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THE HIMALAYA AS A BARRIER TO MODERN COMMUNICATIONS : *A paper read at the Evening Meeting of the Society on 4 November 1935, by*

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(Sixth Asia Lecture)

THE title of my Asia Lecture was suggested by the growth of modern communications across Asia during the last ten or fifteen years, and by a feeling that it would be well to get our ideas clear on the question whether the Himalaya can be considered a barrier to communication in the immediate future, as it has been throughout historical times.

The position before the Great War was this: India, the "keystone of the Indian Ocean," as it has been called, communicated with the West and East by means of the two sea corridors, the Suez Canal and the Straits of Malacca, and to a less extent by South Africa and southern Australia. For her prosperity she looked seawards through her four ports, Calcutta, Bombay, Madras, and Karachi. A little trade trickled across her land frontiers—by Seistan and across the Khyber Pass on the backs of camels to Kabul and beyond, and an almost insignificant amount crossed the Himalayan passes to Chinese Turkistan and Tibet, on ponies, sheep, or yak.

North of the mountains of Central Asia, north of the Altai and Sayan mountains, north of the deserts of Mongolia, there was the great Trans-Siberian Railway, a single track, connecting Moscow, through Omsk, by Lake Baikal and Manchuria, with Vladivostok. At Samara a second line branched south-eastwards across the Kirghiz Steppe and by the valley of the Syr Darya to Tashkent, while the Trans-Caspian railway linked up Krasnovodsk, Merv, Bukhara, Samarqand, and terminated at Andijan. These last two were joined together south of Tashkent, and two important branch lines led southwards to Kushk and Termez on the Afghan frontier. They were mainly strategic, and it cannot be said that they carried a great deal of trade, either with Afghanistan or with Sinkiang. But from Russian Turkistan there was some rather primitive trade with Kashgar and Yarkand.

The disasters of the Russo-Japanese War of 1904–05, and the increasing


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Miles
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Railways
Scheduled Air Routes
unscheduled
Land over 13,500 feet
C. Chelyuskin
London
Paris
Berlin
Warsaw
Vienna
Rome
Murmansk
Archangel
Leningrad
Moscow
Obdorsk
Aldan
Yakutsk
60°
Sverdlovsk
Tobolsk
Samara
Omsk
Novo Sibirsk
Krasnoyarsk
L. Baikal
Chita
Khabarovsk
Manchuli
Istanbul
BLACK SEA
Orenburg
Astrakhan
Great circle
KIRGHIZ STEPPE
Sayan Mts.
Irkutsk
Harbin
MANCHUKUO
Vladivostok
Semipalatinsk
Sergiopol
L. Balkhash
MONGOLIA
Tokyo
Aleppo
30°
Baku
CASPIAN SEA
Krasnovodsk
Tashkent
AlmaAta
Tien Shan
Urumchi
Hami
Jehol
Kalgan
Peiping
Dairen
Seoul
30°
Bukhara
Andijan
Samarqand
Kashgar
Yarkand
Soochow
Baghdad
Merv
Kushk
PERSIA
Basra
Great circle
AFGHANISTAN
Kabul
SINKIANG
Lanchow
Chengchow
Sianfu
Nanking
Shanghai
Medina
Srinagar
Great circle
Hanchow
Duzdab
Lahore
TIBET
Chengtu
Great circle
Changsha
Lhasa
Delhi
NEPAL
Jodhpur
Canton
Yunnan
Karachi
Allahabad
Hongkong
Calcutta
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unsettlement at home, had called a halt to Russia's expansion in Asia, and a convention between Britain and Russia in 1907 had settled the outstanding questions of interest regarding the status of Tibet, Afghanistan, and Persia. Almost for the first time in history the two countries were working in harmony and cooperation in Asia, and in 1913, after three years of scientific collaboration, the trigonometrical surveys of India and Russia were linked on the Pamirs.

The reorganization of the Russian Empire after the revolution brought about great changes in Asia. The Imperial province of Russian Turkistan was split up into various Soviet republics, organized, it was claimed, on racial and ethnological lines. Plans for the self support of the U.S.S.R. meant, in theory at least, that each state of the Union should be developed according to its individual capacity, in order to contribute to the Union as a whole. The tendency has been to create industrial centres at the sites of raw material, rather than to bring the raw material back to old industrial centres in Europe. The growing industrial centres in Asia have brought in their train increased agricultural development. There is, in fact, a shifting of Russian effort from Europe to Asia, with a consequent need for the development of communications in Asia. This development has been considerably speeded up during the period of the "Second Five-Year Plan."

But, while Russia's grip over her own territory has been tightened, China's has been loosened over hers. Mongolia and Manchuria have broken away, one with the connivance of Russia, the other with the encouragement of Japan; and since the war until very recently, there has been little security or stability in Chinese Central Asia. In consequence, there has been little railway development except in the Russian and Japanese spheres.

