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EDITORIAL

On August the 15th, 1947, when Pakistan plodded her way into existence it was to find a host of troubles anxiously awaiting her. The colossal problem of the rehabilitation of six million refugees, the unprecedented obstacles in her uphill way and the innumerable handicaps of the infant-state rendered our onlookers somewhat sceptic. But they say dark clouds have a silver lining! Faced with such heavy odds right from the beginning Pakistan has learnt to defy them all and to progress inspite of them. Pakistan now completes her first year of unabated struggle and the dawn of hope, now so bright and cheering, lends a freshness and a vigour to her zeal.

During the last year, which was one of suffering for us all, we could not undertake the publication of our journal owing to circumstances beyond our own control. We now re-kindle our torch and hope to keep it burning.

The division of the Panjab brought in its train the mass movement of refugees. Most of the departments had to re-adjust their staff to the changed circumstances : some had a surplus of employees while others were seriously deficient. This situation took some time to ease. The Department of Geography also lost its non-Muslim members of the staff but, fortunately, the new members stepped into their shoes immediately. Not a day was lost. Dr. K. S. Din continued as the Head of the Department. Mr. Khalil Ullah Qureshi and Mr. Ali Arshad together took up the Three Southern Continents and Practical Geography. From the local affiliated Colleges Messrs. Aziz Ahmad Sheikh and Farhat Ullah Khan have replaced Messrs. A.N. Kapur and O.N. Kapur. Mrs. R. M. Durrani, Principal, Lahore College for Women, is teaching "Asia" in place of Mr. M. P. Thakur. There is no change in the rest of the staff. The present staff is working indefatigably with the sacred aim of building up the nation's future.

When the Department of Geography was inaugurated it was proposed to attach a research library to it. A commodious room has now been acquired in Woolner Hall and a library-cum-reading room set up. We are striving to make it comprehensive and up-to-date. A team of post graduate students is working on various problems relating to Pakistan. In the next issue we shall be able to publish the work done during the intervening period. We have also re-organised our fortnightly meetings in which important and interesting Geographical problems are taken up and discussed over a cup of tea. The keen interest shown by all the members has been very encouraging and Woolner Hall continues to be the cosy home it has always been for its inmates.

The study of elementary Geology is indispensable for students of Geomorphology. We have always felt a pressing need for a Department of Geology in the Panjab University. After the partition Pakistan had been deprived of all Geological institutions. We are glad to announce that our University is now starting a Department of Geology and its first session begins from October, 1948.

Maryam K. Elahi

SOME EXPLORATION EAST AND WEST OF THE UMASI LA

BY

LUDWIG KRENEK, DALHOUSIE

APART from the Nepal and Assam Himalaya the main range between Nun Kun and the Kangla Jot in Chamba Lahoul is the least known part of the Great Himalaya. A glance at the map, sheet 52C[1] will confirm it : for a length of 70 miles, as the

