervening pass was only about 13,000 feet there was still much winter snow lying on the more protected slopes, evidence that the winter snowfall is here much greater than in Khombu. The rhododendron bushes were in bloom, white and crimson; the grassy slopes below the rocky hills and the meadows bordering a score of lakes and tarns were carpeted with primulas of many colours and with deep drifts of yellow flowers.

We had now reached the outer edge of the high mountain massif and from the pass we looked through shifting banks of cloud, out across the foothills far below. During most of this part of the journey we experienced frequent heavy rainstorms, but the periods between were fine and sunny. Three days later, after having some difficulty in crossing the flooded Kasuwa Kola, we

Ferryman on the Sun Kosi

Path in Dudh Kosi below Namche

Makalu from 22,500 feet. Hillary in foreground

Cho Oyu from 21,000 foot camp

reached the banks of the Arun, which we crossed by a rope bridge near the village of Num. The Sherpas were now lightly laden and, starting at 4.30 each morning, we made a rapid march down the Arun. At Legua Ghat we joined the route by which we travelled up in 1951. From there we crossed the hills to Dharan and Jogbani.

DISCUSSION

Evening Meeting, 22 December 1952

Before the paper the PRESIDENT (Mr. J. M. WORDIE) said: It is my pleasure to introduce Mr. Eric Shipton, the best known of all British climbers. To give a list of his achievements is to give an account of British climbing during the last twenty years. It was Mr. Shipton's privilege to introduce Tilman to mountaineering in East Africa, and together they climbed Kilimanjaro and Mount Kenya. This was the beginning of a very warm friendship between these two outstanding mountaineers.

Shipton's first experience of Everest was in 1933. As an interlude he climbed Nanda Devi in 1934, then he conducted a reconnaissance of Everest in 1935 and again climbed these in 1936 and in 1938. In 1937 he visited the Shaksgam valley. For those travels and explorations he was awarded the Patron's Gold Medal in 1938.

Mr. Shipton then read his paper

The PRESIDENT: Mr. Shipton has mentioned Dr. Pugh, whom I now ask to give an account of the physiological problems connected with the climbing of Mount Everest.

Dr. PUGH: There are a number of physiological questions connected with the climbing of Mount Everest, and as it is not possible for me to enter into all of them now, I will speak only of the temperature and the oxygen problems.

From the records of the temperature lapse rate that we took all the way up to Everest one would expect the temperature at the top to be −40° F. But judging from the accounts of previous expeditions, during the precious fortnight before the monsoon −20° is usual, and it is only that relatively warm temperature that renders the ascent of Mount Everest possible for man without some special means of conserving heat loss from the lungs. Some heat is lost in bringing inhaled air up to body temperature, and more is absorbed in saturating the inspired air with moisture. At 28,000 feet, 75 per cent. of the heat produced by the human body at any given rate of exercise is lost via the lungs. The best Arctic suit available is not sufficiently effective to prevent the body cooling down when there is such an enormous heat-loss via the lungs. When the body temperature has fallen by 40° F. movement becomes increasingly difficult; when the temperature has fallen about a further 3° people go into a coma. That might well happen on Everest without oxygen at this time of year. So that even if the climbers reach the summit they might sit down on their way back from the summit and just die of cold.

At −20° the position is different because the heat lost from the body is so much easier to retain by good clothing; moreover, on a fine still day at high altitudes there is a considerable amount of heat from the sun. In fact the sun's heat at high altitudes may well be equivalent to that produced by a man at rest. I think this factor has accounted for the experience of climbers on Everest in the past who, though at a very high altitude on a still day, have not felt very cold—at least not all the time. Another point is that it is impossible to climb

Everest in a high wind. Normally the wind on Everest blows at 100 miles an hour. It seems that it is only at certain periods of the year, before and after the monsoon, that these high winds are not present on Everest. Thus a successful ascent of the mountain depends on getting a still day.

Now as to the oxygen problem. A climber requires exactly the same volume of oxygen per minute at sea-level as at 27,000 feet. We were able to confirm that by doing standard work at 20,000 feet and comparing the results with exactly the same work at low altitudes. Since the density of the air decreases with altitude, in order to get a given volume of oxygen it is necessary to breathe decreasing amounts of air. Imagine the climbers walking slowly along the summit of Everest. In so doing they will require 1 litre of oxygen per minute. In actual fact it might be found that at 28,000 feet a steady level of activity is no longer possible. If I remember rightly, Norton said his object was to do 20 paces without stopping, but that in fact he never achieved more than 13 paces without resting and panting. In other words, the situation is much like that of runners doing a succession of 100-yard sprints. I do not deny the possibility of climbers able to walk at 29,000 feet without oxygen. What I think would defeat them would be the time factor, because it is not possible to continue doing 100-yard sprints indefinitely for six hours at a stretch. The body would not stand that type of activity at high altitude. My view is that the day is not long enough to allow climbers to go from the final camp at 1500 feet below the summit and to come down again the same day, without oxygen. If they were overtaken by night or bad weather without their tent they would certainly die of cold.

For these reasons climbers ought to try to make use of all the resources which are available and take oxygen when climbing at high altitudes. But the point is that even with oxygen Everest is an extremely difficult mountain to tackle. If you go into a decompression chamber and work on a stationary bicycle, even if the pressure to which you are exposed corresponds to 30,000 feet, by dint of breathing pure oxygen it is possible to work just as though the atmosphere was at sea-level pressure. That is to say, by giving oxygen to an unacclimatized man at 30,000 feet it is possible to get a sea-level physical performance. The curious thing is that those who are acclimatized to high altitudes without oxygen, when given oxygen do not give anything like a sea-level performance. That is unfortunate. It has been suspected from the experience of parties on Everest, among whom certain individuals have used oxygen. Finch used it in 1922 and he claimed great benefit from it. He used it all the way up from 23,000 to 27,000 feet and he claimed that he climbed more quickly than the porters. He used $2\frac{1}{4}$ litres of oxygen a minute. Odell in 1924 said he derived no benefit at all from using oxygen. He used only 1 litre of oxygen per minute. That is not enough, which is obvious when one considers that the breathing rate is 100 litres per minute. If only 1 litre is added it makes only 1 per cent. difference.

Further experiments showed the effect of supplementary oxygen at 20,000 feet. The measure of the performance was the time taken to walk up 350 feet. With supplementary oxygen supplied at 10 litres per minute only a 10 per cent. improvement in time was gained. At 4 litres per minute there was less improvement; in fact, virtually none at all. This was caused by the weight of the apparatus to which Mr. Shipton has already referred. Men carrying the apparatus and not getting any oxygen, took 35 per cent. to 40 per cent. longer to climb the 350-foot hill. It is difficult to supply men with enough oxygen to get to the top of the mountain without having to carry an apparatus which is too heavy. That is the problem we are now trying to solve.

Another important point noted was that when oxygen was given the breathing rate was suddenly reduced, and the users of oxygen have found that the benefit has been due to that reduction in the effort of breathing. While their physical performance is not enormously improved, their conscious sense of effort is greatly relieved by reduction in their ventilation rate. This is an important factor.

There are three possible ways of taking oxygen: one is by the open-circuit system, breathing oxygen through a cylinder at 2, 3 or 4 litres a minute, and breathing it out to the air, when nine-tenths of the oxygen is lost. The second is to have a closed circuit in which the air breathed goes round and round, and oxygen is added at the rate at which it is used, the carbon-dioxide in the expired air being absorbed with soda lime. The advantage is that the climber gets pure oxygen and his equivalent altitude is at sea-level. There is the same oxygen in the atmosphere he breathes as if he were at sea-level. The important second advantage of this system is that no heat is lost in warming and saturating the air with moisture. So the closed circuit on both those counts has great advantages. Unfortunately, it is difficult to make and the mask has to fit perfectly, otherwise the apparatus fills with nitrogen and one cannot continue to use it. Equally, it is difficult to make the air pass through the soda lime, so that the carbon-dioxide is completely absorbed, and at the same time prevent back-pressure building up. Even a small back-pressure becomes intolerable when climbing. When a closed circuit was tried by Lloyd he found it unusable, probably because of the back-pressure. Those are the main points in regard to the closed circuit: the difficulty of making the mask fit perfectly and of designing a set which will not give any back-pressure. Also it is even more difficult to make such apparatus as light as an open-circuit apparatus.

The third system depends on the chemical evaluation of oxygen. The Swiss in the spring of 1952 tried an apparatus weighing only 3 or 4 lb., but I am afraid they under-estimated the quantity of oxygen they needed, and their set had all the faults I have mentioned as being inherent in the closed-circuit apparatus. They had a mouthpiece which leaked and their apparatus became unusable from that point of view. Also it did not supply nearly enough oxygen to allow of the necessary performance. We are trying to develop an improved apparatus on these lines, but I am not sure that it will work. We are therefore putting our faith in the old-fashioned open-circuit system because we know that that will work. The unfortunate part is that because nine-tenths of the oxygen is wasted, it is necessary to take with us a large number of oxygen cylinders. It is doubtful whether it will be possible to take enough up to the South Col to supply the climbers with sufficient oxygen.

I would myself like to see the climbers going up all the way from 15,000 or 18,000 feet breathing oxygen and sleeping with the apparatus on. That ought to solve the question whether acclimatized climbers do or do not derive much benefit from oxygen. If one is acclimatized to 25,000 feet and then breathes oxygen, the improvement in performance may still be insufficient to get one to the summit of Everest in a day. I hope that on the forthcoming expedition there will be during the acclimatization period an opportunity of doing experimental work and that it will be possible to get some direct evidence on the points I have mentioned. Perhaps we shall be able to breathe oxygen from relatively low altitudes and get a really fine effect instead of a relatively small one.

The PRESIDENT: We all thank Dr. Pugh for the way in which he has explained these problems of a physiological nature. He will be going back on the expedition this coming spring. I ask you now to join together in thanking Mr. Shipton and Dr. Pugh for the admirable information they have given us to-night.

THE ASSAM EARTHQUAKE OF 1950

F. KINGDON-WARD

IN JANUARY 1950 my wife and I left the Tocklai Tea Research Station in Upper Assam by road, on a journey up the Lohit valley. For the last two years Tocklai had been our base for plant hunting expeditions south of the Brahmaputra, including Manipur and the Mishmi hills. The last named is, for the botanist, perhaps the most fascinating, because the least explored, region in the whole of India; and the prospect of eight or ten months botanizing in the very heart of the mountains behind the Mishmi hills was alluring.

It is not my purpose to describe in detail either the wonderful vegetation, or the fascinating glacial history of this region. But in order to make the short term—and probable long term—effects of the great earthquake of 15 August 1950 intelligible, it will be necessary to give a brief description of the upper Lohit valley.

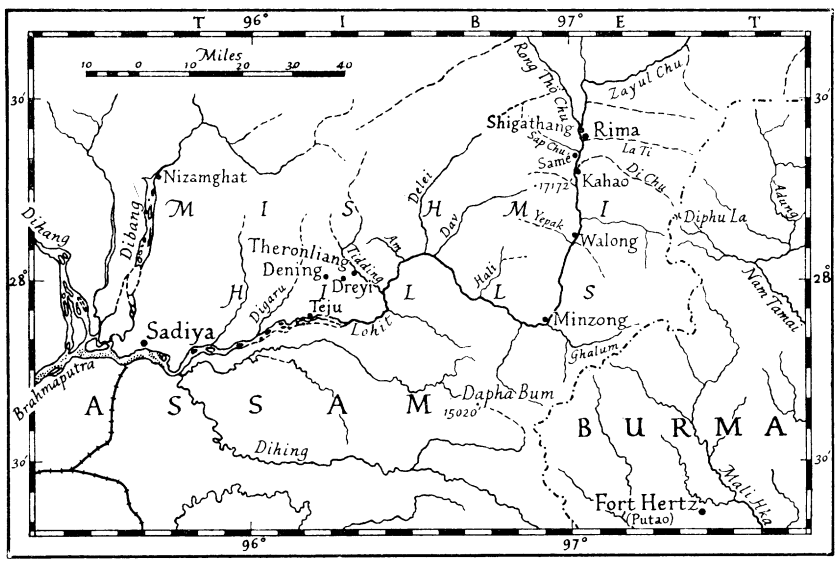
Between the point where the Lohit leaves the hills, and Rima (a distance of about 125 miles), eight major tributaries are crossed, the three largest being the Tidding, the Delei, and the Dav—all rising in the northern Mishmi Hills. As these hills are comparatively high (many of the peaks exceed 15,000 feet), and lie close to the plains, they catch the full force of the summer monsoon, converging on to them through the funnel-shaped Assam valley. The result is a rainfall heavy everywhere, and in some places (Denning, for example) exceeding 200 inches. Nor is that all. Their position, wedged between the escarpment of the Tibet plateau to the north-west and the Yunnan plateau to the east—both these areas, be it noted, dry in winter—draws all the moisture of the north-east monsoon on to themselves, so that the snowfall is also severe. The result is a heavy snow melt in the spring which, when combined with heavy spring and summer rain, causes tremendous erosion, particularly at the higher levels, before the vegetation has started into growth.

On the left bank only five large tributaries enter the Lohit, three of which rise on the Dapha Bum range close to the Burma frontier. At Minzong the Ghalum river joins in from the south-east. Seen from the west, its valley has all the appearance of being the main valley, whose direction it continues—as, indeed, it may formerly have been, when the present main valley to the north was blocked by ice. Evidence pointing to the same conclusion is found in a north–south alignment of high peaks immediately west of the Minzong bend, with Dapha Bum (15,020 feet) south of the river, and an unnamed peak of 17,172 feet about 25 miles to the north. The eastern flank of this range was heavily glaciated and fed the Lohit glacier, while from its western flank flowed the lower Lohit. The joining up of the glacier stream with the Ghalum at Minzong came later.

All the larger north bank tributaries are spanned by wire rope suspension bridges, and though the cables of the Delei bridge had sagged badly, the bridge was quite safe. Even before reaching the Delei, the road engineers

had had to ascend to some height before they could find a good alignment for the path; and as we pushed deeper into the hills, these abrupt ascents of the great buttresses, which shore up the peaks, became more frequent. In places the track was hewn out of the living rock, and being too narrow for a laden mule—it is, I suppose, thirty-five years since a mule caravan passed this way—one needed a steady head round the corners, though there was perhaps no real danger.

As far up as the Hali river, half-way to Minzong, for 2000 feet above the river the mountains are clothed with dense Indo-Malaysian broad-leafed evergreen forest, poorer in species than the Assam foothills but constituting a similar vegetation type. Only on the level terraces and gentler slopes has the forest been cleared and replaced by cultivation and secondary growth,



especially of tall grass. Before the corner is reached at Minzong, pine trees are mixed with typical Indo-Malaysian species right down to the river, sometimes forming thin patches of forest by themselves. By the time one is round the corner and marching north, the change from broad-leafed sub-tropical rain forest to warm temperate pine forest is complete. The change of vegetation takes place in less than 10 miles, and from this point onwards the lower stratum of the forest is inflammable.

Above its knee-bend the Lohit narrows, flowing for some miles in a deep gorge between high, bare cliffs; but before Walong is reached the valley widens again, the cliffs on the west side (whence flow several fair-sized tributaries) receding and becoming less steep. Well preserved terraces are numerous, besides enormous accumulations of boulders and gravel. As we travel north, the climate becomes steadily more arid, a fact quickly reflected in the vegetation. At Rima the valley widens out into a basin some 3 or 4 miles in length by 1 mile in width; the river too widens, and there is actually an

island covered with pine trees out in the stream. A scimitar-shaped bay in the hills on the east bank is occupied by a succession of terraces superimposed on one another, the uppermost being at the very foot of the steep outer range; and a cluster of three or four villages situated on the lowest terrace, in the midst of irrigated rice fields, make up Rima in the broad sense; one of them also carries that name. Its altitude is 5000 feet.

Between the rice fields and the second escarpment is a pond or swamp, where several pairs of Brahminy duck feed in the spring. Parts of three main terraces are well preserved, that on which Rima stands (about 100 feet above the river) being the most important. Only a corner of the second, some 300 feet above Rima, remains; being waterless, it is uncultivated, and uninhabited. The third, the highest and largest, is irrigated directly from the outer range of hills by several streams, and here is grown the bulk of the rice crop. The village of Tooning stands at the top of the gentle slope, 1000 feet above the Lohit.

A torrent—the La Ti—rising on the Burma frontier, separates Rima from the village of La Ti to the south; and 600 or 700 yards north of the La Ti torrent is the official village of Shigathang, where a small timber monastery stands on a square platform of flat stones; but Shigathang was burnt down during the New Year celebrations in February before we got there—all except the monastery—and the crowd of small officials who annually descend upon Rima during the brisk winter trading season were quartered in Rima village.

Half a mile north of Shigathang is the confluence of its two branches, the Rong Thö Chu flowing from the north-west, the Zayul Chu from the north-east. The latter is generally regarded as the main source of the Lohit—an honour to which it has no undisputed claim. Rice fields are plentiful for 20 or 30 miles up the former river, but there is no more rice cultivation up the almost uninhabited Zayul Chu.

Within 10 miles of the confluence, in every direction, the mountains reach 15,000 feet or higher, the average slope of the flanking ranges being 60°, though the cliffs immediately above the river are often vertical (or nearly so) for several hundred feet, and in places for much more. Between Shigathang and the confluence a rope bridge spans the Lohit.

The Rima basin, where not cultivated, supports thin pine forest, with bracken as undergrowth; or thorn scrub. In sheltered ravines, such as the La Ti, a thicker growth, including a much greater variety of species, is the rule, a large Pyracantha (*P. angustifolia*) being particularly abundant. In the stony fields, scattered trees of Rhus and willow are prominent; and in March the terrace is white with pear blossom. The pine forest extends to 7000 feet or higher; above that is solid temperate forest, with a mixture of conifers and broad-leafed trees.

When we reached Rima in the first week of April, the forest fires, which in one place or another had been burning since the previous November, were finished. These fires, started deliberately for the purpose of improving the grazing of a few cattle, or accidentally by careless campers—or even playfully by children—needlessly devastate considerable areas, though the upper valley is so sparsely populated that, apart from the permanent rice fields, only a

fraction of the cleared area is under cultivation in any year. This suggests that the population is diminishing, and derelict rice terraces at various places between Walong and Rima point to the same conclusion.