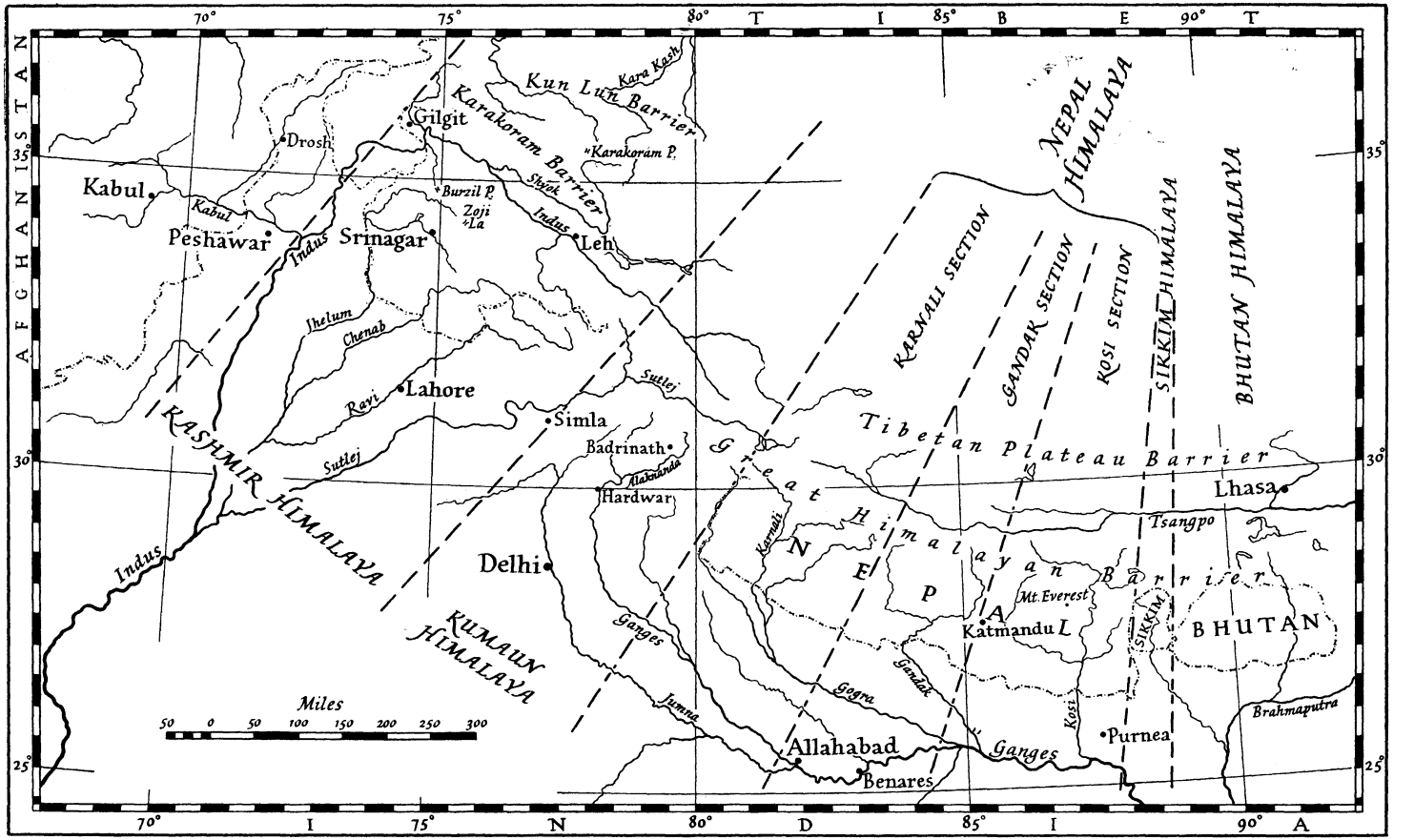
The most important railway connection that has been completed, the Turk–Sib line, links the Tashkent–Orenburg railway some miles north of Tashkent with the Trans-Siberian. It leaves the former at Aris, passes north of the Tien Shan and Issiq Köl to Alma Ata, not far from the Sinkiang frontier, and then northwards to the east of Lake Balkhash through Semipalatinsk to Novo Sibirsk. Certain small branches feel their way towards the Sinkiang frontier. The Trans-Siberian line has been double-tracked almost throughout its length, and other connections between the Trans-Siberian and Turk–Sib lines are under construction. To what extent these developments have been dictated by strategic motives, and how much has been due to economic requirements, it is not for me to say.

Now if we examine a map showing the important railways of Europe and Asia as they exist to-day, we notice the following points:

(1) India is supplied with a dense network of economic railways.

(2) Russia has three main lines stretching outwards to Central Asia, while behind her frontier with Persia, Afghanistan, Sinkiang, and Mongolia, she has a long line connecting the three main lines.

(3) For the rest, as far as Asia is concerned, railway development takes the form of rather insignificant pushings in from the coast. There is the Baghdad railway, still with a break between Nisibin and a point south of Mosul, with a difference of gauge in the two completed sections. The Persian line, under construction from both ends between the Caspian and the Persian Gulf, is


70°
75°
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AFGHANISTAN
INDIA
TIBET
Kun Lun Barrier
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Karakoram Barrier
Karakoram P.
Gilgit
Drosh
Kabul
Kabul
Peshawar
Burzil P.
Zoji La
Srinagar
Indus
Leh
Shyok
Indus
Jhelum
Chenab
Ravi
Lahore
Sutlej
Simla
Sutlej
Badrinath
Alaknanda
Hardwar
KASHMIR HIMALAYA
KUMAUN HIMALAYA
Indus
Delhi
Ganges
Jumna
Miles
50 0 50 100 150 200 250 300
NEPAL HIMALAYA
KARNALI SECTION
GANDAK SECTION
KOSI SECTION
SIKKIM HIMALAYA
BHUTAN HIMALAYA
Tibetan Plateau Barrier
Great Himalayan Barrier
Lhasa
Tsangpo
Karnali
NEPAL
Mt. Everest
Katmandu
SIKKIM
BHUTAN
Gandak
Gogra
Kosi
Purnea
Brahmaputra
Allahabad
Ganges
Benares
TIBET

still a long way from completion. The Indian system, extended to the extreme west of Baluchistan during the war, to Duzdab, has not only moved no farther on, but the last section of 200 miles between Duzdab and Nokkundi was abandoned in 1932 as uneconomic. Meanwhile the road made fit for motors to serve the communications of General Malleson's force at Meshed has fallen out of repair. In eastern India the railway link between Assam and northern Burma has got no farther than the survey stage.