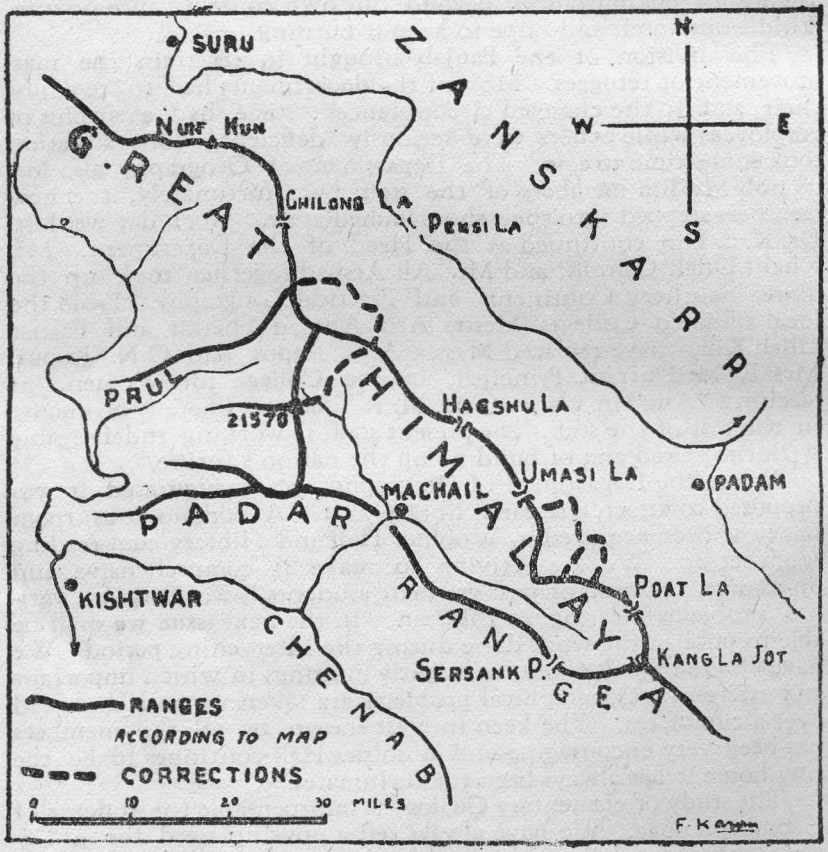


FIG. 1. HIMALAYA BETWEEN NUN KUN AND KANGLA JOT

crow flies, only four places of the main range are fixed : Chilung La (no height given), Hagshu La (same), Umasi La (17370 ft.) and Poat La (18752 ft.). Between these places the main range seems to

[1] The following maps are available : Sheet 52C, 52C/SW, 52C/3 and 52C/7. The last three show only the southern slopes of the Padar range south-west of Machail.

have been inserted rather arbitrarily. We shall see further on how much there is to be revised.

Besides the two passes mentioned the height of no other place on the main range is given. This was one of the main reasons which induced us to select this part of the Himalaya for exploration. Perhaps there were still some high peaks to be discovered ? —high of course in a relative sense ; any mountain approaching 23000 ft. would long have been fixed from the trigonometrical stations south of the Chenab valley.

We[1] spent about five weeks in the region north-west and east of Machail first exploring the upper reaches of the Bhazon Nala, then the glaciated region round the Muni La and finally crossing the main range *via* the Poat La and recrossing it *via* the Umasi La.

A comparison between the figures 2 and 3[2] shows at a glance the main results of our short reconnaissance. They are the following :

1. There is no mountain higher than 22000 ft. between Nun Kun and the Kangla Jot. The peak shown on the northern end of our sketch map—a beautiful white pyramid—might approach 22000 ft., though the height given there, 21500 ft., is more likely. Among the rest there are four or five higher than 21000 ft. but not exceeding 21500 ft. That means that this part of the Himalaya (and the adjacent region to the East) is the lowest of the whole range between Nanga Parbat and Namcha Barwa. This probably accounts for the fact that its exploration has been neglected hitherto.

In spite of their lesser absolute height the mountains of that region—perhaps best called " Padar " region—are truly " Himalayan." There are hundreds of marvellous peaks, with tremendous rock faces, knife-edge ridges and ice-walls showing beautiful " fluting ", characteristic of all the great Himalayan peaks.

This grandeur of the scenery is due first to the steepness of the slopes (in fact some of the mountains, Brammah, Pt. 20440, Shivji ka Pahar and others, are among the steepest we ever saw), secondly to the great relative height of the mountains : Agyàsol[3], 11400 ft. above Machail at a distance of $3\frac{1}{2}$ miles ; Brammah, 15900 ft. above the Chenab valley, $10\frac{1}{2}$ miles distant.

Quite naturally the relative heights are much greater towards the South, as the basis of erosion there, the Chenab, is on the average 6000 ft. lower than the Zaskar valley to the North. The

[1] **Dr. Fritz Kolb, Fabian Gedulding and Ludwig Krenek.**

[2] **The sketch maps shown here are based on leveled photographic panoramas which were fitted into the trigonometrically fixed points of sheet 52C, notably Pt. 21570, 21275 and 20141.**

[3] **" Raul " on the map. The highest point (approx 20400 ft.) lies to the South-east of Pt. 20141. In most cases I have used here the names and spelling of the map, though they do not always correspond to name used by the inhabitants.**

western part of the "Padar range" [1] is the best example of the tremendous erosive power of all the tributaries flowing into the