The annual fires not only check the growth of pine forest, but entirely prevent the growth of broad-leafed forest, except in the gullies. Pines appear to be the only seedling trees which can withstand the grass fires, but even they perish when the whole forest is ablaze. It is certain that a few broad-leafed trees, including *Quercus glauca*, would be well established if it were not for these fires. On one occasion I noticed a forest fire at nearly 8000 feet altitude.

Between April and July, the snow melts fast on the hills; but most of the rain is stopped by the outer hills, and the gorge is distinctly arid. Even so, the torrent beds are full, and the Lohit, whose source lies partly in glaciers on the Tibetan escarpment, is in high flood throughout June and July. The heavy winter snowfall is, of course, not immediately reflected in the Lohit, which reaches its lowest in January.

Such, then, is the background against which we must view the great earthquake, and assess its immediate and probable future effects.

The earthquake struck without warning an hour after dark on the night of 15 August 1950; that is, at about 8 p.m. local time. There were no preliminary tremors—unless a slight, an almost imperceptible jolt immediately preceding the main shock can be called that.

We reckoned that the main shock lasted five or six minutes. It was certainly of long duration and extreme violence, the motion being vertical, as though the crust of the earth were caving in, but found difficulty in getting through the hole. The illusion of everything falling down an immeasurable shaft was, of course, heightened by rocks pouring down the mountain sides all round us with a fearful clatter.

We lay on the ground outside our tent, which was pitched on a low sandhill just outside Rima village; the vibration was so rapid as to suggest the roll of kettledrums. Dark as it was, we could see the ridges silhouetted against the paler sky, with their fuzzy outline of dancing trees. The noise was terrific, petrifying, and long continued as whole hillsides, studded with pine trees, slid into the valley. These external clatterings quickly drowned the internal rumblings deep within the crust. But the strangest noises of all came at the end of the shock, when five or six consecutive explosions, all exactly alike, following each other at intervals of several seconds, were touched off. These muffled booms—they sounded like Ack-Ack shells bursting high in the sky—seemed to come from the north-west; that is to say, from right over the spot where seismologists have placed the epicentre of the earthquake, a few miles up the Rong Thö Chu. They were heard on the plain of Assam 150 miles distant, and in Myitkyina (north Burma) 200 miles away.

During the following three weeks while we remained in Rima—that is, until September 7—I was able to examine some of the local effects. Superficially these consisted mainly of landslides, which continued for months so unstable had the slopes become. The exposed flanks of the gorges which slit the ranges on both sides of the Lohit were frequently scraped clean in the first shock, and continued to pour down avalanches of rock at almost regular intervals. The dazzling whiteness of the scars was due to the nature of the

granite and gneiss of which these mountains are composed. Nevertheless, I was rather surprised how quickly the mountains had succumbed to the main shock, and to the many aftershocks and tremors which followed for weeks, each preceded by a noise like distant thunder. No doubt this was due to a combination of causes—the steepness of the slopes, the burning of the pine forest, the leaching of the granite, and to climatic weathering in a region where the range of temperature, though not excessive, is considerable.

Many of the lower ranges, not only within the Rima basin itself but up and down the gorge, undoubtedly consist of loose boulders, sand and gravel, or are covered with a blanket of such material. The numerous gravel terraces prove that the Rima basin was formerly filled with gravel to a height of at least 1000 feet above the present river level. Other loose accumulations are certainly moraines, while still others are alluvial fans washed out of the ravines.

In the alpine valleys, too, there is always an excess of weathered material, and much of this was shot into the torrent beds. What happened to the Rima and Tooning terraces was typical of all; their scarped edges crumbled and slipped; long, narrow fissures opened; in places the ground sagged and caved in, though I saw no deep cavities. The high river cliffs, of course, gave way in many places, and wherever a footpath ran parallel with the river, it was cracked down the middle, often for long distances, though the crack was never wide enough to put a foot in. Small fountains of fine silver sand—almost silt—were thrown up like worm-casts. Ploughed fields were often badly churned up; but the fact that the rice fields were deprived of water was only indirectly due to the earthquake, the main irrigation channel having been blocked by a rock fall close to where it led off from the La Ti torrent, a mile from Rima. It was cleared within a few days.

Going about the Rima basin from the river bed to the slopes above Tooning on the topmost terrace, and from the La Ti torrent to beyond the confluence, I was alternately amazed at how little the country as a whole had changed, and astonished at the havoc wrought at particular spots. The Tibetan villages suffered comparatively little, though at Shigathang the earthquake completed the work of destruction (which the fire had begun) by throwing the monastery off its plinth on to its side. In Rima every log house was unroofed, which was hardly surprising, since the roofs were of shingles kept in place by stones! Only pent houses, built on to the log houses, where pigs and cattle slept at night, were completely destroyed, killing many of the inmates.

Southwards, the precipice path opposite the village of Samé, which had always seemed to me dangerous—though we had actually taken ponies down as far as the Di Chu torrent—had been swept away, though men could still get by. But south of Kahao it was impassable; hence the only route to Walong was the main path on the right bank, and this, of course, depended on the rope bridge. The rope bridge, however, had been an early casualty, and abortive attempts to get a line across, first at the recognized crossing place, and later a mile or two downstream, left us marooned in Rima. It was three weeks before the river fell sufficiently to allow communication with the right bank to be restored, and this at the old crossing place.

Theoretically there is a wide choice of mountain trails leading out of Rima,

besides the path to India. By crossing the Diphu La, we could reach northern Burma, and eventually Hkamti Long—a journey I had made several times. As aircraft can land at Fort Hertz (Putao), this seemed an attractive route. Or there was the track up the Zayul Chu, whence one could go north, deeper into Tibet, or diverge to Szechuan, or to Yunnan. Finally, there was the path up the Rong Thö Chu, with a choice of reaching either the Dihang or the Tsangpo valley; though this route, like the one to India, depended in the first instance on the restoration of the rope bridge.

Any of these escape routes involved a long and formidable journey, but if the Lohit valley proved impassable, we would have to consider them. In the event, the Lohit valley route, though very difficult, proved possible, whereas the others were not. To great physical difficulties, which might perhaps have been overcome, were added still greater political obstacles which could not. Only the Burma route was safe from Communists, but we heard later that the path down the Nam Tamai river had been ruptured by the earthquake, so that even in the unlikely event of our being able to reach the Diphu La, we should still have been faced by a difficult problem. However, freedom to move about south-east Asia was rapidly being restricted by political, even more than by crustal, upheavals.

Perhaps the two tracks most completely destroyed were those up the La Ti torrent, and up the right bank of the Rong Thö Chu, though the Zayul Chu road (which twice must cross the river by timber cantilever bridges, both reported destroyed) could hardly have been much better. Before the earthquake we had followed the La Ti into its gorge for a short distance, finding ourselves on a narrow path which traversed an exceedingly steep grassy face, where a few tortured pines grew widely scattered. Later, from the opposite bank of the Lohit, we were able to look right into this gorge and see not only that the slope had been flayed dead white, but also that it was swept at regular intervals by tremendous rock avalanches. We heard, without surprise, that a Mishmi village perched on a spur had been buried without trace.

Every avalanche raised clouds of white dust, and as hundreds of them happened every day, the air was always thick with dust. On fine days a strong up-valley wind set in about noon, and by three o'clock a vast white cloud, through which the sun peered like a reddish copper disc, overhung the basin. This dust settled very slowly, yet everywhere the vegetation was thickly coated with it.

Conditions were now ripe for giving birth to heavy floods. But the gorges were quite deep enough to carry them, at the cost of their own beauty. It was not till they reached the plains that floods would become destructive of human life. For example, it would have required a very outsize flood to threaten Rima, which stood 100 feet above the Lohit and lay 600 or 800 yards back from it. Yet one could not altogether discount the possibility of its happening. If either branch of the river became seriously blocked higher up, an immense volume of water might be suddenly discharged when the dam eventually gave way. We might perhaps ignore the possibility of the Lohit itself being blocked *below* Rima, though in fact this did actually happen. However, it happened a good many miles below Minzong, and the Rima basin did not fill up.

It was otherwise with the tributary torrents. These all have their sources in wide glaciated alpine valleys, and become progressively narrower as they descend, finally reaching the main valley through a slit-like gorge in the cliffs. One day we heard a tremendous roaring noise from the direction of the river, and caught sight of a great wave, crested with foam like a bore, sweeping suddenly down from the direction of the Rong Thö Chu. Tree trunks were riding the flood, being tossed about like match sticks. The flood passed in a few minutes.

A more alarming example occurred while we were at Walong in October, when the Yepak, about a mile away, suddenly burst through a dam which had held for thirty-six hours. From where we stood we could not see what was happening, but the noise was ominous, rising to a roar as the flood reached its height, and sinking gradually away. Probably every torrent was blocked sooner or later at least once, for on our way out we crossed several which had had their interiors ripped right out. A peculiarity of these sluiced downstream beds was the iron grey mud which was heavily plastered over the rocks and banks, and its putrid smell. It suggested oil.

So far as I could judge, bird life was not seriously affected, except perhaps remotely; but it was curious that the Rima hens ceased to lay eggs after August 15, till we left on September 7. At dawn on the morning after the earthquake a bird was singing sweetly; but the arid Lohit gorge is a corridor for birds migrating from plains to hills and *vice versa*, rather than a residential area. Another curious effect: the village pye-dogs, which usually barked at night—and half the night—for the mere fun of barking as it seemed, were silent just before, during and long after the earthquake. With aquatic life it was another matter. The Lohit and its tributaries ran so thick with mud that the astonished fish found their world turning solid, and were liquidated accordingly. It was, of course, difficult to extract them from the waves, but we acquired one or two, and excellent eating they were. It seems highly probable that every living thing, plant or animal, must have perished slowly or suddenly, stifled by the mud which for months clogged the waters. (At Dibrugarh, Assam, an analysis of the Brahmaputra water gave 17 per cent. of solid matter!) The day before the earthquake the La Ti was a lovely blue-green, and crystal clear. From the sixteenth onwards it ran thick soup.

But it was, of course, the vegetation that suffered most, and most obviously. The number of pines which were hurled into the river from the lower slopes was prodigious; they came racing down on the crest of the Lohit flood in endless procession, a few helping to form log jams on the island while most passed on. Whole hillsides covered with forest peeled off like wet paper from a wall and slid into the ravines in a wild confusion of rocks and timber. Many trees, hit by flying boulders, snapped off short; but some showed small rocks embedded like bullets in their trunks.

It was not uncommon to see shrubs apparently unharmed on a gravel bank dying where they stood, as though of shock. They were undoubtedly shrivelling from lack of water; but whether some underground source had been switched off, or the gravel had been so badly shaken that the finest rootlets had parted company from the main root system, I could not tell. They could hardly have died as a result of dust clogging their foliage, for all vegetation

suffered in the same way, and had it been lethal, plants must have perished wholesale. The first rain—and some showers did fall even in Rima—washed off most of the dust, and though the film was renewed, there were periods of relief. On the whole the summer in Rima is a rainless season, with high temperature and humidity, a dead time for the vegetation. That dust caused a certain number of casualties seems likely. We ourselves were continually breathing dust, and our skins were powdered with it.

The water shortage was acute. Hitherto we had drawn our supply from the La Ti irrigation channel; but no river water was any longer drinkable. I found a small spring which had worked its way to the surface at the base of a terrace cliff; but when after a few days that ran dry, we had to draw water from holes dug in the still wet paddy fields, or from the marsh where ponies grazed.

On September 1, a patrol of the Assam Rifles from Walong, who had been up the Di Chu gorge at the time of the earthquake and had camped at the hot springs,[1] arrived in our camp. They had found it impossible to return to Walong down the left bank of the Lohit, so had, like ourselves, come to Rima. They were almost out of rations, which we luckily were able to supply, but only at the cost of curtailing our own survival time in Rima since the local people could spare us no more rice. It became imperative to get rice from Walong, or to return there ourselves. We continued to urge the headman of Tooning to put up a new rope bridge without delay, and now at last something was done.

Meanwhile rumours circulated freely, some from words shouted across the Lohit, eked out by signs, some started by new arrivals. How these came to Rima nobody seemed to know, though it was said that men had come down the Zayul Chu. However that may be, there were stories of villages wiped out, of fighting between Chinese and Tibetans, and of shattered paths and hold-ups. We even heard that the Assistant Political Officer for the Mishmi Hills, who had come up to Walong by reason of the Chinese advance into Tibet, had been killed. But until communication had been established with the left bank, from that side we could be certain of nothing.

However, we were greatly cheered when on September 5 word was brought that the local people, assisted by the Samé villagers, had at last got a line across the river, the level of which had dropped. By the sixth, two rope bridges were in position, one a two-way Mishmi cane rope, the other a Tibetan rope of twisted bamboo sloping to the right bank.

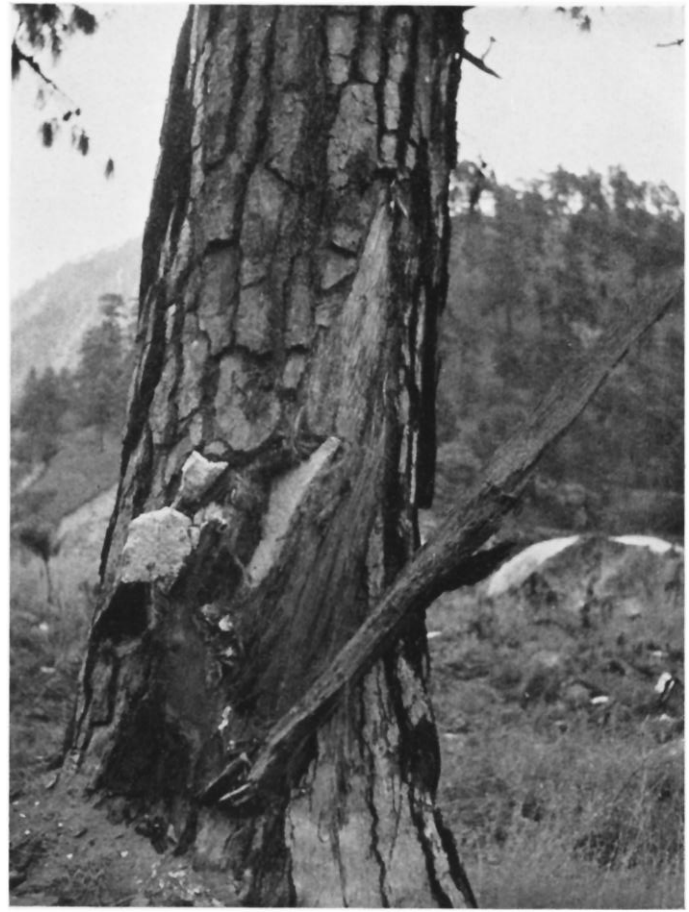
On the morning of the seventh we all set out for Walong, crossed the Lohit safely, and reaching Samé in the afternoon found a rescue and bridging party of the Assam Rifles, who were on their way to our assistance. They had brought rice, some medicine for my wife, and a note from the Assistant Political Officer—who had had a sufficiently narrow escape from death to justify the obituary notice—urging us to stay where we were, owing to the perils of the journey and especially of falling rocks. He himself and all his party had had a bad time, their camp with all equipment being buried beneath an avalanche of rock which had killed three of the porters and injured several

[1] The patrol went on as far as the Diphu La, the pass which leads down into Burma, *after* the earthquake, thus upholding the finest traditions of this force.

Hill split in half by the earthquake

Mishmi porters crossing flooded streams

A burst chorten at Rima



Rocks after earthquake embedded in a tree

people. The majority had escaped with the clothes they stood up in and had with great difficulty made their way back to Walong.

We debated whether to follow the Political Officer's advice or go on. As it was now three weeks since the earthquake, it did not seem likely that the danger would be appreciably less in any foreseeable time; and having started in good company, we decided to go through with it. The track was just as likely to deteriorate as to get better, I thought. Moreover, my wife was still rather upset; if she could do the trek to Walong she could have a proper rest and better food, under the eye of a competent and kindly Bengali medical officer whom we already knew.

Next morning the whole party, now swollen to sixty, set out for Walong and quickly crossed the Sap Chu. This torrent had ceased to run for two days immediately following the earthquake, and the ensuing flood had wiped out every vestige of the forest belt which had lined its banks, leaving in its place a residue of stinking grey mud into which our feet sank. The valley had been stripped and sterilized as though by a tidal wave.

The sights we saw during the next three days filled us with amazement. Along one stretch of the Lohit, pine trees were standing in the river with the water half-way up their trunks; and more remarkable still, a long whaleback of sand was visible above the swift, deep waters; this was at the foot of cliffs hundreds of feet high, down which rocks thundered at frequent intervals. Looking across the river we saw the small terrace above the Di Chu, on which our camp had stood five days before the earthquake, strewn with enormous boulders.

Right on the Assam frontier the men pointed out to us the site of the Political Officer's camp, now buried under hundreds of tons of rock; the regular camp site, with its permanent huts, half a mile on, had disappeared over the cliff. No wonder rumour had reported him killed!

We had to make an early start each day, and get as far as possible before the wind rose. It was noticeable that shortly after midday avalanches—which needed no more than a breath to set them off—became more frequent. By afternoon the air, which had become cleaner during the night, was again fogged with dust. On the third night from Samé, after a particularly awkward but short traverse high above the river, we camped near the Walong hot spring; and next day, after almost a mile of clambering over rocks and splintered tree trunks, we marched into Walong at 7 a.m., to be warmly welcomed by the Political Officer.

We now settled down to rest and await events. So far as that was concerned, I was prepared to wait two or three months; first because my wife was suffering from a mild form of shock brought on by all she had been through, and secondly in the hope of reaching the alpine region and collecting seeds. This latter was, however, a somewhat forlorn hope, since if the main path was so badly disrupted, it seemed unlikely that the tenuous hunters' trails which led into the high mountains would be less so. Another good reason for sitting tight in Walong was the fact that the rainy season would not end in the lower valley for another six weeks, and until it did, it would be safer not to proceed.