Nor has the unsettled state of China permitted the Nanking government to undertake much development, and except for activity in Manchukuo, there is nothing else to record. No important lines have been constructed south of the Great Wall. India has indeed constructed a railway through the Khyber, but otherwise she is as isolated as ever she was from the Russian and Chinese frontiers, for Afghanistan, Sinkiang, Tibet, and Mongolia, are still untouched by railways.

Since the war however many of our old ideas regarding isolation have undergone modification owing to the development of motor and air transport. Seas and deserts, in particular, have almost ceased to exist as barriers to movement, while several of the larger mountain ranges of the earth are crossed regularly by scheduled air-liners. The Rockies, the Andes, the Atlas, and the Alps, are all crossed by mail planes, while the Syrian desert and the Sahara are regularly traversed by motors and by aircraft. In many parts of Africa motor-road development is largely superseding railway construction, for with suitable restrictions during the rainy season such roads are much less costly to maintain.

In Asia also there has been development. A regular air service exists from Moscow to Irkutsk near the south-west end of Lake Baikal, taking the course of the Trans-Siberian railway, and but for political considerations, would be doubtless extended to China. Indeed, it is possible, with permission, to charter a plane and travel from Irkutsk to Manchuria and Peiping, and even from Sergiopol across Sinkiang, by Urumchi and Hami, to Lanchow, the terminus of a fairly regular service in China. From various points of this trans-continental air-line, it is also possible now to fly to distant points in the north; but at present there is insufficient traffic for regular services.

India, too, is becoming air-minded. I look back with mixed feelings to twenty-five years ago, when in December 1910 the first plane seen east of Suez arrived at Allahabad and began what were optimistically called "joy-flights." The machine was a Sommer biplane, of the pusher type, with rotary gnome engine. The receipt for payment of my flight was numbered "4," which means, I think, that I was the fifth person to fly in India. The machine had no fuselage, and before climbing on to what was called the pilot's seat on the bottom plane, my friends shook me warmly by the hand and said "good-bye." Pequet, the pilot, tucked himself between my knees, and we managed to get up to about 500 feet. This plane carried the first authorized air-mails in India, and I believe, in the world, in January 1911. Letters posted on the aerodrome were handed to the pilot, who flew them to a small special post-office, where they were taken over by the normal service.

Since the war India has of course become linked by air with Great Britain and Western Europe, and there are now three lines which control the regular

services across India: Indian Trans-Continental Airways, a subsidiary of Imperial Airways, and the French and Dutch lines, Air France and K.L.M.

I.T.C.A. runs two services a week in each direction between Karachi and Singapore: Karachi, Jodhpur, Delhi, Cawnpore, Allahabad, Calcutta, Akyab, Rangoon, Bangkok, Alorstar, Singapore. An Australian line connects Port Darwin with one of these bi-weekly services at Singapore, and Port Darwin is connected with various parts of the Australian Commonwealth. In his very interesting report last week on the development of Imperial Airways, Sir Eric Geddes stated that the Singapore–Port Darwin service would shortly be doubled, and that with the aircraft now under construction India would be reached in three days, and Australia in seven.

Air France runs one service a week in each direction between Paris and Saigon, and K.L.M. two services a week in each direction between Amsterdam and Batavia. Both these lines fly direct from Jodhpur to Allahabad, but otherwise take the same route as I.T.C.A. across India.

There are two regular feeder services running in connection with I.T.C.A.: (1) Karachi, Sukkur, Multan, Lahore, twice a week in each direction, operated by Indian National Airways; and (2) Karachi, Ahmedabad, Bombay, Hyderabad, Madras, twice weekly by Tata, Ltd. This is shortly being extended from Madras to Colombo. Both feeder services are operated with small single-engined aircraft and are run principally for mails; they only occasionally carry passengers.

That, I understand, is the position as it is to-day, or as it was at any rate a month ago. A firm called the Himalayan Air Transport and Survey, Ltd., has been carrying pilgrims from Hardwar to Badrinath, well in the hills on the Alaknanda tributary of the Ganges, and there is some talk of making this a scheduled service at certain periods of the year. Indian National Airways have also submitted proposals for a service between Lahore and Srinagar in Kashmir. Experimental flights have been carried out, and I learn from India that Srinagar's new aerodrome was opened on September 2. According to my information, the plane that flew the journey on that occasion left Delhi at 6 a.m., stopped for half an hour at Lahore, and reached Srinagar at 11.20 a.m.

These two embryo services are not of course the first occasions when planes have flown over or into the Himalaya. As long ago as 1925 I can remember R.A.F. planes flying over the Ridge at Simla during the King's Birthday parade, and they may have done so earlier. On 28 March 1929 a flight of four R.A.F. Wapiti aeroplanes flew from Risalpur, by Chakdara and the gorge of the Indus to Gilgit, and since that date the R.A.F. have, I believe, carried out the Gilgit flight with service planes regularly once a year. Along the Indus gorge the planes travel at about 12,000 feet, that is about 10,000 feet above the valley bottom, while the mountains rise in places on either hand in stupendous precipices of 15,000 feet. In 1932 a flight of five Hart machines completed the journey of 286 miles in two hours twenty minutes, passing close to Nanga Parbat.