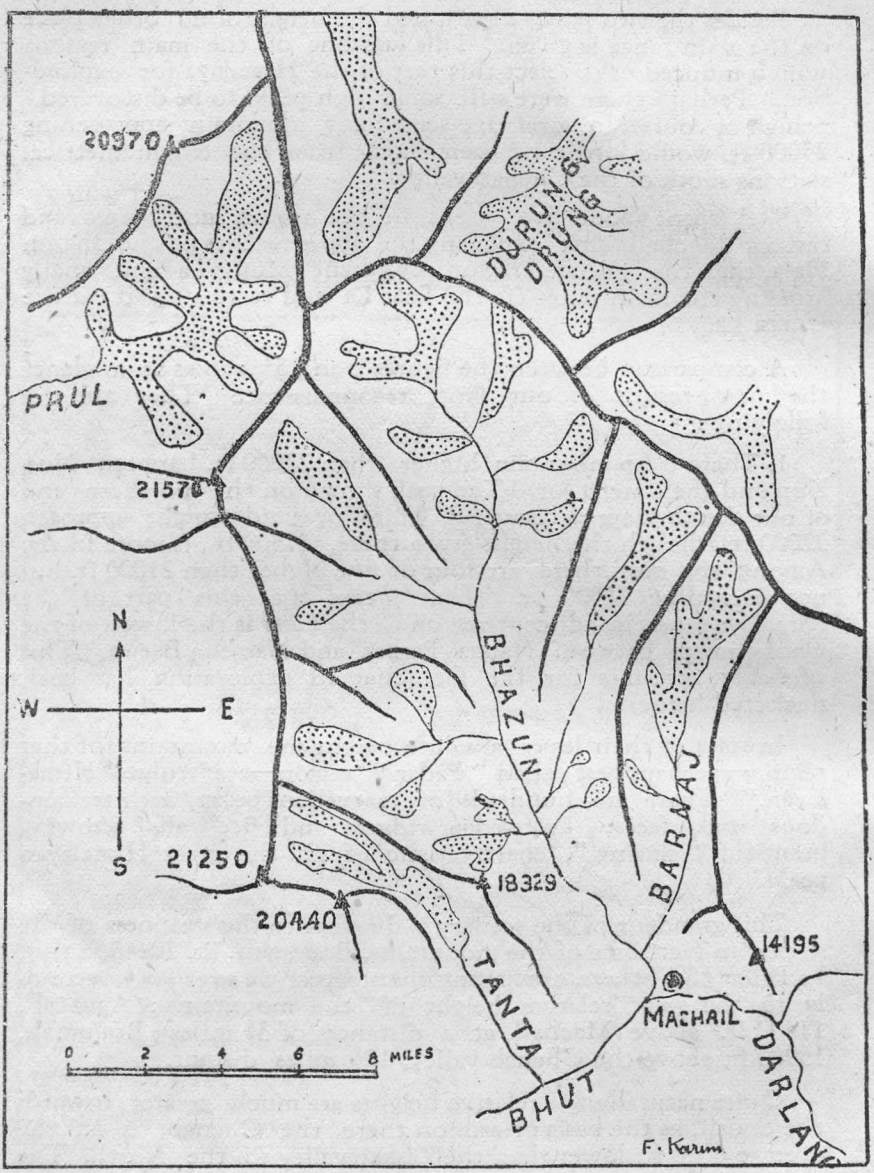


FIG. 2. PADAR MOUNTAINS, NORTHWESTERN PART,
AS SHOWN ON SHEET 52C

[1] There is no name given for the range which branches off at the Kangla Jot from the main range and runs first north-west, later west for about 60 miles. "Padar range" is here suggested. (See Fig 1).—It might be interesting to note that several peaks of this range are visible from Daynkund near Dalhousie: Pt. 21050, Brammah, Pt. 20440 and Agyasol are just peeping over the Pir Panjal.

Chenab : The range here is deeply dissected, the mountains being cut into isolated blocks with deep gorges between them.