Walong itself, both the barracks on the middle terrace and the village on

the upper terrace, had escaped with only minor damage, though several slips on both sides of the river continued to pour down endless cascades of rock. What was more fortunate, the excellent water supply was intact; and with plenty of rice and vegetables from the Assam Rifles garden—which the O.C. generously allowed us to share—we lived better than we had done for several months. Luckily for everybody, the wireless was working and kept us in touch with India. From that, and from the Political Officer, a gallant and cheerful young Lushai, we at last heard the truth about the earthquake, which satisfied us that it was a big one. Naturally our relatives at home had been anxious at receiving no news of us for several weeks; but now H.E. the Governor of Assam kindly cabled them that we had reached Walong uninjured.

The weather was fine, with blue sky over the river, and hot, until the tearing midday wind rose and blew till sunset. I now set about finding a track into the mountains which would "go," but without success. At the third attempt I ascended, not without difficulty, up a steep pine-clad slope to a plateau at over 7000 feet altitude. This track had then continued up the ridge, and by the usual cliff traverse, into the upper Yepak valley; but the cliff had slipped badly and there was no possibility of crossing it, nor was there any water on the plateau.

It was not till October that the Walong men, who go into the hills to shoot goral (a variety of Himalayan goat like a small antelope), pointed out a track by which we could reach, if not the alps, at least the temperate forest. I engaged four Tibetan porters, and we set out on the morning of the ninth. In the first 1000 feet there were some difficult and even dangerous spots, but when these had been surmounted the going was reasonably good, and we finally camped on the edge of the forest beside the stream from which Walong received its water supply. From here it proved not too troublesome to reach a main ridge; but though I twice attained an altitude of over 10,000 feet, and silver fir forest, I never quite reached the tree line.

I remarked that south-facing slopes had suffered most in the earthquake. Across the Lohit the high ridges which climb eastwards to the Burma frontier were heavily scarred, both on their southern and western flanks. I concluded that north and east-facing slopes were better protected by their richer garment of forest than were the more exposed southern and western slopes. The cliffs directly facing the Lohit valley wind, however, were as badly scraped as any, and this was due not only to wind and exposure, but also in part to forest fires. There was very little dust on the foliage above 10,000 feet.

On August 15, when the Political Officer's party had been camped on the frontier, his escort, unable to move so fast, was still one march below Walong. On the sixteenth, after a desperate attempt to go on, they had been compelled to give up all idea of reaching Walong, and somehow managed to get back down the shattered valley. Eventually they had reached the plains, proving that the journey was at least possible, though it took them a long time. Perhaps it was as well they had *not* succeeded in reaching Walong, as pressure on the food supply might have been severe.

Shortly after the Political Officer's escort had retired, a party of volunteers from Walong, led by the indomitable Post Commander Jemadar Bir Bahadur

Gurung, and including the brave little Naga compounder, had done the four marches to Changwinti and back. The object of this sally was to obtain a supply of medicines, the Walong stock having been almost completely destroyed. That the party returned safely was a tribute not only to their courage, but also to their skill.

The Political Officer's party was the first to leave Walong, on October 2. We followed on the sixteenth, with a dozen porters for the four of us, carrying all our botanical collections, food for the journey, one small tent, and a minimum of equipment. We knew from reports which had come back that we were in for a tough time.

The first four days to Changwinti included two peculiarly unpleasant cliff traverses high up on the face, where the track had disappeared with the sloughing of the surface rock. Added to the possibility of losing one's balance on the 60°-slope was the perpetual threat of bombardment from above; in fact, getting out of the broken mountains was a far worse ordeal than the earthquake itself had been. It so happened that the earthquake occurred when all snow except permanent snow had melted, and this fact affected the result very considerably. So far as the upper Lohit is concerned, it was perhaps the season of maximum damage. The torrents were low (though by no means at their lowest) and it was difficult for them to keep their channels open in the face of the stuff poured into them. Even a small slip could block them for a day or two, while a head of water was forming behind the dam. Secondly, the slopes were well drenched with water, so that even though the rainy season was nearly over, the heavy surface was in a condition to slip easily. Thirdly, the strong summer wind blowing up the gorge and raising the dust, had some effect on the stability of slopes, making the passage of the valley highly vulnerable.

On the credit side was the fact that the vegetation cover had reached its zenith and was still in active growth; and this would help to hold together the soil. But once a slope gave way, this factor, of course, no longer operated; rocks and trees came down together in one solid piece before breaking asunder in chaos.

What then would have happened had the earthquake occurred in mid-winter? The surface layers would have been drier, and therefore lighter, and at alpine levels, frozen. Hence there might have been less tendency to slip, and that despite the dying down of the vegetation. On the other hand, the danger of snow avalanches would be greatly increased, especially towards the end of winter, when the snow would be more compacted. But as these avalanches take place anyway in the early spring, large snow beds accumulating in the gorges as low as 10,000 or even 9000 feet, this would make very little difference. Even if the earthquake did pitch large amounts of snow suddenly into the main valleys, its quick melting would be a great help in keeping the channels open; with the Lohit at winter level, there would be plenty of room for more water.

We stuck as closely as possible to the original track, considerable sections of which were undamaged. Only when crossing the great screes, some of which were 600 yards or more across, was it necessary to work out a new route. When we reached the broad-leafed jungle below Changwinti I

confidently expected to find fewer slips; surely the thick forest growth would prevent them?

However I had, it appeared, overlooked several important facts. In the first place, the rains in the lower half of the valley were not nearly over when the earthquake smote the hills. September and October are both wet months. Secondly, the outer ranges consist not of granite and gneiss, but largely of shales and schists, which give rise to a heavy greasy soil. Thirdly, I now recollected that vegetation, while it binds soil together, is not less active in disintegrating the rocks. Whatever the reasons, the mountain sides, heavy with water and a great weight of forest, had slipped badly here too. If less numerous than in the dry gorge, the slips were equally extensive, and even more hazardous to cross. One mountain at the base of which we passed, was literally split in twain.

Below Minzong we quickly ran into heavy rain, so that all temporary bridges were once more swept away; on the other hand, we were lucky to find nearly all the permanent suspension bridges—and notably those across the Dav and the Delei—intact, though the footway of the Am river bridge was canted at an angle of more than 30°, owing to the sagging of one of the cables.

My wife had a fall, and though she hardly more than grazed her skin, it turned septic. This accident, and more heavy rain down the valley, held us up for a week. Nevertheless, we reached the Tidding river on November 2, and found men putting finishing touches to the third temporary cane suspension bridge.

Approaching the outer range of hills, I expected to find fewer signs of the earthquake. As we reached the Tidding valley, therefore, it came as something of a shock to observe the colossal damage inflicted—far worse than anything we had seen previously. The steep hills which flank the gateway to the plains seemed to have been turned inside out. Not far above the Tidding confluence there used to be a big rock basin in the Lohit, where the river suddenly widened, then poured through a narrow gap; it was a magnificent fishing pool. Some days after the earthquake, the Lohit itself got blocked at this very point; we saw many trees still partly submerged along the banks. I believe that was the only time the Lohit failed to keep its channel open.

The most terrific sight of all, however, was the Tidding valley. The river, it appeared, had been blocked some distance above Theronliang for at least forty-eight hours—not on the night of the earthquake, but some days later. The result was dynamic. A wall of water 60 feet high had rushed at headlong speed past Theronliang, carrying the rest house and everything else with it. It had roared over the suspension bridge—we could not recognize the place where it had stood—and ripped out the rich lining of jungle on both banks, as though it had been turned on a lathe. The valley was now twice its former width, but it contained nothing but stones piled in vast mounds, with a muddy torrent rushing through the wilderness. It was a graveyard.

We crossed the Tidding a couple of miles below Theronliang, and walked up the right (west) bank, sometimes in the bed, sometimes high above it. Everywhere the mountains were silver as lepers with shining white scars, a country of death. No vestige of bridge, bungalow, sheds, or terrace remained;

only stones and stones. One would never have suspected that this valley had ever been inhabited.

We spent the night of November 2 at a relief camp which had been established on a small plateau several hundred feet above the Tidding, and next morning returned to the site of Theronliang. Curiously enough, the bridle path from here to the Saddle, nearly 4000 feet above, weathered the storm fairly well, and we reached the top, with few diversions, towards evening. Once again a thick mist prevented any view of the Tidding, and henceforth our only view was westwards across the plain. The Lohit had obviously widened out.

Descending the western slope, still in dense forest, we reached the headland on which Dreyi stands, at a height of 5000 feet, to find the rest house in ruins; we slept in another bungalow which was severely damaged but habitable in the circumstances. Below Dreyi, however, the mountain face had slipped badly, and we plunged straight down to a stream bed whence we reached the Sadiya-Teju motor road, 6 miles above Teju, in another three hours. Denning had been virtually wiped out and abandoned. After a day's rest at Teju we travelled by motor lorry to the Digaru river, which was shallow enough to wade, and a friend from Sadiya who had driven out to meet us, took us the last 30 miles.

It was surprising to see the outer ranges to the north dazzling white instead of jungle green. The Sadiya plain appeared to be ringed about with snow to the foot of the hills. There had been marked changes in the rivers too. The Dibang valley had suffered rather more than the Lohit, the river had been blocked, and in the short 30 miles between Nizamghat (where it debouched on to the plain) and Sadiya, it had changed its course, breaching the Nizamghat road and threatening to wipe out Sadiya.

So much sand had been poured into the Lohit that its bed had been raised several feet, causing extensive flooding. Miles of jungle on the left bank had been drowned, and when the river fell in November, a thick deposit of mud was laid down, where formerly there had been sand. A party of men had actually waded across the Lohit above Sadiya—perhaps on the very day it had been blocked at Nara.

But though the ground had swayed about in Sadiya, and considerable damage had been done in many places, all the serious damage on the plains had been caused by flood, but after the earthquake. Nor has Assam seen the end of it yet, for serious floods are likely to recur with the melting of the snows each spring, or the heavy rains, for some years. Any of the four big rivers which debouch into the head of the Assam valley—that is to say, the Subansiri, Dihang, Dibang, and Lohit—may give trouble at any time; but perhaps the most serious threat comes from the two last named, which might easily switch their waters to the south, just east of the railway, following more or less the alignment of the Assam Trunk Road.

No better opportunity for studying plant succession in this area, at all altitudes from 3000 to 12,000 feet, could be hoped for. Slope after slope was completely sterilized, and though many of them will be unstable during late spring and early summer—perhaps for years—and subject to devastating bombardment, the climate is such as to encourage plant life from the start. The battle between vegetation and earth movement is on. Abundant

windborne seeds of many species will reach the barren slopes from the surrounding forests; but the fact remains they must fall on stony ground, and on shifting sands at that. Unfortunately the opportunity to observe what is taking place is being missed, partly from lack of trained ecologists, partly for lack of funds, and partly owing to the remoteness of the region.

However, a large part of the devastated area will one day be reclothed though it is certain that the scars of the great earthquake will be clearly visible a century hence, and possibly long after that. Some of these will be cliff faces, some will be gullies, but many will be mere mounds of boulders.

One may surmise that the wounds will heal from the edge inwards, as is the way of wounds; plant life will creep slowly out from the living formation tissue, consolidating the ground as it advances. Amongst the earliest populations are likely to be many *Compositae* and grasses. Mosses and ferns, so abundant in the forested ravines, will be little in evidence because of lack of water and shade. There are plenty of local plants with wind-borne seeds belonging to numerous families. Pines will certainly be amongst the first trees to appear up to 7000 or 8000 feet; and, indeed, it was chiefly pine-clad—that is, exposed—slopes that slipped. Rhododendrons also have wind-borne seeds, and may predominate, with birch, poplar and willow, at altitudes of over 8000 feet, but only where moisture and shade are available.

In the Indo-Malaysian forests nearer the plain, regeneration is likely to be more rapid, and more complete. It is impossible to prophesy what the succession is likely to be, though one might hazard that alder will figure amongst the first trees. But it must be remembered that in the arid Lohit gorge, open pine forest is the dominant vegetation type between 3500 and 7500 feet, and that the sheer cliffs are almost bare in any case. The earthquake has made more such barren ground.

In February 1951, when Dakotas were dropping supplies to the outposts scattered round the head of the Assam valley, my wife and I on two occasions went as passengers to Walong. We had a fabulous view of the shattered ranges, which lost nothing in dramatic appeal when seen from the air. All the way up the gorge we flew about 3000 feet above the river, the mountains towering up on either side of us; from here the buttresses up which we had climbed, and the nerve-racking traverses, looked utterly impossible. What did seem surprising was, not that some of the side valleys had been blocked, but that any should have escaped being filled in like a grave. It will be a pity if the entire region has not been photographed from the air.

The area over which considerable or great damage was done extends from Rima north-westwards across the eastern Himalayas to the Tsangpo, above the gorge where Tsela Dzong was destroyed, and south-eastwards to northern Burma where the bridle path up the Nam Tamai was badly damaged. The principal rivers in the shaken area—any or all of which may be involved in floods—include: in Assam, the Subansiri, Dihang, Dibang and Lohit; in Burma, the Nam Tamai and the Adung. How far eastwards in the direction of the Salween river the disruption extended is unknown. But there seems no doubt that the earthquake, centred on the neighbourhood of Rima, affected more or less permanently a block of highly mountainous country which to west and south alone covers some 50,000 square miles, and to north and east probably no less.

THE FIRST SWISS EXPEDITION TO MOUNT EVEREST, 1952

ED. WYSS-DUNANT

AT THE beginning of 1952, the problem of the south route to Mount Everest presented itself in the following terms: our first task was to master the ice-fall of the Khumbu Glacier which rushes down between the western ridges of Everest and of Nuptse, covering a difference in level of 800 metres. The Anglo-American reconnaissance of 1950 led by Tilman and Shipton's British Expedition of 1951 had prepared the way. Our second task was to explore the unknown West Cwm and to place there Camps III, IV and V. Thirdly, we had to reconnoitre the best approach to the South Col up the precipitous 1000-metre slopes; and finally, there was the assault on the summit of Everest itself, by way of Camp VII which we hoped to establish on the south-east ridge of the mountain.

Such were the different aspects of the problem, complicated by all the unknown elements of glaciology and meteorology. In order to secure the success of the expedition it was necessary to take advantage of the latest improvements in equipment, and those points of our organization which seem to me particularly important and of special interest will be found summed up in the Appendices.

Taking it for granted that most people interested in Everest are already familiar with the reports of the American and British reconnaissances of 1950 and 1951, I shall merely recall them in a few words. The first American expedition was carried through rapidly in thirty-six days: starting from Biratnagar, the climbers took off from Namche Bazar and reconnoitred the Khumbu Glacier as far as the foot of Pumori and up to the great ice-fall of the West Cwm. The second post-monsoon expedition, the Everest Reconnaissance led by Shipton in 1951, started from Jaynagar and pushed the exploration further by crossing the Khumbu ice-fall as far as the entrance of the Cwm where the great crevasse put a stop to further ascent.

Starting on March 29, the Swiss Mount Everest Expedition, including 165 coolies and 12 Sherpas, arrived in Namche Bazar on April 13. Here the coolies were disbanded and porters from Namche were engaged to forward the loads to the Base Camp. The Base Camp was established and the whole column had arrived by April 23. Here we found traces of *yeti*, or "abominable snowmen," of which we can give the following account.

The "Abominable Snowman"

On April 18, the snow still covered the moraines from a height of 4500 metres along the Khumbu Glacier. A heavy fog hampered the observations of the patrol which was sent to reconnoitre the exact spot of the Base Camp, and it came back without realizing that it had unwittingly put to flight the mysterious being which haunts the mountains of the Himalaya. There it was that I discerned traces crossing the icy surface of a small frozen lake, and on

the same evening Professor Lombard arrived at the Base Camp announcing that he had followed *yeti* traces for a long way. These traces all came from the West Col, which we dubbed the "Yeti Col," and which connects the Lobje Valley with the Western Valley. We began by examining the traces on the frozen lake. They were somewhat blurred and much smaller than those we followed afterwards in the valley towards the col. I then discovered several tracks, three of which were undeniable, and of which we took the measurements. The plantar surface was 25 to 30 cm. long (according to the age of the specimen) and 12 to 15 cm. wide, which corresponds to the dimension given by Shipton; the traces on the lake did not exceed 20 cm. in length. The stride was 35 cm. long and the steps absolutely rectilinear. The depth of the track indicated an animal of good size but not enormous, and we reckoned the weight of the beast to be between 80 and 100 kilos. On examining the tracks closely, although they had been altered by wind and by snow fallen between April 18 and 23, you could distinguish five toes, only three of which showed claws. The thumb was generally turned backward and deeply marked; on two tracks I noted at the back of the heel two triangular imprints, probably of tufts of hair. We finally stopped before an obstacle in the animal's path, a rock behind which was the deep mark of three paws close together, the fourth being suspended for the next jump over another rock. Beyond this, the same traces of three paws together recurred, while the fourth marked the first stride. The track that followed was rectilinear. Farther on, I saw three tracks, one coming from the moraines and the others from the vale; they met and continued as though a single animal had pursued its way. These *yeti* are true alpinists, walking in each other's footsteps.

The following conclusions can, I think, be drawn:

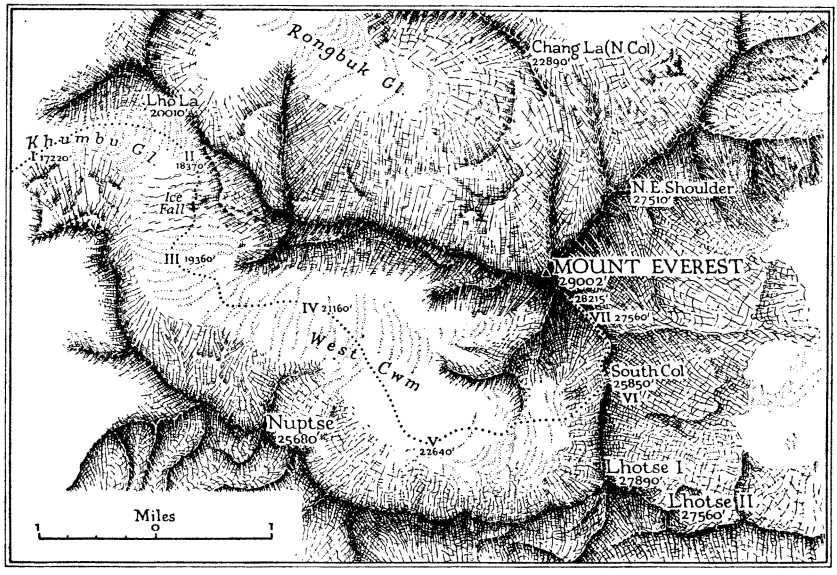
(*a*) We have to deal with a quadruped: this is proved by the jump over the rock.
(*b*) The *yeti* doesn't live alone, but in a family: the converging tracks, the footprints of different size confirm this, as does the track on the lake which indicates a young specimen.
(*c*) Its weight may be reckoned at about 100 kilos.
(*d*) The footprints belong to a plantigrade with five toes.
(*e*) Behind the footprints are found, in certain specimens of evidently adult footprints, the double triangular mark of tufts of hair. This last mark, not without importance, is not visible on the excellent photograph of the fresh track taken by Smythe, nor on Shipton's photograph.