In India also there are private flying clubs and a very enterprising Air Survey Company. Flights for police and other purposes have become a regular routine on the N.W. Frontier, while most of you will recollect the very fine performance of the Royal Air Force in evacuating the staffs of the various

R.A.F. planes passing Nanga Parbat, 17 Oct. 1932

Over the Indus valley by Shatial

legations at Kabul during the insurrection against King Amanullah in 1929. It is extraordinary how quickly the inhabitants get used to aeroplanes. In 1929 the Mirs and chiefs of the Gilgit Agency were uncertain whether it was great daring or gross sacrilege to approach an aeroplane upon the ground. In 1933 the enterprising Mehtar of Chitral flew over the North-West Frontier hills to his new aerodrome at Drosh. The only other flight that need be mentioned at this stage is the spectacular Mount Everest Flight in the same year.

On the far side of the Iranian plateau, beyond the Hindu Kush, there is, I understand, no regular scheduled air service between Moscow and the Soviet Republics of Turkistan; but there are no physical obstructions to flying, there are landing facilities at most of the large towns, and Soviet officials use the air a good deal in the course of their duties. Nevertheless, no one has yet flown overland to India from Soviet Asia over the mountain barrier. Kabul has been reached by air from beyond the Soviet and the Indian frontiers; but no one has completed the through journey, and no one has yet thought it worth while to attempt any other route.

If we examine the state of motor-road development, we find much the same state of affairs. On both sides of the mountain barrier good roads have been constructed. In a few instances surveys have been made for extensions of such roads farther into the hills; but no one has yet succeeded in getting wheeled traffic across the whole barrier. In this connection you may remember the effort made by the Haardt Expedition in 1931–32. Of the seven light six-wheeled caterpillar-tractors which left Beirut, and which reached India by way of Herat, Kandahar, Kabul, and the Khyber, two only succeeded in reaching Gilgit, and one of these managed to get a few miles farther. I use the words "succeeded" and "managed" advisedly, for the journey took considerably longer than it would have taken to crawl the whole distance on all fours, the cars had to be winched and jacked round many of the bends, and at one point they had to be entirely dismantled and carried across a bad stretch of the track on the backs of coolies. An officer who met the expedition on the Gilgit road told me that one of the party walked backwards in front of the cars to insure that they did not go over the precipice into the Astor river below.

This examination of the present position leads me to observe that a map of Asia showing air routes for scheduled and unscheduled flights, roads fit for motors, and existing railways, is no certain guide to what may be possible in the future. The extension of air-routes throughout the world has been mainly due to private enterprise and individual daring. But such enterprise can only be fully effective if all countries are sympathetic to intercourse by air. When therefore we see on such a map the lack of modern communications across the northern frontiers of India, we have to take into consideration the political factor as well as the physical barrier.

Let us consider the political factor. Flying over the states bordering India is prohibited by the governments of those states, and we respect their wishes. Afghanistan has a small air force of her own which flies within her frontiers, but on this sector of the Indian borderland no one is permitted to fly from one side of the boundary to the other. Tibet, Nepal, and Bhutan have no aircraft and want none; their rulers are definitely averse to Europeans entering their countries at all. Permission to fly over them in existing circumstances is

almost impossible to obtain, and has only been given once by Nepal and never by the other two.

China is, as we should say in the West, more "progressive." Assuming, then, that China and her loosely controlled province of Sinkiang might possibly be willing to permit flying over the latter country, the only routes across the Himalayan frontiers of India must lie between the North-West Frontier hills and the western boundary of Nepal. The whole of the rest of the Himalayan frontier is enclosed by Tibet on the north. This sector west of Nepal contains the state of Kashmir, whose Maharaja is sufficiently air-minded to fly out to India by Imperial Airways, and thence by private plane to Srinagar.

So much for the political considerations. Before considering in detail the best lines for air travel across the Himalaya, irrespective of those considerations, I will draw attention to certain governing factors of air travel. And here, being no expert, I must be subject to correction. I am told that, though it is possible to land with a light load at 15,000 feet, it is much more dangerous, if not impossible, to take off above that altitude. Aeroplanes presumably could be designed for the special purpose of high altitude landing and taking off, but such planes, I understand, would not be so handy at lower levels. Flying over mountainous country for long stretches is very much more difficult than over lower and more populous levels. An air-route over mountains covered in snow or clothed in forest is difficult to identify from the air, and the lack of obvious landmarks makes it difficult to keep to a definite course; engines develop trouble more easily at high altitudes; storms and cloud, with consequent bad visibility, are more frequent; and forced landings may be most common where the ground is least suitable. In mountainous country wind currents are more variable, while, if one attempts to avoid them by flying at great altitudes, additional oxygen and special warming apparatus for man, machine, engine, fuel, and instruments are necessary, and add considerably to the cost.