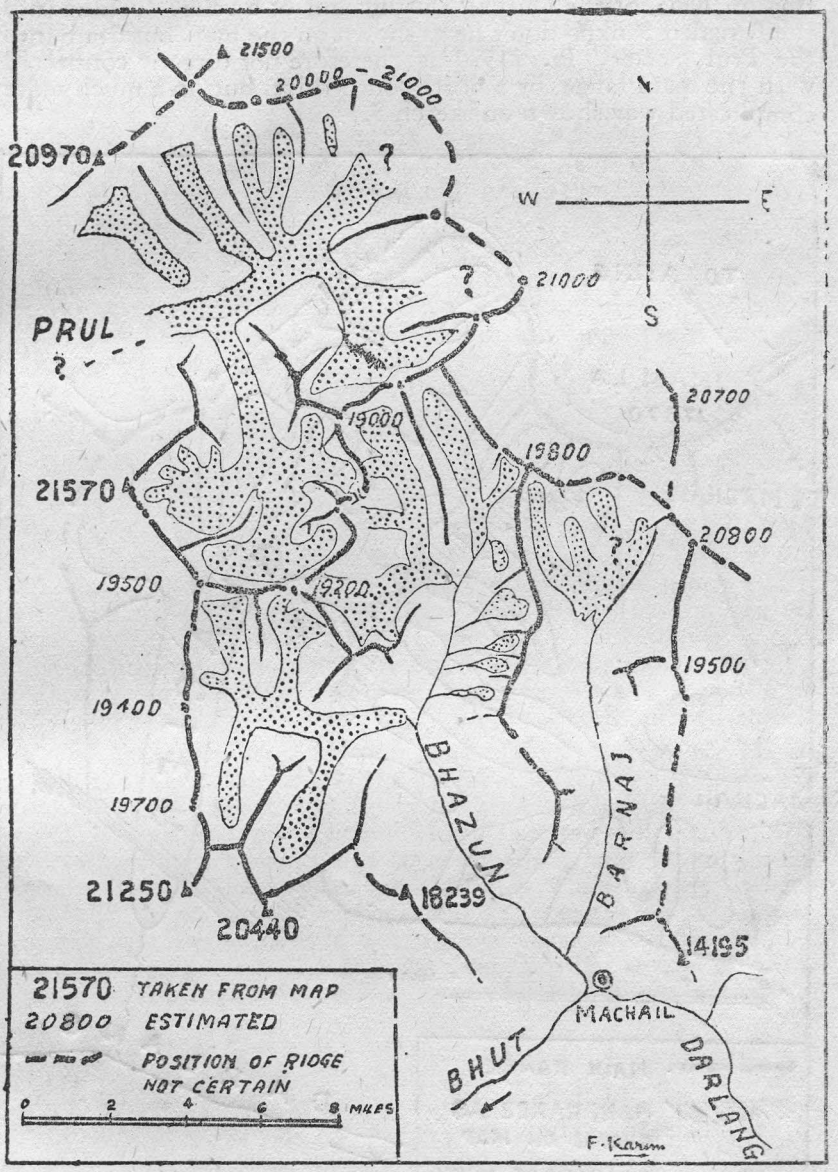


FIG. 3. PADAR MOUNTAINS NORTHWESTERN PART (SEE FOOTNOTE 3)

It seems that the erosion from the South is fast progressing : Several of the highest peaks (f. i. Pt. 20440 and Brammah) are not on the water-shed between the Chenab and the Bhut Nala, but some distance to the South of it, as the saddles are more and more receding northwards.—It is thinkable that the subsequent valleys of the Bhazun and Darlang have been "captured" in a similar way as the old courses of the Jhelum and Chenab.

2 The area of the Prul valley is 70 sq. miles larger than shown on sheet 52 C. The heads of the two branches of the Bhazun Nala, of the Durung Durung and of a valley opening into the Ringden Sankpo don't lie as shown on the map, but drain into the Prul glacier Pt. 21570 is therefore not directly connected with the main range by a north-south ridge, but in a much more complicated way shown on sketch 3.