I could find no trace of meals, nor yet of excrements, and this confirms the hypothesis that the animal is only passing through and that it does not frequent these heights; we should at least have found a place of refuge if not a lair if the *yeti* was living and hunting in the neighbourhood. I rather think it passes over the cols only when, having scoured one valley, it tries to reach another. This bear is a wanderer, avoiding the zones inhabited by men and making for the high altitudes haunted by the panther—a wild beast of which the *yeti* appears to have no fear. I don't think one can say more. The information given by natives is always inconsistent, and it is difficult to distinguish legend from reality. Let us therefore await patiently the day when

explorers will come back with photographs of the beast itself or, maybe, the very skin of the bear *ursus arctos isabellinus*, according to the conclusions of the late P. E. Pocock of the British Museum.

Into the West Cwm

On April 27, we climb to Camp I, following along the Khumbu Glacier—that marvellous Valley of Ghosts which is really a wide alley through ice pinnacles. The indefatigable Dittert is again ahead, patrolling with Chevalley, Aubert and Lambert. He has spotted the place for Camp II, and already seeks to penetrate the ice-fall at a point in the middle of the Glacier. But they are obliged to give up this approach and come back on their tracks. We work to



Approach to Mount Everest by the West Cwm

meet them (Roch, Flory, Hofstetter, Asper and I) carving and improving the track to Camp II up to the ledge at 5600 metres where the Camp is to be established.

On April 28, Roch, Flory, Hofstetter and Asper set out on patrol. They choose the left-hand path to take them out of the seracs, that is to say the right bank of the glacier, despite the danger of avalanches from the western arête of Everest. Just beyond the seracs, not far from the rocky spur of the western arête, yawns a gaping crevasse, six or seven metres wide and twenty metres deep, which bars the way to the famous West Cwm. Roch does not hesitate: he decides to make a rope bridge. To do this, the point of least resistance is chosen and Asper lets himself slide down to the bottom of the crevasse. Then, cutting and climbing, he manages to climb up the icy slope and to instal himself firmly on the other side. The obstacle is overcome: nothing remains but to drive in posts and to fix ropes to them; from now on

West Cwm from the Lhotse face

everyone and everything will pass over this improvised bridge and those Sherpas who hesitate at first will soon be clambering over with smiles.

Camp III is established on April 30, and the Cwm is open to exploration. Glorious sight—the valley stretches before us between the western arête of Everest and the ridge of Nuptse, sparkling with crystalline ice! At its far end, the Cwm is closed by the 8501-metre height of Lhotse which merges with Everest by the sweep of her arête on to the South Col, and with the ridge of Nuptse on the other side. This icy basin runs to about five kilometres in depth, and we have called it the Valley of Silence. The powdery avalanches founder without rumble or roar, and the stones roll down the flanks of Nuptse with no more than a plaintive whistle. Day after day, the columns of porters bring supplies from Camp I to the crevasse; three blasts on a hunting horn announce the deposit of the loads at the point from where Camp III will take them over. The best time for the coming and going between Camps I and III is from seven to eleven o'clock in the morning. The thunder of the avalanches which follows the nightly freeze-up ceases suddenly at five in the morning, and in the solemn silence which supervenes the porters set out, making the best of a lull which breaks around midday when the din of the avalanches begins once more. The snowfalls on the western arête of Everest, on the vulnerable stretch of the track from Camp II to III, choose their time discreetly: one fell half an hour before a column had passed, another half an hour after.

On May 9, Roch, Aubert, Lambert and Asper establish Camp IV at 6450 metres at the far end of the Cwm, and on May 10, Flory and Asper achieve the base of the Lhotse glacier from which successive reconnaissances are to set out; on May 11, Aubert and Lambert bivouac at the spot chosen for Camp V. Gradually, Camp I empties itself, just as did the Base Camp.

On May 14, most of the equipment is carried up to Camp V (6900 metres) and I set out myself, with Sarki and Gyalzen, for Camp IV. The weather is beautiful this morning, but soon we are caught in the usual afternoon showers which worsen into a storm as night draws on. I find Hofstetter at Camp III, and next day we are able to follow through glasses the two patrols which, at the end of the Cwm, are making their first sally towards the South Col. They have taken the Lhotse corridor and are skirting the right bank of the glacier of the same name. They advance slowly, avoid the rocky arête of the Éperon des Genèvois which must be sheeted with ice, and, making height all the time, attain to 7450 metres. Having consulted together, the patrols come down again.

Next day, May 16, I leave with Hofstetter for Camp IV. How magnificient is this approach to Camp IV between the giant peaks! Straight ahead of us, the wind sweeps away an avalanche of dusty snow before it can fall. It would be like fairyland were it not for the whine of the cascading stones. Where do they fall, I wonder? There is not the faintest trace of them in all this soft snow. We plod on more and more slowly through the shifting snow and after what seems an interminable spell we come up with Chevalley, Aubert, Flory and Asper at Camp IV.

By good luck, our walkie-talkie is working today, and I am able to make contact with Dittert, and then with Dr. Chevalley at Camp V. "At first it

was merely tiring in the snow, then the cutting of the way became exhausting and we had to give up" Dittert tells me, and "We are trying the left corridor tomorrow." "We are all in good health," Chevalley assures me. Tomorrow I mean to try the closed circuit type of oxygen equipment on the same journey as to day from Camp II to Camp IV. The benefit of this sytem of continual inhalation is shown by the shortening of the time taken by 25 minutes; say, 30 per cent. improvement in climbing power. I am doubtful whether the equipment which is adjusted to intermittent inhalations can, owing to inadequate suspension and the absence of a mask, do as well at 8000 metres.

Today, May 17, I see as I proceed Dittert, Lambert, Aubert, Chevalley and Tensing, cutting across under the rocky arête of the Éperon des Genèvois and exploring the left-hand corridor. At —20° Centigrade, they have to cut steps in the solid ice, and presently they retrace their way to climb once more on the old track diagonally along the rocky arête. They reach 7600 metres. On May 19, a new attempt takes Chevalley and Asper, roped together, up to 7800 metres, and they descend in a loop on the glacier of Lhotse; meanwhile, Flory and Aubert explore without much progress the seracs of Lhotse's western flank. There remains no alternative but to revert to the attempt of May 15, furnishing the worst transits with ropes fixed along 150 metres, which enables us on May 21 to establish a depot at 7400 metres. But on May 22 and 23 the wind unleashes its full blast, and the team which leaves with high hopes on the 24th finds the way blocked by a tempest of snow. It seems that the elements are doing their utmost to keep us from climbing the South Col. The happiest member of the party, for the present, is the botanist Zimmermann who came up to surprise us, and who has discovered at 6400 metres near Camp IV, on an open moraine, some minute plants of arenaria and androsace. This establishes a botanic record in height.

At last, on May 25, a team composed of Lambert, Flory, Aubert and Tensing decide to force their way up Everest. The narrative continues in Lambert's and Dittert's own words.

The first assault: Lambert's narrative [1]

"The morning was exceptionally clear and no plume showed on Everest. Flory, Aubert, and I set out accordingly with the Sherpas Tensing, Pasang, Danamgyal, Phu-Tarky, Ang Norbu, Mingma Dorgi and Ajeeba.

"Slowly we climbed the spur again and went obliquely on in tracks already made by Chevalley and Asper, bending back along the centre of the couloir leading down between the Spur and Lhotse, over patches of snow and small rocky ledges. Hours passed. The sun began to sink, the wind rose, and at about 25,260 feet two of the Sherpas, Mingma Dorgi and Ang Norbu, turned to descend, afraid of frostbitten feet. There was nothing to be done but divide up most of their baggage. Flory and I each took a 13-pound tent, Aubert a sleeping bag. Unluckily the sleeping-bag slipped from his hands in the wind and rolled down the slope to be lost for ever.

"The situation was becoming critical. The sun sank behind Pumori, and as it disappeared the wind and cold increased. At seven p.m. we arrived just in

[1] Abridged version of Lambert's and Dittert's reports in 'The mountain world, 1953.' Allen and Unwin, Ltd., London.

time at a depression in the snow less steep than the surrounding terrain. The four Sherpas dug a platform for a tent on one side, and on the other Flory and I prepared the ground for our tent, while Aubert held tight on to the packs on the slopes. We squeezed into our tents, and then began a fearfully cold night in an extremely hazardous position. It was impossible to stretch our legs, in fact we dared not move for fear of rolling with the tent to the bottom of the couloir. The three of us lay still roped together and wearing crampons and it was impossible to spread out a mattress or sleeping bag. Our plight was not encouraging for the continuation of the assault, for the night merely caused so much extra fatigue.

"It was a long and dreary night and we shivered as we waited for dawn. I had fixed my ice-axe at one side and passed ropes underneath it in order to safeguard us in case the tent, buffeted by the wind, should be blown away down the slope. Dawn broke at about six o'clock, Nuptse became clearer, and the sun appeared at the bottom of the valley towards Pumori. As soon as it touched our slope we began to fold the baggage and roll up our tent. The Sherpas also got ready, but were not feeling well. Two went down to retrieve some of the supplies left en route, but Tensing who throughout had shown outstanding courage and dynamic qualities, continued with us. We climbed with our muscles stiff and cold towards 26,250 feet and arrived at last on a hump of ice facing the peak of Everest with Lhotse behind. Below us the South Col was swept by a relentless wind which left nothing but the stones. After Tensing had fetched up the rest of the supplies, and also induced the three Sherpas to rejoin the party, we managed, with difficulty, climbing in that terrible wind, to get our two tents up to the col. We had to crawl about on all fours, wearing crampons, to establish the camp. The wind continued murderously fierce, but we rested a little in the shelter of the tents. The altitude was affecting the young porters; Pasang wanted to die on the spot, Phu-Tarkey zigzagged about as if drunk and Danamgyal had a headache. This meant that our Sherpa team was finished, for the next day it would have to retreat, instead of bringing up more supplies to set up a camp at 27,560 feet. There was nothing to be done about it. Despite the wind which battered the canvas, we had a better night, and on May 27 the four of us moved off towards the base of the south-east peak of Everest, at the foot of a great rocky slope; in two hours we reached a little col at 26,296 feet and had a magnificient view of Tibet. A projection resisted our efforts to surmount it; Flory pushed on a little further, but the slope was too steep and any idea of climbing it had to be given up. Retracing our steps, skirting along the base of a spur falling to the South Col, we approached a wide couloir, which was easily climbed between rocks and snow. Then the couloir narrowed and soon we found some easy ledges on the right. After a rest we decided to open a canister of oxygen, Tensing and I, while waiting for the other two. It revived us, but only for about twenty minutes. I took the lead again over rocks, then over rocks mixed with snow, and at about three in the afternoon I was astonished to find myself on the arête of Everest itself, at the summit of the first spur leading from the small col. There was a sensational view over Tibet and the east face of Everest tumbling 16,000 feet down into Karta valley. Farther away were the small rounded mountains of Tibet. Lhotse behind us had receded, for

we had almost reached the level of its summit; Nuptse looked very small in the west. This was a moving and impressive moment.

"Tensing suggested—just as I was thinking the same thing—that we should sleep there in the tent he had been carrying since morning and make an assault on the summit the next day. I agreed, in spite of the absence of a mattress or sleeping-bag. The opportunity was there and we had to take it for the sake of the expedition. Both of us were in luck, for our physical condition was good, and so were our heads.

"When Flory and Aubert arrived we discussed it with them, and as it was a delicate situation we spoke frankly. It was eventually agreed that Aubert and Flory should return to Camp VI on the South Col and await our return. At four p.m. Tensing and I established ourselves in our ice-pit. Then followed another terrible night, which we spent slapping one another to maintain our circulation, with nothing to drink except some snow melted with the help of a candle. We had a little food, and we had the cold.

"At long last the dawn of May 28 broke, and we emerged from the tent absolutely frozen, but to our disappointment great clouds were rolling over Nuptse and there was a west wind. Over Tibet it was fine and clear. We set off at about six o'clock with three canisters and some food, and slowly we climbed, making use of snow and easy rocks. Fog and snow hampered our advance, but we climbed on, conquered two ressauts, then came to a zone of cornices connecting up to the top of the south summit. We crossed these ledges, again sinking in snow to our knees and making tracks in relays. It was heavy going—three steps and then a halt for breath. Snow was falling, but from time to time the summit cleared, and we peered up at the last forbidding heights.

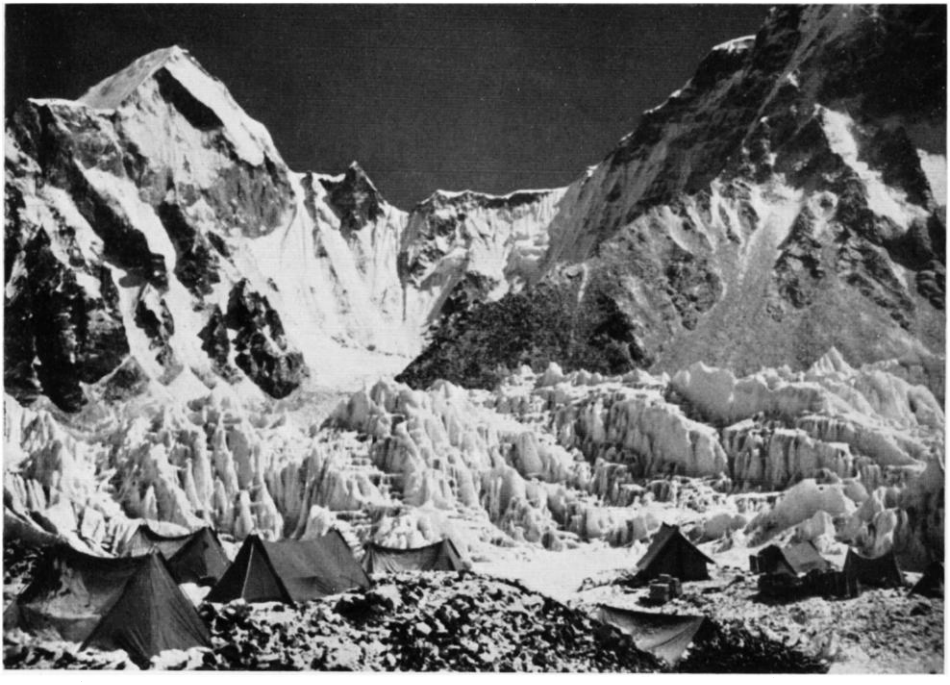
"What were we to do? Wind and snow threatened us with further hardships. We were near the last rocks before the final pyramid, but the weather was deteriorating and common sense urged us to turn back. We took a little more oxygen. But I can record that at 28,215 feet I was in good condition, except for a deceptively pleasant sense of well-being.

"When I stopped I felt magnificent. That is perhaps the most fateful moment at this altitude; everything seems to be going very well, and at precisely that moment one fails. Tensing, too, had moments when his balance seemed uncertain. Happily we always kept our heads; we were aware of our position and of what we were doing. The oxygen helped, but it was impossible to pump it in while moving, and when we stopped its effect lasted about 20 minutes and then we relapsed.

"We decided to descend. Tracks recently made had almost completely disappeared, and we had to stop as often coming down as going up. Down on the South Col, Aubert and Flory came to meet us in a state of great anxiety and got us into the shelter of Camp VI. Tensing was by this time half dead with fatigue, and for the rest of the day he had continually to be awakened and forced to drink. He slept motionless until next morning."

The Second Assault: Dittert's narrative

"Lambert's party left for its attempt on the summit on May 25, and now, on the 29th our team, composed of Dr. Chevalley, Roch, Asper, Hofstetter



Camp I, Khumbu Glacier

Reconnoitring the Ice-fall on way to Camp II

Rope bridge across 30-foot wide crevasse beyond Camp II

and myself, leaves in its turn to climb the South Col. We expect to meet the returning members of Lambert's team, which we know to be reduced to four, their other Sherpas having rejoined Camp V on the evening of May 27 in a state of extreme exhaustion. There is a sudden cry of "There they are!" and there to be sure are our four comrades, slowly approaching the crest. They reach it at last and we hasten to join them. We embrace each other, but to our consternation we discover that they have reached the limit of their endurance. Tensing, worn out by his exertions, can hardly move and has to be helped. Aubert's eyes are sunk in their sockets and he, too, seems worn out. Briefly they tell us what they have done. They still believe that with luck we can reach the summit. I doubt it a little, but I am nevertheless optimistic, in spite of the prospect of a return in the same shape as the first group.

"As we move upwards the Sherpas in front constantly turn back to see if we are coming. We realize that they have placed their lives in our hands, and this responsibility weighs on our shoulders. I tell myself that if one member of the party is taken ill or injured, he is lost: a man has only enough strength to look after himself. And if a storm gets up, what then? As we advance, the South Col extends before our eyes, and suddenly we see two yellow points—the tents—a hundred yards or so below, on the other side of the ridge. And at six p.m. we reach Camp VI, 25,853 feet up on the South Col.

"Next morning, May 30, we emerge from our tents to find to our surprise that Everest has assumed its great plume of snow. The sky is clear enough, but the wind is violent and icy. I spend a few minutes outside, and in a moment my hands are numb; when I go back into the tent I am very nearly frost bitten. In these circumstances, I postpone until tomorrow the climb to Camp VII. In any case, it will only be possible if the wind dies down a little, and if Everest sees fit to do without its plume. Thus we pass our third night on the Col. It is a night which drastically weakens the strongest of us, and a much enfeebled team leaves the Col on June 1 for the descent to Camp V. The first rope team consists of Mingma Dorgi, Roch, Asper and Hofstetter. Sarki is not ready, and it takes all Chevalley's energy to get him out of the sleeping-bag in which he has spent the past three days.