Neglecting political considerations, let us now consider the shortest routes by air between London and India. Bombay is roughly half-way on a great circle course between London and Perth in Australia. There may come a day when it will be possible to fly that course in twenty-four hours, stopping for lunch at the Gateway of India. But the day is not yet. The great circle course between London and Bombay would approximately take the line London, Cologne, Sebastopol, Batum, Tehran, Seistan, Karachi. That course itself would shorten the journey to Karachi by more than a day even at present cruising speeds. The great circle course between London and Calcutta would be farther north: London, Berlin, Warsaw, Kiev, Astrakhan, and a little north of Bukhara, the Khyber, Delhi, Allahabad. Its continuation would be to Rangoon and Bangkok. It will be observed that neither of these two great circle courses passes over the high Himalaya. Nor would a great circle course from Tokyo to Calcutta pass over them. Nanking and Hankow would be on such a route and it would enter India a little south of the Lohit branch of the Brahmaputra. It seems to me that for long distance air-routes such as these, multiple-engined air-liners of special construction could be designed to make the journey without excessive risk, always provided the

political considerations were favourable. Judging by what has already been accomplished, the routes Batum, Tehran, Duzdab, Karachi, and Astrakhan, Bukhara, Termez, Kabul, Peshawar, are quite practicable.

With the Himalaya however the problem is different. The distances over the mountains are considerably greater, the altitudes much higher, the country much more rugged, and beyond the Himalaya there is either the additional broken country of the Karakoram, or the wide 16,000-foot plateau of Tibet. Even these are not the end of difficulties. The Kun-Lun forms a further obstacle, while either the Pamirs or the uninhabited Taklamakan desert, as well as the Tien Shan have still to be crossed before the main artery of Asiatic communication is reached. The shortest distance between the existing trans-Indian and trans-Siberian air-routes is about 1800 miles of this difficult country, though the Turk-Sib line at Alma Ata, the railway centre near Lake Issiq Köl and the Sinkiang frontier, is only about 1000 miles from Lahore. It may be that, with the gradual shifting of the economic centre of the U.S.S.R. to the region of Omsk in Asia, some such long distance connection will become advisable. When I look back to the developments of the last twenty-five years I cannot help feeling that it will certainly become possible.

But perhaps I should confine myself to what would be practicable at present, if it were not for political considerations, and I propose now to examine the barrier by itself in some detail. I need hardly remind you that the existing method of transport is by pony, yak, sheep, or man, and that very few of the land routes are open for more than six months of the year. There are high snowbound passes and profound gorges to be traversed. Some of the less important routes are full of difficulties, the rivers being unbridged or only crossed by rope suspension bridges. In the densely forested east the track may be taken along the hillside on bamboo platforms. In the drier regions of the west the track may climb over the barren precipices 1000 feet above the rivers. Travelling off the main trade-routes is still primitive, and I for one hope that it will long remain so.

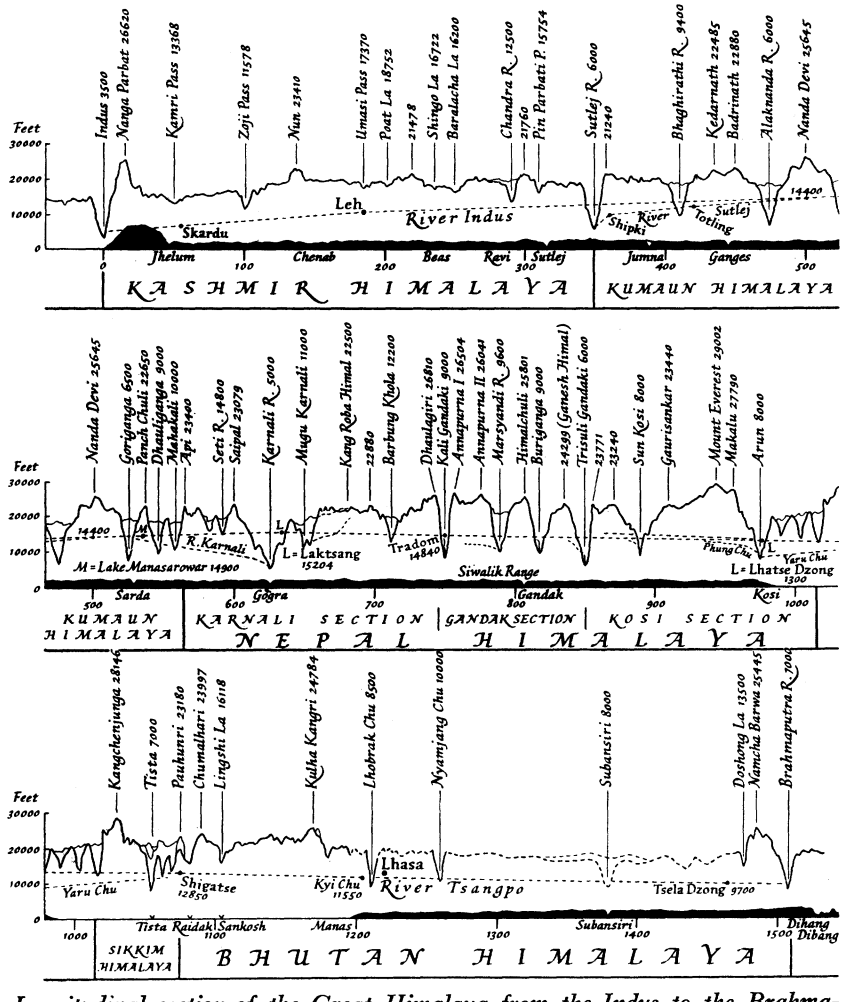
It is usual for geographers to divide the Himalaya into three zones: the outer Himalaya, comprising the low Siwaliks and the *Duns* behind them; the Lesser Himalaya, made up of the eroded ranges and ridges north of the Siwaliks; and the Great Himalayan zone which contains the great peaks. The distance in a direct line from Lahore to Kashgar is about 600 miles, and from Calcutta to Lhasa not much less.