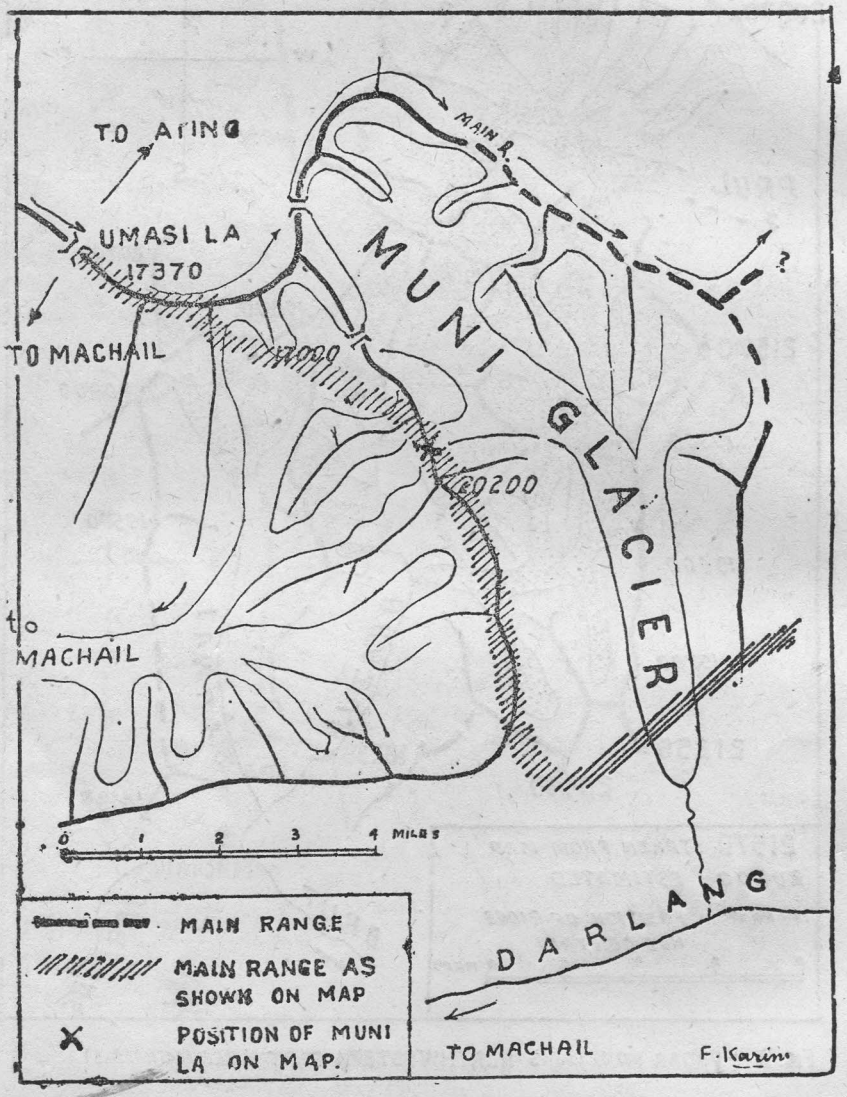


FIG. 4. UMASI LA AND MUNI LA

3. A small area of about 8 sq. miles to the North of Pt. 20440 and Brammah, shown on the map to be the head of the Tanta Nala (a side valley of the Bhut) drains into the West Donali glacier.

4. The Muni La of the map does not exist (Fig. 4). Crossing

the range at the point indicated on the map (which would not be so easy !) one does not reach the Seni valley leading into Zaskar, but only a side valley of the Darlang, filled by an enormous glacier,[1] which has its origin south-east of the Umasi La. Consequently the main range lies much further to the North and an area of some 30 sq. miles drains into the Darlang and not into the Zaskar.

Judging from the amount of water discharged by the next tributary to the East the area of its valley must be nearly as large as the Muni valley. This second addition to the Darlang drainage is indicated in Fig. 1.

5. The Poat La is not situated at the head of the glacier, but at the end of a small, inconspicuous side valley (in fact we would never have found it, were it not for a group of Zaskaris who crossed the pass on the same day in the opposite direction). The glacier, perhaps best termed Darlang glacier, has its origin approx. 1½ miles north-west of the Poat La and ends at a place marked " Danga " on the map.

GLACIATION

According to the map, 123 sq. miles of the northern slope of the Great Himalaya range are glaciated as compared with only 86 sq. miles of the southern slope. This is surprising, as nearly everywhere in the Himalaya the southern side shows more extensive glaciation (due to the greater precipitation). If we however take into consideration the few corrections we were able to point out, then the proportion changes considerably : We find then 104 sq. miles for the northern and 105 sq. miles for the southern slope.