"The climb to the crest of the Col is very slow. Luckily the weather is calm. If it had been stormy, our situation would have been critical. Certainly a man in Sarki's condition—he collapsed several times—would have to be abandoned. In front of us is the way down, and the all-but-certain prospect of arriving safe and sound at Camp V. We are completely exhausted and are dismayed to find that the efforts necessary for the descent today are even more exacting than those we made three days ago on our way up. This shows all too clearly how a man's strength deteriorates at a height of more than 25,500 feet. Slowly we continue the exhausting descent. Never, it seems to me will we reach the buttress; but approach it we do, as the hours drag by. Just before six-thirty p.m. we arrive at the little platform of the depot. Sarki is at the end of his strength, and we decide to pass the night here. Asper, who is very exhausted, will stay with us, while Roch, Hofstetter, and Mingma Dorgi will go on to Camp V. The moon will help them, and tomorrow morning they will send two Sherpas up to help Sarki.

"We make our way to Camp V next morning, where Lambert greets us, and

next day we leave together for the base camp. It is time we did so. The crevasses are wide open, the melting seracs threatening and the route absolutely changed. Happily, Sherpas are sent from Camp I to lead us through this frightening chaos, which our leader had to manage during the whole expedition. Thus we arrive safely at the base camp on June 4. On the 9th, after a friendly meeting with the British Cho Oyu expedition in Thyang Boche, we arrive in Namche Bazar. The monsoon has broken in cataracts of rain, and the adventure is at an end."

I should like to sum up the experiences of this expedition, and to assert that the crossing of the seracs right into the Cwm is practicable in spite of the dangers caused by the instability of the seracs and the ever-threatning avalanches from the hanging glacier of the west ridge. But, I must underline that this way is easier in autumn than in spring time because of the ice conditions.

It can be also asserted that the crossing of the great crevasse is not a sufficient handicap to prevent men and material from reaching the Cwm. In the spring, however, operations must be conducted rapidly and should not run the risk of the monsoon, which would not fail to close the trap—I mean the icefall—after heavy falls of snow.

The South Col slope remains the obstacle number one; for the extremely variable glaciological conditions there might at any moment turn an expedition into a catastrophe, either because of an early monsoon or because of the exhaustion of the climbers after too long a sojourn on the South Col, which itself becomes a channel for avalanches in an excess of fresh snow and an icy surface when the snow is lacking. An intermediate camp on the slope itself at 7600 metres would present considerable advantages as a safety factor by diminishing the excessive distance between Camp V and the South Col, and would avoid the exhausting bivouacs that two columns, one on the way up and the other on the way down have had to endure. The second Swiss expedition was to undertake this task which is now accomplished, but not without great difficulties. The creation of this supplementary camp depends entirely on the snow conditions. In spring 1952 it would have needed pick-axes, perhaps dynamite to obtain an even surface on this ice slope. On the South Col, an important camp could be established, not on the saddle itself but, if possible, higher where the winds stop whirling.

At 8400 metres, the south-east ridge offers a rocky platform where you can pitch a tent as a last stage before the supreme assault; the establishment of another relay higher up would be physiologically impossible for a prolonged stay owing to the disconcerting speed at which the human organism deteriorates at very high altitudes. One may allow oneself two days of assault on starting from the South Col, but the third must be given up to the descent. On the fourth day the exhausted organism would run the risk of no longer standing the strain of walking, particularly if the weather broke.

From 8400 metres to the top no difficulty of a technical order seems likely to create a definite obstacle. The powder snow constantly blown by the wind is only deep at certain spots in the curves of the ground. 8500 metres does seems to be the physiological limit for the human organism without the aid of

oxygen apparatus; and this only in the case of one or two climbers specially fit for the effort, and not for the whole team. And it is the duty of the leader to give extreme care to the evaluation of the resistance to altitude of the climbers and their respective capacities.

The only thing to be considered is the toughness and the perfect fitness of the subject, and it is here that the age question is predominant, I may almost say a matter of life or death. The age of thirty-five is the optimum average for the greatest heights. But not only this: the leader has to manage to judge the speed of his party's relation to the time necessary for acclimatization. Our acclimatization from the Base Camp took place between April 23 and May 16 up to Camp V at 6900 metres; that is, in three weeks, which should be sufficient lapse of time. From May 10 to 15 the continual coming and going which took place between Camp IV and V, greatly helped to make adaptation easier. From May 15 to June 1 operations were conducted from an altitude of 7000 metres to the maximum height attained. Consequently, the organism was spurred on to a supreme effort during twelve days after becoming both acclimatized and adapted. I consider this to be a maximum. The proof of it is that a second assault, with the same men, above 8000 metres, was absolutely out of question without an interval of two weeks rest. In any case, the oncoming monsoon would have excluded the possibility of another trial. A repetition of the Annapurna experience must at all cost be avoided. Warned by our former experiences, we reckoned that the monsoon was due between June 6 and 10. It broke on June 9, by which time we were all safe and sound in Namche Bazar.

Now that the south route of Everest has been discovered, now that all technical data of the problem are known, the essential point is this: to succeed in diminishing the hours of march from the upper camp to the top; time that may be reckoned, without oxygen, at ten hours (45 metres per hour): as many must be counted for the return. Therefore the climb cannot be attempted without the help of oxygen apparatus, for the continuous inhaling of oxygen may at such a height increase the climbing power of man 40 per cent.

The conquest of the summit of Mount Everest has entered into its ultimate phase, but it needs such a miraculous concurrence of circumstances, physiological, meteorological and glaciological, all simultaneously favourable, that the probability of success is very small. May the British expedition achieve success; it is my heartfelt wish.

APPENDIX I

Equipment and food

I am personally convinced, since the 1949 Kanchenjunga-Pyramid Peak expedition, that ordinary mountain boots, even if improved, are not fit for Himalayan climbing. Even in former expeditions, British and others, it was clearly demonstrated that leather boots freeze in the night and that to put them on again is something of a tragi-comedy. I have had the opportunity of seeing Arctic peoples, for instance the Eskimo with sealskin boots and Samoyedes and Laplanders with reindeer boots, and these ethnological observations among the cold zone people gave us the necessary elements for fighting against frost bite of the extremities. But the original native boots would have been no use for

climbing. The solution was found by manufacturing a very light buckskin boot which could be placed inside the reindeer boots. For protecting our hands, we bought the double silk gloves used by British airmen, woollen gloves and eider-gloves. For our heads we had caps with earflaps like those worn in Tibet, and for the rest, the ordinary Arctic equipment.

The oxygen apparatus

With the Institute of Physiology of Geneva we constructed equipment of the closed circuit type weighing 5 pounds. We used the Chemox canister manufactured in the United States and adapted to it the inhaling apparatus of plexiglass, but without rubber tubes and without mask. The theory of this type of equipment is that the expired carbonic gas combines with the tetraoxide of potassium and liberates the oxygen for inhalation. As I have good reason to think that the 1953 British Everest Expedition was equipped with a very similar kind of apparatus I will not go into full details of this purely technical problem. I consider this system of closed circuit to be the best, with the restriction that the inner resistance of the closed circuit must be corrected, because it was this factor which handicapped us at the greatest heights.

Food

This problem reduces itself to a question of vitamins, and of acid food and glucose in a liquid form. Our own experiences showed that the chemical vitamins are not sufficient to replace completely the living vitamins consumed. That is why on the way back the members of a Himalayan expedition are generally seized with a vitamin hunger. I can tell you from bitter personal experience that on my return from both expeditions I devoured anything I could find in the nature of vegetables or fruits (mushrooms, turnip leaves, wild spinach and so on).

But at great altitudes, where the air is of a dryness similar to that of the desert, the greatest plagues are those of thirst and the wind. Food is possible only in liquid form and we were glad we had brought tinned orange juice. This contains glucose and sufficient living vitamins to feed the body at these altitudes where the mastication of solid foods is unsuitable because of the decrease of saliva and its thick consistency. Moreover, citric acid is an excellent antidote against alkalosis, *i.e.* the alkalinization of the body, a well known phenomenon which takes place at high altitudes.

The disadvantage of tinned juice is its weight, but this is of minor importance in comparison with its utility. It is far better therefore to increase the number of porters, which must be increased in any case, and to avoid the recurrence of the terrible handicap which hampered the two assault parties to such an extent: the Sherpas reduced to impotence by the great height.

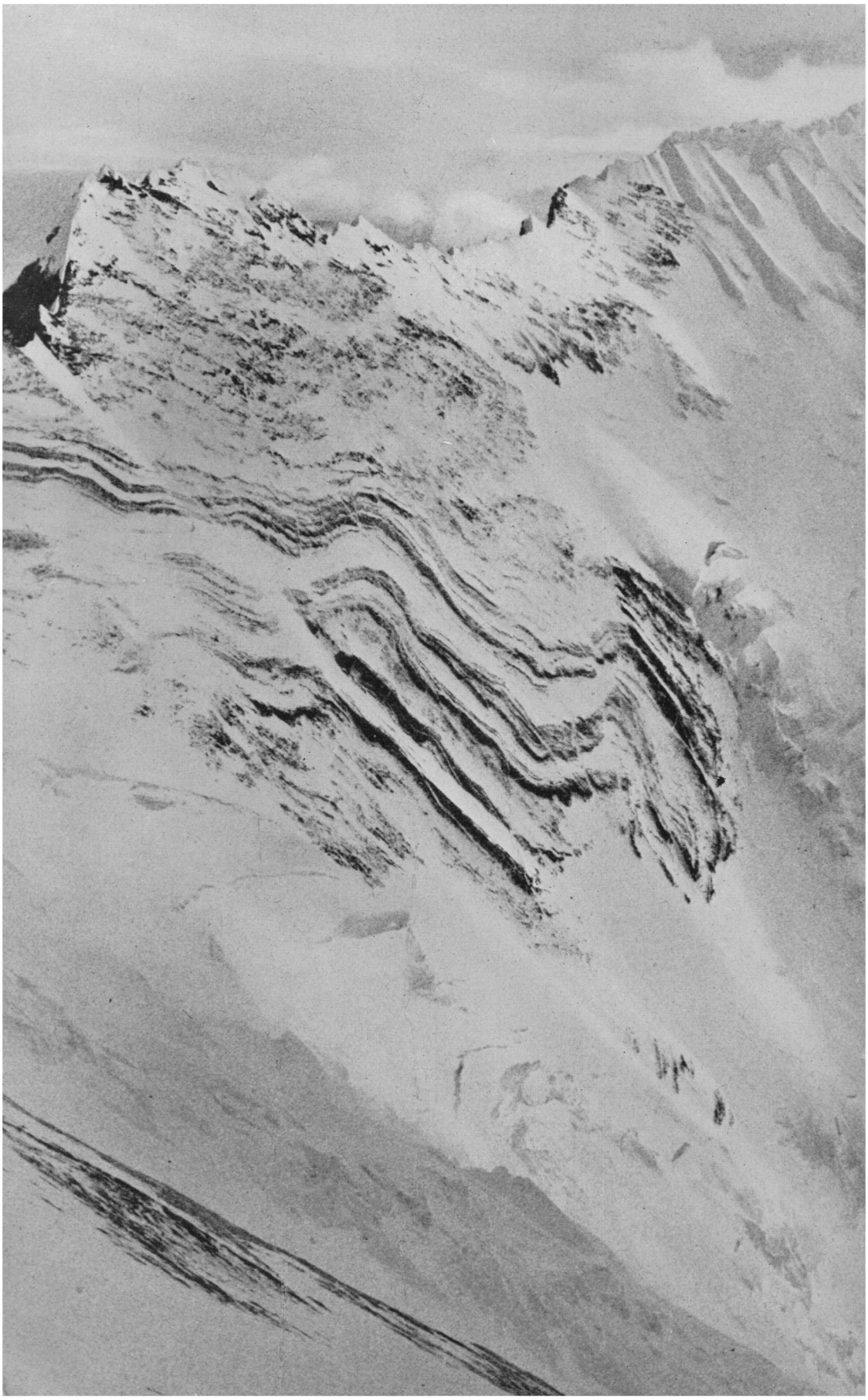
APPENDIX II

General organization and team

The Committee created in Geneva had at the same time to choose the team and to organize the scientific mission. The Foundation for Alpine Research in Zurich was negotiating the whole affair, taking steps to arrange the transport of men and material already packed in Zurich.

Concerning the team, we were convinced that the homogeneity of the members of an expedition can greatly improve their output. With this idea we chose

"Organ-pipe" snow structure on Nuptse ridge



members of a Geneva mountaineering club called "Androsace," which is a very good school for climbers and is in reality a nursery for strong alpinists. To avoid the psychological incompatibilities which occur so often in expeditions, the cause of difficulties and of unnecessary loss of energy, we chose men who had been accustomed to climbing together for many years and who had a good knowledge of themselves, of their physical strength, of their character, and of what they could expect from each other. They made up a very strong homogeneous team. René Dittert was the technical leader for high altitudes. He and André Roch, our photographer, were in the Himalaya for the fourth time. Dr. Chevalley and myself were there for the second time. This permitted all members of the expedition, from the Base Camp to the furthest patrols, to be roped in and managed by Himalayan climbers who were experienced and perfectly aware of Himalayan conditions. The other members were: Raymond Lambert, Leon Flory, Ernst Hofstetter, René Aubert and J. J. Asper. The scientific mission was composed of Mrs. Lobsiger-Dellenbach as ethnologist, Professor Augustin Lombard as geologist and Albert Zimmermann as botanist.

As far as it was possible we chose men neither too young nor too old (between 30 and 40) for it is a well-known fact that men of twenty are no more fitted than are men of forty to encounter great heights. Younghusband was one of the first to draw attention to this fact, followed by Hartmann. The pulse question is closely bound up with that of age; I should not like to omit laying stress on this important matter. The observation of the pulse is the best way of testing the acclimatization and adaptation of the climbers. Acclimatization is not the same as adaptation. You get acclimatized to conditions compatible with life (for instance up to 6000 metres, where recuperation is possible): or you can get adapted to conditions incompatible with life for a short while (above 7000 metres) where no recuperation is possible. The pulse suffers modifications accordingly, corresponding to the individual's resistance to height.

We made our first observations on this matter in our 1949 Kanchenjunga expedition. The pulse was taken in complete rest only in the morning on waking. We could observe three type of pulsations, which we called: the indifferent pulse; the sensitive but compensated pulse; the sensitive non-compensated pulse.

The differentiation of these three pulses is only that the indifferent phase varies with the resistance to height of the individual. For instance, Mr. A. has an indifferent pulse up to 5000 metres, at which height, it begins to play about. Mr. B. has an indifferent pulse up to 4000 metres, where the same joke begins for him. But Mr. C. has an indifferent pulse only up to 1500 metres. This is more than a joke, and it is better for him not to go to the Himalaya. Consequently Mr. A. is the more resistant of the three and fittest for the 8000 metres height, which will certainly not be the case for Mr. C. The sudden slowing down of the pulse is the first sign of an effort to get acclimatized. This modification is immediately compensated and the rhythm of the pulse returns to its normal level. But from this moment the pulse is quiet no longer and has an ever more marked tendency to increase its rhythm in an up and down movement.

DISCUSSION

Evening Meeting, 30 March 1953

Before the lecture the PRESIDENT (Mr. J. M. WORDIE) said: Her Late Majesty Queen Mary became a Patron of the Royal Geographical Society in 1932 when she visited the new building with King George V. They marked the occasion

Folded strata in Nuptse ridge

by presenting the Society with two minature globes which are on view in the new Map Room.

Queen Mary took a great interest in the Society's activities and made many visits to the Society. She was particularly interested in mapping. Lord Chetwode once told me that in his younger days he was responsible for taking Queen Mary round during military manoeuvres at Aldershot, when they found themselves adrift. Queen Mary insisted on the map being set correctly, and as Lord Chetwode said, the use of the word "set" told that the Queen knew all about mapping.

Queen Mary made many other gifts to the Society and in latter days presented some atlases, including one which she had used as a schoolgirl. Her last visit was in 1947. I feel sure you will all wish to rise with me in tribute to the memory of our late Queen and Patron.

Then the PRESIDENT continued: Our lecturer this evening is Dr. Wyss-Dunant, a very well-known climber and traveller. My first knowledge of him personally was his ascent in East Greenland of Mount Forel in 1938. That was a great achievement. Also among the great achievements of his country is the expedition which Dr. Wyss-Dunant led to Mount Everest, and we are all looking forward to his lecture.

Dr. Wyss-Dunant then read his paper

The PRESIDENT: We have with us H.E. the Swiss Minister and we should be glad if he would care to say a few words.

H.E. THE SWISS MINISTER (M. de Torrente): Mr. President, Ladies and Gentlemen, it is with pleasure and pride that I have listened to the account which Dr. Wyss-Dunant has given us of the Swiss Everest Expedition of 1952. With "pleasure" because, like any of you, I am intensely interested in mountains and in foreign lands; and with "pride" because these stirring and courageous deeds were accomplished by compatriots of mine. I regard it also as an honour that the representative of one of the smallest countries has been called upon to lecture in this Hall of the Royal Geographical Society whose rooms have been the spiritual home of so many of your Empire-builders. Explorers the world over have had much support and encouragement from your Society. Indeed, for a long time one regarded geographical exploration nearly as a British prerogative.

Your men and your Society have not only set high standards which serve as an example to all who endeavour to follow in your path, but you have also most unselfishly been willing to help others. The Swiss Everest Expedition has been no exception in this respect, and your reception tonight of Dr. Wyss-Dunant and his lecture has proved it once more. I and my compatriots thank you most sincerely for your hospitality.

Sir EDWIN HERBERT (President, Alpine Club): Mr. President, Ladies and Gentlemen, I feel you would like to join me in expressing our gratitude to the lecturer for his lecture and our sense of admiration for the magnificent performance which Dr. Wyss-Dunant's party put up on Everest. There is no doubt—and I mean this literally—that they pushed their effort to the very limit of human endeavour.