At a few points the Siwalik zone is entered and crossed by railways, as, for instance, at Hardwar, where the Ganges breaks through the range; and at two points, Simla and Darjeeling, the railway climbs laboriously up to the outer edge of the Lesser Himalaya. The outer zone is crossed at many places by modern motor roads, and it cannot be said to present obstacles to aircraft.

The general altitude of the hills of the Lesser Himalaya varies from 7000 feet to 15,000 and even 16,000 feet. Within it there are certain open valleys, which are considerably lower. The Vale of Kashmir, north of the 15,000-foot Pir Panjal, is at 5000 feet; Katmandu, in the valley of Nepal, is at 4200 feet. As I have already stated, aircraft have already landed at Srinagar and at Badrinath in the Alaknanda valley, in the Lesser Himalayan zone. This zone is undoubtedly practicable for aircraft by certain routes, and at certain seasons

of the year; though landing-grounds would have to be prepared with more than ordinary care, and emergency landings, except in a few open valleys, would always be dangerous.

As regards motor roads, there are two good routes to the Vale of Kashmir, and motors can reach most of the Himalayan hill-stations. Some of these



Longitudinal section of the Great Himalaya from the Indus to the Brahmaputra. Horizontal scale in miles measured approximately from the Indus

roads have been extended farther into the hills, as for instance to Kulu, where there is some economic justification. They are however constantly liable to interruption by landslips and are costly to maintain. Undoubtedly roads, such as the Treaty High Road, between Srinagar and Leh by the Zoji La, or the Hindustan–Tibet Road through Bashahr, could be made fit for motors and kept open for some months of the year; but it is difficult to see how they

could be economically justified in view of the small amount of trade, and the heavy snowfall during the winter months.

Nevertheless it is the Great Himalayan zone that presents the most formidable obstacle. This forms a great barrier averaging 40 or 50 miles wide, with a double and sometimes a treble crest zone of peaks. Except in Kashmir, where the average elevation of the range is about 17,000 feet, the average altitude is roughly at 20,000 feet, with many great massifs rising to 23,000 and even 25,000 feet. A longitudinal section of the range shows that where it has a high average crest altitude and many higher mountain groups, it has been cut into blocks by deep gorges, while towards the extremities, in Kashmir, and probably in Bhutan, where the general altitude is lower, the carving of the great range is less marked. It is in fact a very noticeable fact that the highest mountains are closely associated with the deepest gorges, especially in Nepal. In Eastern Nepal, Sikkim, and Western Bhutan, the outer Himalaya have been entirely eroded away, the Lesser Himalaya have been very largely destroyed as ranges, and the watershed of the Great Himalaya has been driven back into the Tibetan plateau.

These points are, I think, obvious from the section that I have drawn from large-scale maps. I have shown the mountain blocks and the river gorges to scale. In general, it is by these breaks in the main range that the limited communication between India and Tibet, or Nepal and Tibet, takes place. In Kashmir, where there are no such gorges between the Indus and the Sutlej, caravans make use of passes over low depressions in the range.

The most important routes from west to east cross the Great Himalaya at the following gaps:

From	*To*	*At*	*Height*
Srinagar	Gilgit	Kamri pass	13,368
		or Burzil pass	13,775
Srinagar	Leh	Zoji La	11,578
Simla or Kulu	Leh	Baralacha La	16,200
Simla	Shipki	Sutlej valley (H.T. road)	*c.* 6,000
Tehri	Totling	Bhagirathi valley	*c.* 9,400
Garhwal	Totling	Alaknanda valley	*c.* 6,000
Almora	Gyanima	Goriganga valley	*c.* 6,500
W. Nepal	Laktsang	Karnali valley	*c.* 5,000
Central Nepal	Tradom	Kali Gandaki valley	*c.* 9,000
E. Nepal	Lhatse and Lhasa	Sun Kosi valley	*c.* 8,000
E. Nepal	Lhatse and Lhasa	Arun valley	*c.* 8,000
Sikkim	Shigatse and Lhasa	Tista valley	*c.* 7,000

I do not mean to infer that these are the highest points reached by these routes, but merely the altitudes at which the Great Himalayan axis is crossed.

Considering the very high altitudes that aircraft would have to fly to clear the range itself, it is interesting to examine the possibility of using these valley routes. Valley routes have certain advantages as well as disadvantages for air travel. Among their advantages I would put the comparative ease of identifying the route; the lower altitude of the flight; the finer weather, owing to local rain-shadowing; the greater likelihood of suitable ground for forced

landings. The disadvantages seem to be the danger from air pockets and shifting winds, and the consequent danger of hitting the mountain side if visibility is bad. Applying the advantages and disadvantages to the different valley routes enumerated, I would put the Sutlej and the Karnali as the most suitable routes for air travel, then the Alaknanda, the Arun, the Tista, and possibly the Sun Kosi, while I would rule out the Bhagirathi, the Goriganga, and particularly the Kali Gandaki, as dangerous. In Kashmir there seem to be no great objections to the Kamri, the Burzil, or the Zoji La. Unfortunately, in the Kashmir section, where the Himalaya is lower, the real obstacle comes from the ruggedness and altitude of the Karakoram range north of it. From Gilgit the Karakoram can be turned by the course of the Hunza valley; from Leh, less easily by the upper Shyok and the Depsang plains. It is just possible that a forced landing here might not be fatal, though it would have to be made at a high speed; but it would be much too high with existing designs of aircraft for a successful take-off again. The main mass of the Karakoram should most certainly be avoided.