They have done three things which are of great value to us. They have proved the solution of two problems; they have defined one problem and they have posed another. The first thing they have proved is that there is a practicable way up Everest from the south. Secondly, they have proved that if oxygen is going to be used at all it must be used continuously and not intermittently, preferably from 21,000 or 23,000 feet upwards.

The problem which they have defined is that Everest will only be climbed by a fit party, assuming that the weather is right, going for the assault from a prepared camp and looked after by other people. It is incredible to think that Lambert and Tensing made that attempt and got so near to the top after having themselves prepared three consecutive camps on three consecutive nights and having slept in the last one—if "slept" is the right term to use—without either sleeping-bags or food of any shape or kind. If a party can be put into such a position as that last camp, the camp having been prepared for them and they having been nursed as far as possible on the way there, then there is a good chance of getting up to the summit of Everest, but it does require that, and the Swiss have, I think, proved it.

The problem that they have posed is a serious one. What I have had to say about the necessity of starting the assault party from a prepared camp up the South Col means that there has to be a tremendous amount of support at and below the South Col, and that means that a great many people, not only Europeans but Sherpas, have got to get through that ice-fall and up the Lhotse wall to the South Col, which is a very serious undertaking indeed. The question is whether that must necessarily be done in any particular spring before the monsoon starts, or whether the possibility is not better after the monsoon and before the heavy winds are re-established. I think that the lecturer would agree that in their effort to avoid going up the centre of the ice-fall they went very dangerously near to the western buttress or western ridge of Everest. I believe that after the monsoon later on they found it was possible to go up the centre of the ice-fall; difficult, but probably safer. It may also be that the Lhotse wall from the West Cwm up to the South Col is more practicable after the monsoon with more snow than it is before. That is another problem they posed. On the other hand, if a party get to the South Col after the monsoon they may find that the wind—as the Swiss found it in their post-monsoon effort—will make it quite impossible to go any further.

I think the Swiss Everest Expedition has added greatly to our knowledge of the topography of the mountain, the way of approach, the means of organizing the expedition and of the physiology concerned. I am sure we are all very grateful to them and I close by saying this personally: I hope that having done so much before, the British will get up Everest, but if it is not to be the British—let it be the Swiss.

The
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THE ASCENT OF MOUNT EVEREST

BRIGADIER SIR JOHN HUNT AND SIR EDMUND HILLARY

Her Majesty the Queen, Patron of the Society, His Royal Highness the Duke of Edinburgh, Her Royal Highness the Duchess of Kent, Honorary President of the Society, and Her Royal Highness the Duchess of Gloucester, were graciously pleased to be present at a meeting held at the Royal Festival Hall, London, on the afternoon of 2 November 1953. This meeting, as well as one on September 14 at the Royal Festival Hall and another on October 19 at the Central Hall, Westminster, was attended by Fellows and members of the Royal Geographical Society, members of the Alpine Club and many distinguished guests.

The paper that follows is based on the illustrated lectures delivered on these occasions by Brigadier Sir John Hunt, Sir Edmund Hillary and other members of the British Mount Everest Expedition 1953, under the auspices of the Joint Himalayan Committee of the Royal Geographical Society and the Alpine Club.

IN DESCRIBING the ascent of Everest, I must first of all recall that this is a story which has been going on for nearly thirty-three years; there have been no less than eleven major expeditions to Everest since 1921, eight of them, including this year's expedition, sent out by the Royal Geographical Society and the Alpine Club, acting jointly as the Himalayan (formerly Mount Everest) Committee. Not all of these were serious attempts to climb the mountain, for the problems encountered were so numerous and difficult and the chances so limited by the weather, that three whole seasons were spent during these thirty odd years in preparing the way for an attempt planned to take place the following year. This happened in 1921, 1935 and again in 1951 after the war.

To put our own expedition in its right perspective, therefore, it must be realized that a great deal had already been done to pave the way. Not only had our predecessors brought to light most of the problems and found the answers to many of them, but they had also actually climbed to a very great height on different flanks of the mountain—about 28,000 feet was attained by Norton and Somervell as early as 1924, and again in 1933 by Smythe, Wyn Harris and Wager, on the northern side; the Swiss guide Lambert and the Sherpa leader Tenzing reached approximately the same height on the southern side in 1952. It was our task and opportunity to complete an

Her Majesty The Queen with Brigadier Sir John Hunt, looking at equipment before the film "The Conquest of Everest"

adventure—I might almost say a mission—which had already been lived and told almost to its end by many gallant men before us.

Organizing a big expedition is a formidable business. We started to get ready in September 1952, about five months before we were due to leave this country for Nepal, and in many ways this was far too late; we were working against time throughout the preparatory period. We tried out the most critical items of clothing, equipment and food on a high pass in Switzerland in mid-winter and made trials of the oxygen equipment on our own hills in North Wales.

One of the lessons of the past was the need to become thoroughly accustomed to a high altitude before attempting any of the bigger Himalayan peaks and the only way to ensure this was to go out to the Himalaya some time before the period when we planned to climb Everest, and to carry out a programme of acclimatization training among the lower mountains. The period when the weather seemed most likely to give us a chance on Everest was after mid-May, when the winter gales and the extreme cold should have abated, and the arrival of the monsoon some time after June 1. There was no certainty that we should be lucky enough to have a fine weather gap, but we aimed to be absolutely ready from May 15 onwards. To do so, and at the same time have a period of preliminary training, meant leaving for India and Nepal in the middle of February.

On February 12 the main party left Tilbury by sea while a small advance party set off a few days later by air to pave the way. We were a party of thirteen: Charles Evans, Tom Bourdillon, Michael Westmacott, George Band, Wilfred Noyce, Charles Wylie, Edmund Hillary, George Lowe, Alfred Gregory and myself. Dr. Michael Ward came as expedition doctor, Dr. Griffith Pugh was the physiologist[1] and Tom Stobart was the cameraman. All but two of the team had been to the Himalaya before.

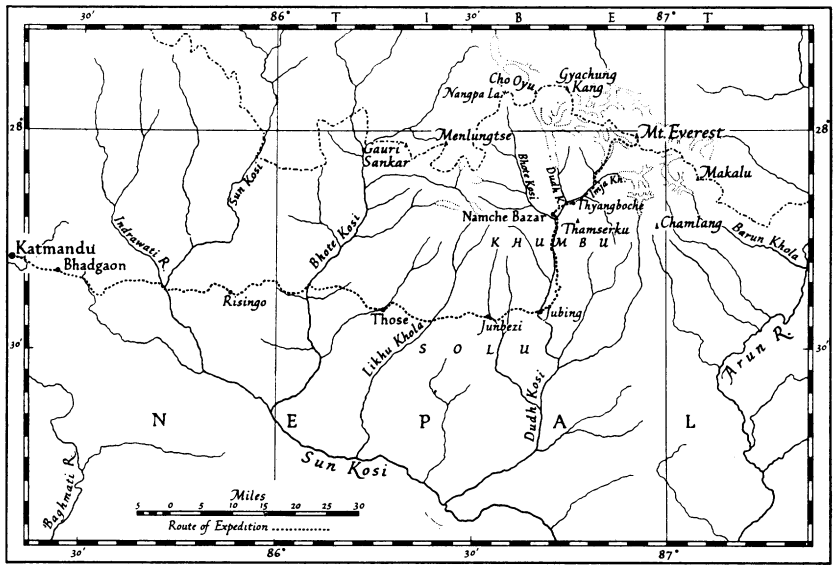
The expedition assembled at the British Embassy at Katmandu the capital town of Nepal. It was from here that we were to travel on foot to the mountain, a journey which would take us seventeen days. We had with us no less than $7\frac{1}{2}$ tons of baggage made up into man-loads each weighing about 60 lb. This meant a small army of carriers, or coolies—about 350 of them. So numerous were we at the moment of leaving Katmandu, that I decided we must travel in two convoys at a day's interval.

During our stay at Katmandu those other full members of the expedition, the Sherpas, arrived under their great leader Tenzing. We had arranged for twenty of these splendid little men to do the most arduous carrying on the higher part of the climb, and here most of them were, smiling and gaily coloured in their odd assortment of clothing from the various expeditions they had served on, ready for this biggest expedition of all. Tenzing himself made up the climbing party to a total of eleven. Only a few months earlier he had come back from his second expedition to Everest in a year with the Swiss, and it was uncertain whether he was fit enough to go again. But from the moment we met there was no further doubt about this—he was obviously going to go high.

[1] His attachment was made possible through a generous grant from the Council of the Royal Society.

We were to march eastwards from Katmandu for about 150 miles, moving roughly parallel with the main range of the Himalaya. This had the disadvantage that we would be going athwart the grain of the land, crossing ridges and climbing thousands of feet in and out of deep valleys. But this was more than made up for by the variety and excitement of the scenery and by the fact that such a march was in itself an excellent way of getting fit for the job.

We had a wonderful journey through the beautiful land of Nepal. During the early part of the march the hills were gentle, broad and richly cultivated, just what we needed in our then unfit condition to run us in gradually for higher and steeper ground. The weather was perfect and it was still cool among those lower hills; some of the early flowers were out—almond blossom



The route from Katmandu to Mount Everest

in the cultivated areas, rhododendrons, magnolias in the higher forests and primulas along the paths. Breasting the ridges we had tantalizing views of the high mountains on our left, towards the north. We went down and down the flanks of the ridges to the foaming torrents, crossing them sometimes by log bridges close to the turbulent suface of the water; sometimes by a high swinging suspension bridge of chains and planks. The marches were short, owing to the slow progress of our laden coolies, and we had time to bathe as we waited for our cook Thondup to prepare breakfast. As the days passed, the country became first alpine, then more truly Himalayan in appearance; the hillsides were steeper and rocky, covered in places by virgin forest; we began to catch glimpses of the snow mountains, now challenging in their nearness. We had turned northwards up the deep glen of the Dudh Kosi, making directly towards our goal; and just before we reached our first base camp we sighted Everest itself.

On March 26 we arrived at the monastery of Thyangboche. Situated at over 12,000 feet on a high ridge, it must be one of the most beautiful places in the world. Here we set up a base camp for the next three weeks, while we trained among the surrounding peaks. The camp was on a grassy alp in constant view of the Everest group. We paid off the coolies who had carried our loads and got our kit ready for the next task—acclimatization. For three days we discussed plans and attended lessons in the use of our equipment, and then set out in several parties for the training period. We climbed six peaks of about 20,000 feet, got to know the country and one another, and became accustomed to our equipment, especially the oxygen.

It was now about mid-April and we had to move up the Khumbu valley to reach the foot of Everest, where we planned to set up a second base camp high up on the Khumbu glacier. The various parties moved there independently in the third week of April, moving up beside the Khumbu glacier which takes its source from Everest and dominated by Everest's close neighbours. The new base camp was situated at just under 18,000 feet in the centre of the glacier surrounded by fantastic ice pinnacles, above which stood the great peaks—Lingtren, Pumori, Nuptse and others. One party under Hillary had arrived there before the others to explore the lower part of the mountain.

Into the West Cwm

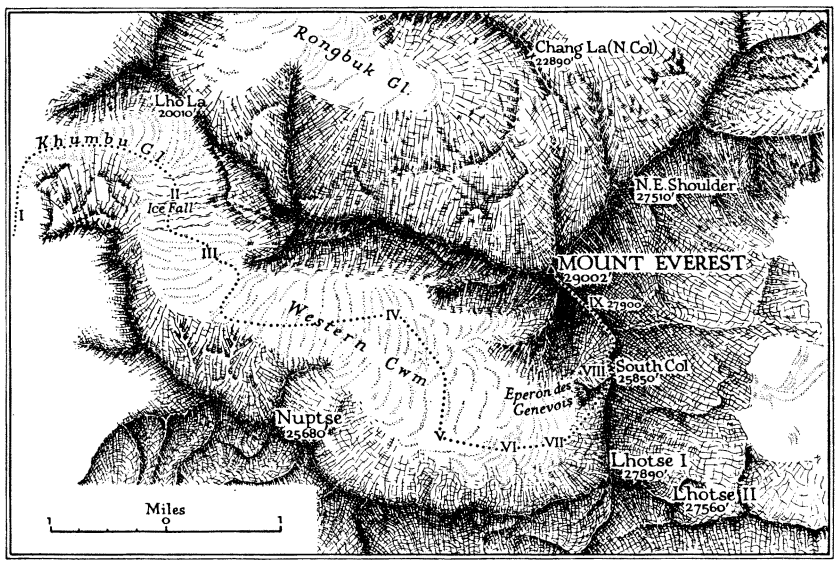
The first problem in getting up Everest from the Nepalese side is to climb the great Icefall, which descends steeply over a height of 2000 feet. It presents a serious obstacle from the technical climbing point of view and it is also a constant source of danger, for the ice is always shifting downwards in sudden unpredictable surface changes. Great chasms open up, masses of ice are poised at one moment and the next come crashing down, obliterating everything in their track of destruction, and it is a maze through which it is difficult to trace a practicable way. The Icefall leads into a long narrow high-level valley running down from the final walls of Everest and enclosed both by our mountain and two others which complete the trinity of the Everest group—Lhotse (27,890 feet) at the head of this valley, and Nuptse (25,680 feet) on the side opposite Everest. The valley itself is known as the Western Cwm. The average height of its floor is 21,000 feet and it slopes gradually downwards towards the sudden drop of the Icefall.

Before we could make an attempt on the summit we had to shift the great bulk of our stores higher up the mountain and closer to its final keep; we planned to establish an advance base camp high up in this Western Cwm at over 21,000 feet. First a way must be found up the labyrinth of the Icefall and farther along the Cwm to the site chosen for the advance base. Then over 3 tons of stores must be carried (in smaller loads of about 40 lb now, owing to the greater height and the difficulties of the climbing), staging at various camps yet to be set up, by teams of Sherpas led by members of the climbing party.

We had now increased the Sherpa team to thirty-four by recruiting and equipping local men from Khumbu and the work of stockpiling in the Western Cwm started according to plan on April 24—it will be remembered that it was to be finished by May 15. We worked on two levels; one party

Everest from the south beyond the Lhotse-Nuptse wall
Photo: Indian Air Force

from Base Camp, the other from Camp III at the top of the Icefall at over 20,000 feet. The work became a regular system of ferries, working almost to a time schedule. The low-level teams would leave Base Camp about midday and reach Camp II about half-way up the Icefall two or three hours later. There they stayed for the night and, starting early, would reach Camp III at the entrance to the Cwm by 9 or 10 o'clock. They dumped their loads at Camp III and descended directly to base in the early afternoon, ready for the same programme next day. The high-level parties would take over the burdens dumped by the Icefall Sherpas, carry them up to the site for the future advance base—at first only a dump for these stores and later labelled Camp IV—and return down the Cwm to Camp III in the course of a long, hard day. The climbing in the Icefall was always strenuous and difficult;



The Western Cwm

there were bridges to cross, ladders to climb, vertical ice walls to ascend in steps carved in the ice, with the aid of a hand line or rope ladder. There was always the danger of falls of ice at a moment when a carrying party was underneath some tottering ice cliff. Falls were constantly occurring and it was mainly chance (perhaps indeed a miracle) that we were spared any accident throughout the many weeks that we moved up and down the Icefall. The weather was bad. For five weeks it snowed during a part of every day, covering the laboriously prepared track with deep new snow, making each journey a fresh problem in track making and route finding and it was all the more depressing in that we were so intent on being ready from mid-May onwards. Our numbers were reduced too by sickness; many suffered from sore throats and hacking coughs, and there were numerous cases of tummy troubles.

But the work, though slowed down, went steadily ahead, and everyone took

View down the North face of Everest, taken by Hillary from the summit, showing the North Col, North Peak, Rongbuk Glacier (left), East Rongbuk Glacier (right) and Rongbuk Valley

a cheerful, full and effective part in this process of getting ourselves ready for the assault. The stores at Base Camp dwindled; at Camp III they piled up only to be whittled down as they were shifted daily farther up the Cwm to Camp IV.