In view of what I have already said regarding rail and motor possibilities in the Lesser Himalayan zone, it would be superfluous to discuss such development across the Great Himalayan zone in detail. But there is one point which is important. Roads fit for motors could be constructed across the plateaux of Tibet and the Pamirs to the northern foot of the Himalaya or Karakoram without any great difficulty. It is the actual gorges through the range and the weather-worn southern flanks which form the most formidable barrier to motor traffic. Such roads across the high plateaux would however never be economically justified.

I have left the question of weather to the end. The Himalaya forms an almost impassable barrier to the south-west monsoon. Beyond it we get the clear atmosphere of Tibet. I believe that no one in their senses would attempt to cross the Lesser Himalaya by air during the monsoon period from say June 20 until mid-September, except perhaps in a multiple-engined air-liner with a ceiling of 40,000 feet, with everything and every one artificially warmed. The monsoon is a low-altitude current and the clouds break against the mountain sides. In the eastern Himalaya the monsoon is particularly heavy and prolonged. At Darjeeling, for instance, the average rainfall for the four months from June to September, taken over a period of thirty-eight years, is 102 inches. Eighty-eight days in these four months are wet, and visibility is generally bad on the remaining days. The highest summits might be clear, but they would be like islands in an ocean of cloud. I need not stress the dangers of attempting to cross such a country at such a time.

The other period of unsettled weather is due to "western disturbances," beginning towards the end of December and lasting in the high Himalaya of Kashmir as late as the beginning of May. It is these disturbances that recover the Himalaya with snow. In March and April it is usual to have spells of five fine days between spells of bad weather. The intervening periods, from early May to June 20, and from the end of September to mid-December, are generally fine and present good flying weather. November is the finest month throughout the Himalaya. Visibility is then about as perfect as any pilot could wish for. There are more wet and cloudy days in the period May–

June, before the monsoon breaks than after it is over, but when fine, visibility is good and the temperature is less exacting than in November. The outer ranges, such as the Pir Panjal, of course, do rain-shadow the valleys to the north to some extent, and the published figures for stations in the Vale of Kashmir seem to indicate that the monsoon is largely ineffective here. This is however not so; for while the amount of rainfall is effectively diminished by the outer ranges, the actual number of wet and cloudy days is still considerable even in the valleys, while the surrounding hills are much worse off than the lower stations. I remember years ago, on the false assumption that the greater part of the monsoon rainfall was precipitated on the outer hills, and that the inner hills could be relied upon for generally fine weather, we attempted to carry on our survey throughout the monsoon period. It turned out that not one day in six was fit for work. Beyond the Great Himalaya it is a different matter altogether, but the airman has to get there first.

I could enlarge further on the physical obstacles to communications across the Himalaya and describe the difficulties due to forest growth, landslides, avalanches, and the rest of Nature's mountain armaments. But I have said enough. Whatever the future brings in the way of surprise, it seems to me that the Himalaya will always remain the pedestrian's paradise. Motor roads and railways have been developed as far as they are economically justified; we want no more of them. Political and physical obstacles combine with technical difficulties to prevent air development across this barrier; I thank God for that! And until we can cross it in artificially warmed, multiple-engined air-liners, with a ceiling of 40,000 feet, in one "hop" of 1000 miles or so, I see no prospect of air development. And I am glad that it should be so.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: The lecture to-night is the Sixth Asia Lecture. The last was delivered in March 1934 by a missionary lady, Miss Mildred Cable, on her experiences in Dzungaria. To-night Professor Mason is to lecture to us on "The Himalaya as a Barrier to Modern Communications."

The Asia Lecture, I would remind you, was endowed by the Rev. Livingstone Dickson to provide a lecture every second year on some subject of general interest appertaining to Asia: and we are very glad to have Mr. Dickson with us to-night.

Professor Mason needs little introduction to any one in this audience. He was for many years in the Survey of India. He has a thorough knowledge of the Himalaya from all points of view: as a climber, explorer, and surveyor. You could hardly have a better combination for speaking with authority on any subject connected with the Himalaya.

As to the question of a barrier to communication, I first went to India half a century ago, and I remember that in those days we regarded the Himalaya as an absolute barrier to the possibility of a Russian advance towards India. We shall hear from Professor Mason how he regards that aspect of the Himalaya under modern conditions. They have changed greatly.

Professor Mason then delivered the lecture printed above, and a discussion followed.

The PRESIDENT: Sir Francis Younghusband is here, and to us he is the father of the Himalaya. I remember fifty years ago, nearly, when he came across from

China, what a stir it created among his young comrades in India. I will ask him to speak.

Sir FRANCIS YOUNGHUSBAND: As I listened to the lecturer it struck me that he was talking against the grain the whole way through. He was talking about flying across the Himalaya when all the time he was longing to be walking across it. It was only in the very last sentence, when he said that the Himalaya was the pedestrian's paradise that his true heart came out. Very fortunately for me I was a pedestrian, and am now, and crossed the Himalaya eleven times from the plains of India to the plains of Turkistan, or the Pamirs, or to Tibet, and back, and I should agree with the main conclusion of Professor Mason, that while that barrier is fairly easy of access from the north it is always on the south that you get the real difficulties, either having to cross high passes or go through the most tremendous gorges. I should imagine the best way in the future would probably lie through the Hunza valley. Terrific gorges would be met with, but they can be negotiated, and it is the nearest way to Central Asia. By the Karakoram is a long way round, and you have to cross some very high passes.