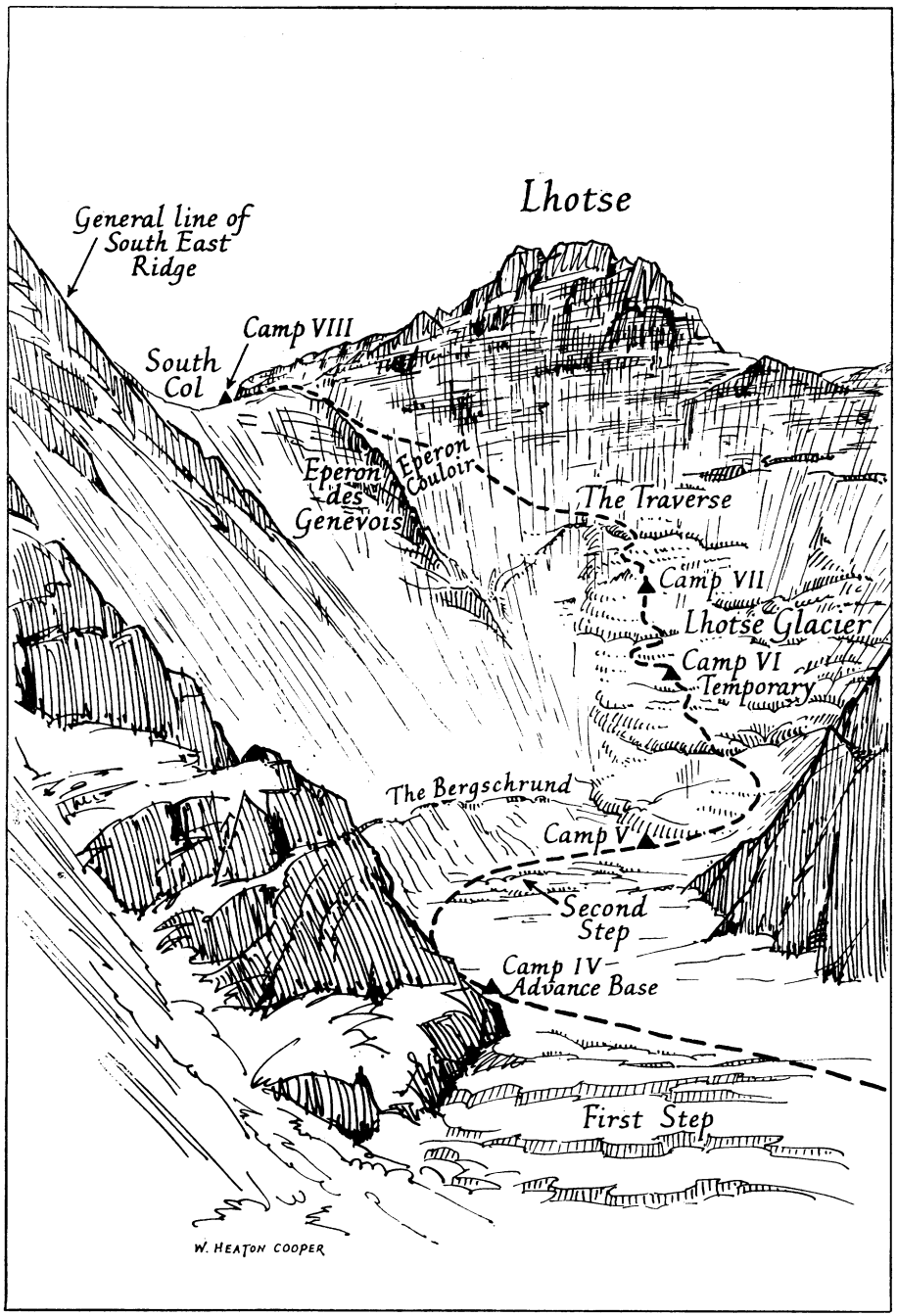
Up the Lhotse Face

During all this time, of course, we were spying out the land ahead. Reconnaissances had preceded the making of the route through the Icefall: likewise we had sent a party up the Western Cwm at the beginning of the build-up period in order to prepare a way to and look for a site for Advance Base. Now, about half-way through the three weeks' period of stockpiling, the most important reconnaissance of all was carried out: the way out of the Western Cwm. This, the Lhotse Face, is the crux of the whole climb. It is 4000 feet high, it is uniformly steep and it is technically difficult—a glaciated slope with vertical cliffs or steps of ice separated by snow-covered shelves—and the problem of climbing it is made infinitely more severe by the altitude, for it rises from 22,000 feet at the head of the Cwm to nearly 26,000 feet on the South Col. First we sent a small party to find a way and also to experiment with our oxygen equipment for the first time at really high altitude, for hitherto we had been able to try it out only below 20,000 feet during the training period. As a result of this reconnaissance, which was carried through in appalling weather conditions by Evans, Bourdillon, Ward and Wylie, another party was sent up to prepare a route through the main difficulties—Lowe, Band and Westmacott with a special party of Sherpas. Band and Westmacott fell sick at the beginning of this important mission and Lowe had to carry on with the Sherpas alone. He set up a tent on a ledge where the Swiss had camped the previous autumn at about 23,000 feet and for ten gruelling days he, assisted during various stages by a magnificent Sherpa Ang Nyima, and by Noyce and Ward, remained on the Lhotse Face, operating between 23,000 and nearly 25,000 feet, without the aid of oxygen; cutting steps in the steep ice, fixing ropes to assist parties on the most precipitous ground, stamping a trail through the deep snow on the terraces. For the first five days his work, like that of the toilers lower down, was hampered by heavy snowfall; and at times the Lhotse Face team were waist deep in fresh snow. Yet by May 20, they had forced a route nearly two-thirds of the way up the Face, and over the main difficulties. It was a performance which will go down in the annals of mountaineering history.

While this was going on, others of us were carrying the stores ever higher, from Camp IV to the very foot of the Lhotse Face; from there the special items required for the assault plan were lifted up the Lhotse Face in the track prepared by Lowe's party, first to the temporary Camp VI then, as he progressed, to a Camp VII at 24,000 feet. Thus we infiltrated up the mountain.

We had made a rough guess at an assault plan in London, but it was only after the reconnaissance of the Lhotse Face that a definite scheme could be made, based on actual experience of the ground, the weather conditions and the performance of our equipment. On May 6 I was able to make the final decisions, which were as follows:—

We would be prepared to make, if necessary, three attempts on the summit



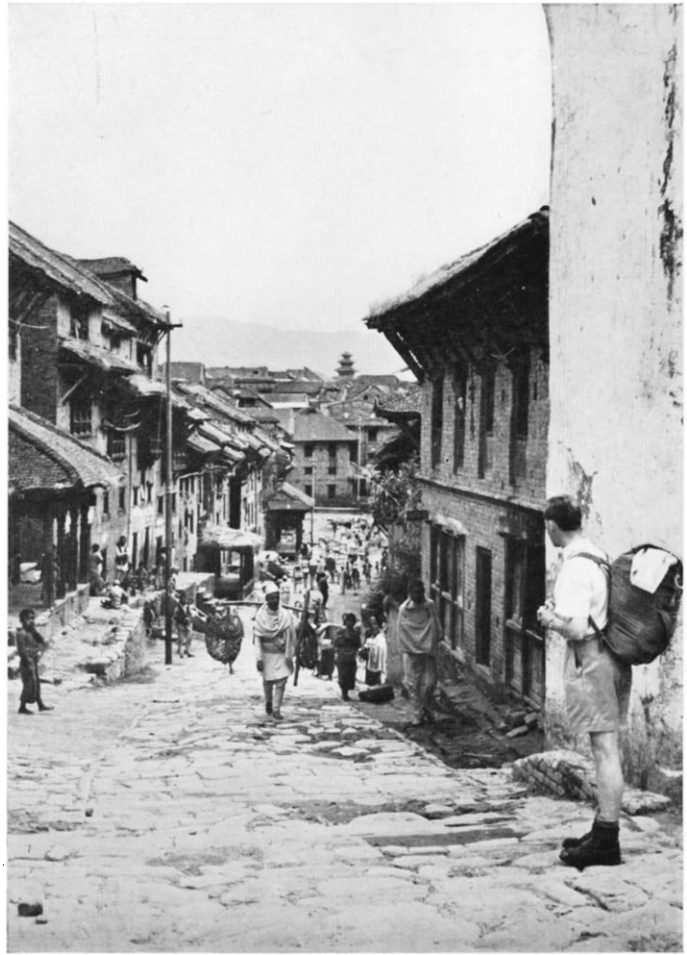
Reproduced from "The Ascent of Everest" by John Hunt (London : Hodder and Stoughton, Ltd., 1953)

Route up the Lhotse Face to the South Col

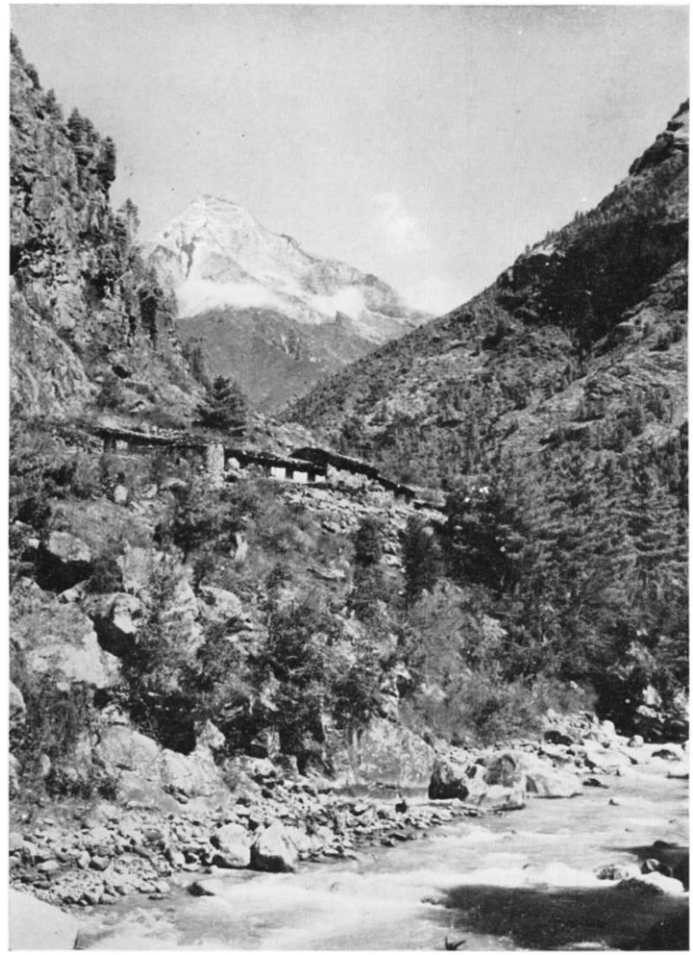
—this much was feasible in terms of men and material. Two of these would be made in quick succession, the one supporting the other, on consecutive days if the weather allowed. Each assault party should consist of two men to attempt the summit, and others to accompany them, in support so to speak, and carrying stores to establish the highest camp of all, the final camp from which the attempt would be made. The first assault was to be made using an experimental type of oxygen equipment—the closed circuit type—which we hoped would enable us to save time, effort and (not least) the burden of additional oxygen cylinders, by climbing directly to the summit from the South Col without the use of a further camp. The second assault, using the more fully proven open circuit equipment, would be made if necessary from this top camp. Bourdillon and Evans were to make the first attempt on 'closed circuit,' supported by myself and two of our élite band of Sherpas, Da Namgyal and Ang Tenzing. We had, during the acclimatization period, trained seven of the best men in the use of oxygen. The second attempt was to be made by Hillary and Tenzing, supported by Gregory and three other Sherpas of the select team—Ang Tema, Pemba and Ang Nyima. Ang Nyima had already established a reputation by his fine work with Lowe on the Lhotse Face.

But before these first two attempts could be made over 700 lb of stores—oxygen, tents, food, fuel, cookers, climbing gear—must be lifted from the head of the Western Cwm up the Lhotse Face to the South Col. Fourteen more Sherpas, chosen specially as a result of their showing during the build-up period, and led by Noyce and Wylie, were to undertake this vital preliminary mission.

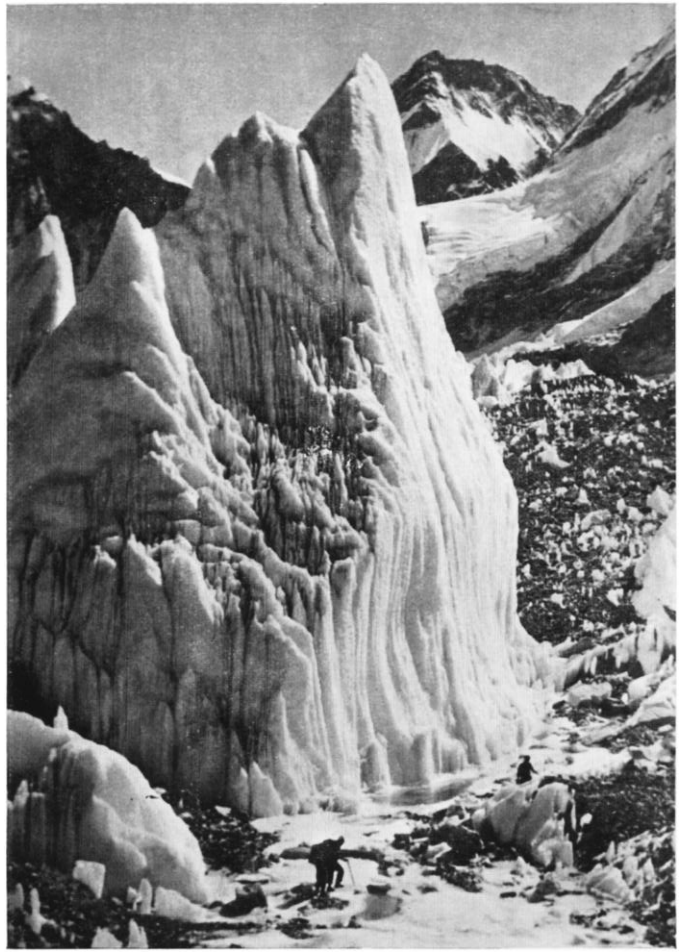
It was now May 21. Two days before I had sent off Noyce with the first party of eight men to Camp V at the foot of the Face and the day following (May 20) he had reached Camp VII, half way to the Col. Wylie's party had started off for Camp V on this same day and was due to go up to VII in Noyce's tracks—twenty-four hours behind him. It was an anxious and critical day in the history of the expedition, for everything depended on whether Noyce's party would in fact get up to the Col; they would be doing so largely over ground which we had not yet explored, let alone prepared, for Lowe's magnificent effort had at last petered out on the 20th below 25,000 feet and he had come down for a badly needed rest. We were watching from Camp IV a certain point on that immense backcloth of dazzling whiteness—a pinnacle or sérac of ice which concealed the tents of Camp VII. Would they come out? At about 10 o'clock two figures emerged alone, two tiny dots barely visible to the naked eye. Apparently, Noyce had decided to adopt the alternative plan which we had discussed, of taking his leading Sherpa—Annullu—and making the track upwards while leaving the rest of his men in the camp that day. This was disappointing, for it meant a serious overcrowding in the few tents of Camp VII that night when Wylie's party would also have arrived, and the lurking uncertainty remained as to why the others had not accompanied him? Were they sick or too tired, and if so would they go on even the following day? We waited and watched throughout that day, our anxieties banished by wonder and admiration, as Noyce and Annullu climbed steadily up those steep slopes to the top of the glaciated incline and turned across



The Expedition passing through Badgaon, with Noyce (right)

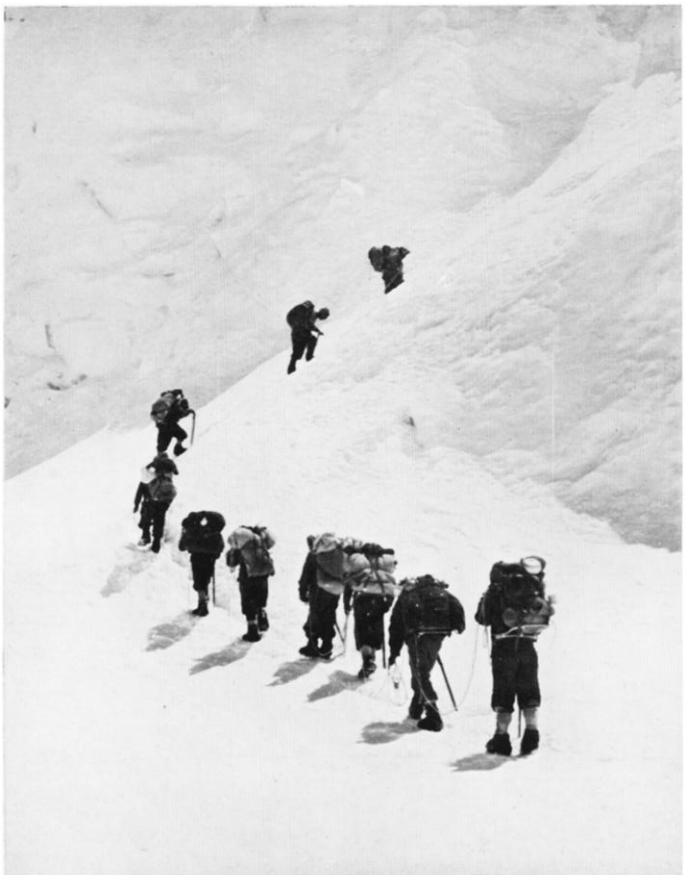


In the Dudh Kosi



Ice pinnacle on the Khumbu glacier

Bridging a crevasse in the Icefall



Wylie and Sherpas on the Lhotse Face

Evans (left) and Bourdillon on return from the first assault when they reached the South Summit (28,720 feet)

towards the South Col itself. Soon after 2 p.m. we caught a last glimpse of him, a speck of blue against some rocks, and then he disappeared beyond the crest of the Col. It was a triumphant moment. For twelve days now we had been doing battle with this, the greatest obstacle of all on our way to the top —and now it was overcome. As we watched Noyce on his epoch-making climb, we also saw Wylie and his nine men arrive at Camp VII. The watchers at Advance Base settled into their tents for the night, excited by the drama of that day but carrying their anxieties to bed with them—for the big question still remained, would the complete party of fourteen men with their leaders follow Noyce's lead and go up to the Col next day?

And on May 22 we again stared at the Lhotse Face. Despite the possibly grave consequences to the assault plan I had sent Tenzing and Hillary up to Camp VII the day before to give encouragement to the Sherpas in their vital mission and support, if it were needed, to Wylie and Noyce, and we watched in amazement as a whole string of seventeen little dots spread out across that great white expanse, creeping gradually—with painful slowness but moving none the less—in Noyce's footsteps of the day before. As the day wore on, it became obvious that they were going to make it and at long last I was able to put an end to the anxiety and suspense by deciding that the assault should start.

The first assault: Evans and Bourdillon

The weather, having done its best to deter us for five weeks, had suddenly turned fine on May 14, just the day before we had planned to be ready to seize any opportunity we might be given. It had succeeded in delaying our readiness for a week, but miraculously—I can give no other explanation— the elements continued to smile upon our struggle. Bourdillon, Evans, Da Namgyal, Ang Tenzing and myself went up to Camp V on the evening of May 22, meeting there on arrival some of the most stalwart of the men who had made this possible by carrying loads to the distant Col that day. Among them were Hillary and Tenzing, who, having left Camp IV only the day before, had climbed to the South Col and were now on their way back to Advance Base from 21,200 to 26,000 feet and back in thirty hours—not only this, but they must now get ready to follow us in the second assault. These facts speak eloquently of the guts and stamina of these two men.

Using oxygen though we now were, we found it a long, hard climb to the South Col. We spent a restless and anxious night at Camp VII, with the great west wind sweeping across the Face of Lhotse in tremendous gusts which buffeted the tents and seemed intent on uprooting us bodily, tents and all, down the mountainside. We struggled on upwards next day (May 24) heavily burdened and slowed down by the tiresome breakable crust formed on the snow surface by the wind; no traces remained of the large party which had climbed these slopes only two days before. At about 4 p.m. we at last climbed out of the couloir and stood on the top of the Geneva Spur gazing down at the South Col of Everest, a dismal enough scene. We were also looking for the first time at the final keep of the fortress of Everest, the last 3000 feet of the mountain. This was an awe-inspiring but scarcely encouraging sight. A tall slender snow peak, the South Summit (28,720 feet), rose

The Western Cwm and Lhotse (centre)

directly above our heads, incredibly close yet somehow depressingly far above; leading to it was the ridge by which we must climb, running down to the south-east, its angle gentle in places but surprisingly steep in others. To reach it was not going to be easy, for we must climb by one of several steep snowfilled gullies in the South Face, which rises above the Col for over 1000 feet. The peak was clear, but a great plume of snow dust was as though appended to it—a banner of cloud which is an almost permanent feature of the mountain.

To reach the surface of the Col you have to descend a slope of some 200 feet, so down we went, with the uncomfortable feeling of going into a trap, for this slope, gentle and innocent as it was, must again be climbed to get back to our comrades and safety, at 26,000 feet and very weary, after making our attempt on the summit. It was a dreary, dread scene. There were the tattered remnants of the Swiss tents set up there last autumn, the bare skeletons of them, all but a few shreds of canvas stripped from them by the westerly wind. Around were scattered remains of equipment, a bleached climbing rope, oxygen frames, odd tins of food. A more comforting sight was the mound of stores carefully weighted down with boulders, which had been carried up for the assault. We dragged out two tents, and set to work to put them up. For the next hour and more we were engaged in a struggle which none of us will ever forget. We were trying to put up just one of those two small tents, fighting with the wind, an invisible enemy which pulled the canvas from our hands and made our task all but impossible. Weak as we were after our climb, deprived now of oxygen, we were hopelessly inadequate for the job. We tripped over the ropes, fell over stones, got in each other's way. In the end the tent was up somehow, just before we became completely exhausted and the sun went down. We scrambled in and, amid a confusion of gear, settled down, utterly weary, for the night.

It had been blowing hard during the night; but the morning of May 25 was not only brilliantly clear, the infamous north-west wind, which had so nearly prevented us from getting into our tents, had died away to a stiff breeze: conditions were as favourable for an assault on the summit as they ever can be on Everest. But we quickly decided that we must wait for another day before essaying it. It will be remembered that Evans and Bourdillon were to make their attempt directly from the Col and for this an early start was essential. We had been far too tired the night before to get ready—and getting ready at 26,000 feet is a slow and exhausting business. There remained much to be done, particularly in preparing our oxygen equipment. Moreover, one of the two Sherpas who were to help me in getting a part of the stores for the highest Camp (IX) up on the south-east ridge was in a bad state of exhaustion and we still hoped he might recover with rest. Despite the drawbacks—a possible turn of the wind or weather against us; using up food and fuel not allowed for in the plan; the risk of our own physical deterioration—we stayed through that day on the Col, resting and getting ready for the morrow. On the 26th after some delay and much anxiety over the functioning of the oxygen equipment, both parties set out—Evans and Bourdillon as summit party and Da Namgyal and I as support party. Ang Tenzing was still sick and we two were fairly heavily laden with a tent, fuel,

food, in addition to our own oxygen sets and personal equipment—about 45 lb each. The two 'summiters,' with their more powerful oxygen soon pulled ahead of Da Namgyal and myself, as we followed very slowly in their tracks up the snow gully we had chosen to lead us to the south-east ridge. Near the top, the angle of the snow steepened uncomfortably and we had to move away on to a slope of rock and snow on the right. A little higher the slope eased suddenly and we found ourselves beside another pathetic relic of the Swiss Expedition: the frame of a small tent just below the ridge, where Tenzing and Lambert had spent a terrible night without sleeping bags almost exactly a year before, during their splendid effort to reach the top. Here we lay to rest and recover from the ordeal of that climb up the gully, fighting and gasping for air for a while; in my case, though I did not realize it at the time, there was a blockage of ice in the tube of my oxygen set which must have added very considerably to the pain and grief of that day's climb. We were both pretty tired by now but decided to struggle on up the ridge as long as we could. Being short of one of our carrying team I had realized that we should probably not be able to lift the stores for the top camp as high as I had planned—I had always intended to place it much higher than any camp established on Everest before and hoped that this might be at 28,000 feet. Now, without Ang Tenzing, it seemed that the best we could do would be to dump the stores and leave the second assault party with their three Sherpas under Gregory, to carry them still higher. Before leaving, I looked round at the view—on the world, in fact, for we were now climbing on its roof. There was Lhotse, for all its 27,800 odd feet not very much higher than we. Away on the western horizon rose another Himalayan giant Kangchenjunga, third highest in the world, only 800 feet lower than Everest itself. We must have climbed on for another half hour or perhaps a bit more (it seemed an eternity) until we found a niche in the crest of the ridge where the loads could safely be placed. Here we built a cairn—the height we now reckon to have been 27,350 feet—and leaving our oxygen bottles for Hillary and Tenzing we started down towards the Swiss camp. Even going downhill now seemed a very great effort; every step had to be carefully considered for we were moving on steep ground and a slip would have been serious. We moved one at a time down the couloir, each safeguarding the other with the rope passed over his ice-axe; as we went down, I was relieved to see figures spread out across the great slopes of the Lhotse Face on their way up to the Col. This was of course the second assault party, who had started forty-eight hours after us because of the exhausting feat of Tenzing and Hillary in accompanying the Sherpas to the South Col only a few days before. Here they were, fitting perfectly into the timing of our own attempt. We were both well-nigh at the end of our tether when we reached the level ice surface of the South Col, and without the wonderful help of Hillary and Tenzing, who had got up ahead of the rest of their party, I doubt whether I should have had the strength to crawl back to the tents.

Meanwhile Evans and Bourdillon were climbing strongly and steadily up the south-east ridge—I had last seen them in a break in the clouds—some 300 feet above us, while we rested near the Swiss tent. But those of us who were now gathering on the Col below could not know this, for the weather

was by no means good; it was once again blowing hard and the whole of the upper part of the mountain was obscured by cloud.

It might have been half an hour after Da Namgyal and I had got back—I was resting, I remember, in a tent and chatting with Tenzing—when George Lowe shoved his head in through the narrow entrance. He was wildly excited—jubilant. "They're up!" he shouted, "By God they're up!" Everyone was overcome with excitement. The Sherpas, believing the slender snow cone of the South Peak to be the summit itself, were even more thrilled than we ourselves. They thought Evans and Bourdillon had climbed the mountain. I remember Ang Nyima, one of the trio forming Gregory's support party for the second attempt saying to me in slang Hindi "*Everest khatm ho gya, Sahib,*" which in equally slang English might be translated "Everest has had it."

But we knew that we must await their return for definite news, for from that South Peak there remained a long stretch of ridge which had never before been seen close at hand; we had many times wondered what Everest held in reserve on this final part of its defences. It was an anxious wait, with the lurking question ever in mind: Could they come back safely? We could see nothing through the mists swirling around the mountain, tortured by the rising wind.

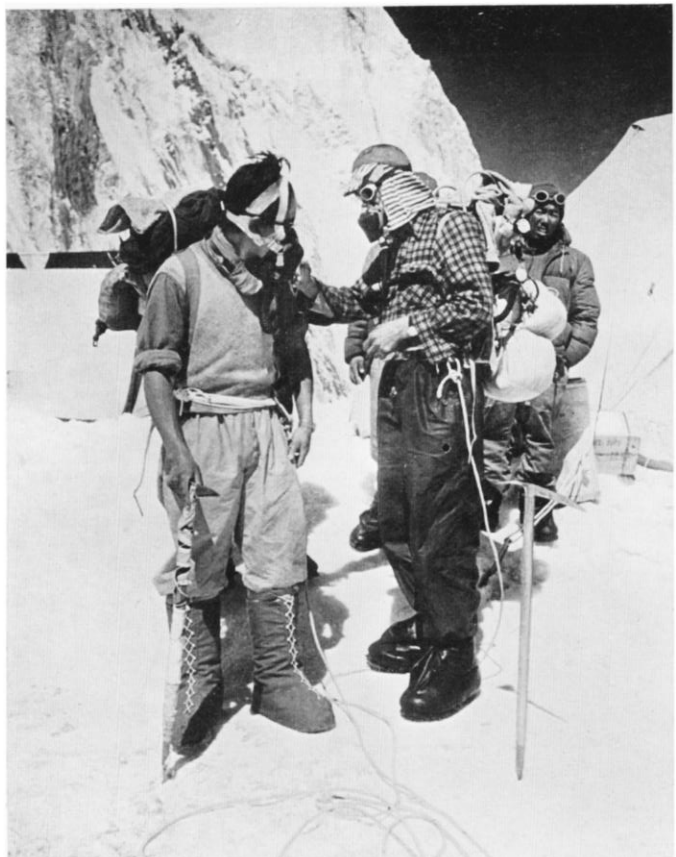
Then about 3.30 there was a fleeting break at the lower end of it and there, framed in this gap were two little dots at the head of the gully, some 1300 feet above us. I heaved an immense sigh of relief. At least they were safe. They moved slowly and were obviously very tired, but at last they were back among us, telling us of their wonderful first ascent of the South Peak of Everest—28,720 feet. That they did not continue along the final ridge to the highest point was exactly in accordance with my briefing, for I had been most anxious that they should not take risks with their experimental oxygen equipment. It must have been a tantalizing situation to be up there at 1 p.m. that day, so near to the fulfilment of a life's dream and yet knowing that they had neither the time nor the oxygen to reach the summit along the formidable alpine ridge they now saw stretching before them. To continue would not have been in the interests of the expedition, and in returning safely they not only made a fine mountaineering decision, but gave us all enormous confidence in final triumph.

The second assault: Hillary and Tenzing (Hillary's narrative)

"By May 22 we had made the first great carry to the South Col and fourteen 30-lb. loads of vital food, equipment and oxygen were awaiting our use. As we descended to Camp IV after making this lift, we met Bourdillon, Evans and Hunt setting out up the Lhotse Face to make the first assault on the summit. During the next two days we rested and watched their tiny figures on the Lhotse Face climbing steadily to Camp VII and then on to the South Col.

"It was now time for us to move. On May 25 Tenzing and I supported by Lowe and Gregory moved up to Camp VII. The following day we climbed the steep glacier above the camp and then began to cross the great traverse towards the South Col. From here we got our first glimpse of Evans and

Lowe climbing from the South Summit (28,720 feet) towards Camp IX (28,900 feet) in support of the second assault



Hillary and Tenzing preparing for the second assault

The Expedition: left to right, back: T. Stobart, Griffith Pugh, W. Noyce, C. Evans; middle: G. Band, M. Ward, E. Hillary, T. Bourdillon, M. Westmacott; front: A Gregory, G. Lowe, J. Hunt (leader), Tenzing, C. Wylie

Bourdillon on the south-east ridge, obviously moving strongly. Just before we reached the South Col, through a gap in the clouds we saw two tiny specks moving on the South Summit. It was a tremendous moment for us.

"We reached the South Col in time to assist Hunt and Da Namgyal back to their tents after their strenuous efforts in carrying food and equipment to 27,350 feet. Much later in the afternoon, two tired figures descended out of the clouds on the ridge and came slowly down the slope towards the Col. They were Evans and Bourdillon. They told us how they had reached the South Summit, the problems they had been faced with and the difficulties they had had with their oxygen sets. They also reported that the ridge leading to the top appeared to be of considerable difficulty.

"We went to bed that night elated over the success of our companions but not particularly happy about our prospects for the summit. The next day the South Col wind at its worst was blowing and no move upwards was possible. We assisted Bourdillon, Evans, Hunt and Da Namgyal to the top of the Geneva Spur and saw them start off on their long and weary descent to the relative comforts of the lower camps. All night it blew fiercely and although we were ready to leave very early, no start was possible before 8.45 a.m. The high-altitude Sherpas chosen to carry our camp high up the south-east ridge had all fallen ill except Ang Nyma, so there was nothing for it but to carry everything ourselves. Lowe, Gregory and Ang Nyma cut a stairway up the firm, steep snow of the couloir. Tenzing and I followed in these tracks and were able to conserve our strength and make faster time. We caught them up on the south-east ridge near the remnants of the Swiss tent of the previous spring. Despite our large loads we were all going very well. The ridge above, although steep, was generously supplied with foot and hand holds and although we moved slowly up it, we were able to climb steadily and rhythmically, taking every care.

"At 27,350 feet we came to the dump left by Hunt several days previously and reluctantly tied this extra equipment on to our heavy loads. Ang Nyma had just over 40 lb. but the rest of us were carrying between 50 and 63 lb. Moving very slowly now, we hauled ourselves up the ridge, all of us breathing oxygen at the rate of 4 litres a minute. A possible camp site would appear deceptively above us, only to vanish as we reached it. We were all very tired, and indeed a little desperate, when we finally reached a snowy ledge, which although uneven was sufficiently roomy to pitch a tent.

"While Lowe, Gregory and Ang Nyma descended to the South Col, Tenzing and I made a very rough platform, tied our tent down as best we could and crawled in for the night. After a somewhat uncomfortable night, I looked out of the tent very early and was greatly encouraged to see every sign of a fine day. We quickly organized ourselves and at 6.30 a.m. set off up the mountain. The first 500 feet was covered very slowly but steadily. We were going well, and were able to overcome without difficulty any problems we met. But then we reached the great 400-foot face running up to the South Summit, and this was a different proposition. Not only was it very steep but I felt the snow was in a dangerous condition. Laboriously beating a track up it, sometimes to our knees and often deeper, we were always conscious of the tremendous drop to the Kangshung Glacier, 11,000 feet below.

Half-way up the slope I asked Tenzing his opinion and he replied that he was rather unhappy about it and thought it very dangerous. When I asked him whether he thought we should go on, he gave his familiar reply: 'Just as you wish.' I felt we had a fair chance so decided to persevere. It was a tremendous relief however when, 100 feet from the South Summit, the snow became firm and we were able to kick and chip steps up the last steep slopes on to the South Summit itself.

"We sat down and had a drink from our water bottle. We had been using oxygen at the rate of 3 litres a minute and I estimated that this would give us another four and a half hours on our remaining bottle. The ridge ahead looked both difficult and dangerous, heavily corniced on the right, dropping off to enormous rock bluffs on the left. The only possibility was to keep along the steep snow slope running between them. I cut a line of steps down to the saddle between the South Summit and the ridge and was overjoyed to find that the snow, far from being soft and powdery, was firm and hard and that a couple of good blows with the ice-axe would make a step big enough for even our outsize high-altitude boots. We moved slowly and very carefully. I cut 40 feet of steps, then forced my ice-axe into the snow and belayed Tenzing as he moved up to me. Then he in his turn thrust his ice-axe in and protected me as I cut another 40 feet of steps. Moving one at a time and fully conscious that our margin of safety must inevitably be reduced at this great altitude, we forged slowly ahead.

"After an hour's going the South Summit was dropping away beneath us, but I suddenly noticed that Tenzing, who had been going very well, was starting to drag. When he approached me I saw he was panting and in some distress. I examined his oxygen set and, finding that the exhaust outlet from his mask was blocked with ice, was able to give him immediate relief. We moved on again and soon reached the worst problem on the ridge—a great rock bluff which looked far too difficult to tackle directly with our limited strength. There was one possibility: attached to the right-hand side of the rock bluff was a cornice and the ice had peeled away leaving a gap running the full length of the bluff and just large enough to take the human frame. With Tenzing belaying me I moved into the crack and cramponing on the ice behind and using every handhold on the rock in front I wriggled and jammed my way up and pulled myself panting on to the little ledge at the top. I signalled to Tenzing and heaved on the rope until he in his turn struggled up and collapsed exhausted on our little ledge. I really felt now a fierce determination that we would succeed in reaching the summit.

"The ridge stretched on in a never-ending succession of corniced bumps and as I continued cutting the trail round the back of them I wondered just how long we would have to go on. We were starting to tire. I had been cutting steps continuously for almost two hours and wondered rather dully, whether we would have enough strength left to get through. I cut around the back of another hump and saw that the ridge ahead dropped away and that we could see far into Tibet. I looked up and there above us was a rounded snow cone. A few whacks of the ice-axe, a few cautious steps and Tenzing and I were on top. The time was 11.30 a.m.

We stayed fifteen minutes, removing our masks and so conserving oxygen.

After an hour we were back on the South Summit; moving gingerly down the great snow slope, we were able to shrug off the sense of fear that had been with us all day. At 2 p.m. we were at Camp IX, where we brewed some lemonade before setting off on the long trek down to the ridge. We were both very tired, but not too tired to make the last effort of cutting steps down the couloir where yesterday's tracks had already been blotted out. On the Col we were greeted by Lowe and Noyce; the latter had come up that day in support with Passang Phutar, both making their second trip to the Col." (*End of Hillary's narrative.*)

We waited at Advance Base in vain for news all through May 29. Gregory had come down with the two remaining Sherpas of his support team and had raised our hopes by telling us that he had seen Hillary and Tenzing at 9 o'clock that morning, just as he had watched Evans and Bourdillon on the 26th, approaching the South Peak and going well. This, the early hour that he had seen them, and the glorious weather, apparently with little wind even higher up, had given us great confidence that they might have made it. But by evening we were in the dark about the outcome. I had asked Noyce, who with three Sherpas had gone up a second time after Evans, Bourdillon and I had come down, either to reinforce or rescue the second assault party, to lay out sleeping bags on a certain snow slope just below the Col visible to us below—"T" would mean success: two bags laid parallel would mean they had reached the South Peak; only one would mean failure. But as evening approached, mists drifted across the Lhotse Face, and we stared in vain at the blanket of vapour behind which Noyce and Passang Phutar had, in fact, placed the signal.

Next morning part of our anxiety was removed when we counted five specks high on the Face coming down. They were all there and all were moving independently—they were safe and well. Soon after 2 p.m. they appeared again, much closer this time, only a few hundred yards up the glacier above our Camp. Most of us, unable to bear the suspense, went up to greet them and hear their news. As they came towards us the returning summit party made no sign, just plodded on dejectedly, obviously very tired. My heart sank—this must be failure; I tried to focus my thoughts on that third effort which we had kept in reserve. Then, when they were quite close, George Lowe, who was leading the little group, started gesticulating, making unmistakable jabs with his ice-axe towards the top of Everest, frowning down above us.