I know nothing at all about flying, but I was wondering, as I listened to the lecture, whether those new machines, the autogyros, would be in future, perhaps, of more use than ordinary planes when flying up those valleys.

Then there is a little detail—I do not know whether it is worth mentioning. The lecturer spoke about the rivers cutting through the Himalaya. It is very noticeable that some of the greatest rivers rise on the northern side of the Himalaya—the Brahmaputra and the Indus, the Sutlej and the Arun—and find their way through the barrier, and it may be that the river is older than the mountains. It may not be that the river started first and cut its way through the mountains, but that the mountains have gradually risen on each side of the river.

As regards the economic worth of any route through these mountains to Turkistan or Tibet I would imagine there was very little to be gained. As the lecturer has said, there could never be very much trade between the plains of Turkistan and the plains of India. So I would agree with him in what he said as regards the economic worth of any routes that way.

I conclude by congratulating Professor Mason upon having recovered his real heart at the end of his lecture. I hope he will always keep it.

The PRESIDENT: We have Mr. Ruttledge with us, whom we hope is going to the Himalaya. Perhaps he will come and say a word or two.

Mr. HUGH RUTTLEDGE: It is a great privilege for an ordinary pedestrian to be allowed to follow that most distinguished pedestrian, Sir Francis Younghusband, in congratulating his old school-fellow and fellow-pedestrian, Professor Mason.

I think it is pretty clear from Professor Mason's lecture that the crossing of that great barrier is very difficult in nearly all places except the old, traditional route up by the North-West Frontier. The parts that I know slightly are the Central Kumaun Himalaya and the eastern end. Personally, I should be very sorry indeed to try to fly up through those gorges of the Kumaun Himalaya. I daresay Professor Mason would not mind because I saw him go up on those early flights at Allahabad and I know he risked his life during the few moments he was up. The wind, what is called locally "Ráni ka punkha," in the Kumaun gorges is simply terrific. I do not think you would have the slightest chance if anything went wrong with your plane. I daresay you could get up at the eastern end, by the Chumbi Valley, but it does not seem to be worth it. The only places that will be worth coming down through, I think, will be on the west, but I naturally hope the day will be far distant when the combustion engine replaces

the homely yak and those gallant, simple people of the hills with whom it is such a privilege to associate.

The PRESIDENT: Sir Percy Sykes, would you be so good as to speak to us for a few minutes?

Sir PERCY SYKES: Professor Mason has looked at the Himalayas more or less from India. I have looked at them on the other side, on the north, from Kashgar and Yarkand. When I was there some twenty years ago I do not think we had ever heard of aeroplanes in the country, but goods were sent by pony caravans over the Himalayas to Ludakh and India. The big range across which lay the route was called the Karakoram. It was known among us as the "Ridgepole of the World." The range was only open for about five or six months in the year, and a variety of goods were carried across it: a certain amount of jade, a certain amount of hemp, and a certain amount of silk. In return the traders brought back Manchester goods, and sugar, tea, and so forth. On the whole, the natives bravely faced the difficulties of the route and were certainly practical. For instance, it is very cold in that part of the world, and they always very kindly gave the sheep overcoats when they marched them, and in order to make the coats quite warm they filled them up with borax, which is one of the exports; so they really are very practical people.

As to flying, of which we have heard a great deal, there is one thing which Professor Mason has not told us, namely, that in Chinese Turkistan, where I do not think he has been, the loess in the atmosphere makes it absolutely impossible to see more than 200 or 300 yards, which rather knocks a multiple-engined aeroplane, or any other type. I once travelled through Kashgar, Yarkand, and then to Khotan, where there is a huge range, the Kun-Lun. I noticed in reading Marco Polo that he never mentioned the existence of that range. I went along it to Khotan and I never saw it either, the reason being that the loess rendered the whole range invisible, and that is the case practically all the year through. This fact, I think, is rather against flying in that part of the world.

I may add that when my sister and I mounted the Pamirs, the "Roof of the World," I had the pleasure of meeting the Russian Survey Officers, who had completed the triangulation with the British, and I must say they had the greatest admiration for our lecturer and the very fine achievement by British officers of that very difficult piece of work.

Finally, may I say a word about Persia, namely about the railway there? The railway is not quite as Professor Mason said. It has been started from Khor Musa, an inlet situated at the top of the Persian Gulf into the interior from that end, and it is also making very good progress from the north through the main Elburz range. It is expected that it will be finished in about four or five years' time.

We have heard an extraordinarily valuable lecture and, as it deals with a part of the world in which I have spent most of my life, it has been of special interest to me.

The PRESIDENT: I do not know whether there is any Air Force officer here who would care to comment on the air aspects of the problem? Apparently not.

It only remains for me to sum up. I am sure that you will agree with me that we have had a most instructive and a most efficient lecture. I do not think the problem could have been more lucidly stated nor any illustrations more apt than those shown by Professor Mason.

Not being an airman, I know little about air possibilities, but it seems to me that pending the invention of an autogyro or helicopter it would be quite impossible to negotiate the Himalaya for any commercial purpose by aeroplane.

I will not detain you further. I only ask you to join me in thanking Professor

Mason for his very fine lecture. He must have spent an infinity of time and trouble to prepare such an efficient and satisfactory discourse. I ask you to join me in thanking him most warmly.

Editor's Note.—During the course of the discussion the point of the correct pronunciation of the word "Himalaya" was raised. This has already been discussed in the *Journal* (vol. 84, p. 395), and it has therefore been considered unnecessary to include the discussion here. No new facts were produced and no conclusion reached.