The figures are given here only in order to illustrate the *proportion* of the glaciation on both sides of the range. They do not give the *actual amount* of the glaciated area. It has to be borne in mind that the upper reaches of the glaciated valleys are nearly everywhere mere guesswork as far as the main range is concerned. In most cases the ice-covered area is larger than shown on the map. In the region of sketches 2 and 3 the figures are as follows : Map 36 sq. miles ; according to our rough survey 60 to 65 sq. miles. No accurate figures can be given as we did not see the whole area of the Barnaj glacier and of some of the branches of the Prul glacier.

Length of the glaciers.—If the end of the Prul glacier is shown correctly on the map, its length is about 12 miles. The Muni glacier is about 10 miles long, the Darlang glacier 9 miles. In other words there are no really long glaciers in this part of the Himalaya.

Regarding *area* the Prul glacier is by far dominating (between 40 and 45 sq. miles). It is certainly the largest of all the glaciers shown on sheet 52 C.

End of the glaciers.—In the longitudinal valley of the Bhazun and Darlang the glaciers terminate between 12500 and 13500 ft.

[1] **The gaddis could not give a name of this valley. Its glacier is further on termed "Muni" glacier.**

(Western Donali : 12500 ft., Eastern Donali : 13500 ft., Muni glacier ab. 13000 ft., Darlang glacier ab. 13000 ft.) Due to the extraordinary steep longprofiles of the southern valleys of the Padar range the glaciers there are much shorter, but reach much lower altitudes : Kuheg Nala glacier, length 5½ miles, and 9900 ft. ; Kijai Nala glacier, length 7 miles, end 10300 ft. (Figures taken from sheet 52 C/3). On the other hand the mighty glaciers flowing to the North end much higher, judging from the two examples we have seen : Bardur Nala ab. 14000 ft., Tema Nala (from Poat La) ab. 14500 ft. This is not so much caused by the more gentle gradient of the northern slope as by the greater dryness of the air.

It is somewhat surprising that the Padar range, the summits of which are as high as those of the main range (at least in the western part) does not act as a real barrier to climatic influences. Though behind the first range, the Darlang and Bhazun valleys are richly forested (up to 12500 ft.) ; all the larger side valleys are glaciated—in several cases the glaciers extend right down to the main valley. Everywhere the eye is attracted by beautiful white peaks.

What a contrast to the Zaskar valley north of the main range ! There one will find only isolated patches of trees, along irrigation canals or near villages. Only occasionally some glaciated peaks are visible. Brown and red are the dominating colours. There is no doubt that the main range is the great climatic barrier, and not the Padar range.

One has however to keep in mind that there is a large opening in the first barrier the Bhut valley—and that there are many deep gaps between the peaks, whereas the main range is an unbroken wall for all the distance between Nun Kun and the Kangla Jot (and even further on) with no passes lower than 17000 ft.

Type of glaciers.—Most of the glaciers are of the *Alpine type* (snow collected in high basins, " névés "). It is however interesting to note that all the branches of the Eastern and Western Donali glacier belong to the *Mustagh type*. Here the glacier gets its material mainly from avalanches from the steep side walls of the deeply cut valleys. The valley-head is invariably a steep, rocky wall, which makes it impossible to cross from one glacier basin into the other. It is curious that both types are so close together (Western Donali and Prul glacier).

Variations.—All the glaciers visited by us show signs of retreat and decay. As none of them have been investigated before, not much can be said about the amount of this recent retreat.

More interesting and more clearly marked are *secular movements* of the glaciers. In front of all the icestreams high old moraines can be discerned, testifying to a more extensive glaciation in former times. As we were interested in exploring an area as large as possible, we had naturally no time for a thorough study of all the problems of former glaciation.

From occasional observations the following facts could be gathered : Similar to Lahoul[1] two sets of old moraines are

[1] L. Krenek, Recent and Past glaciation of Lahoul (The Indian Geogr. Journal, Vol. XX, No. 3, 1945).

clearly marked (named " I " and " II " in the paper mentioned below). Most of the glaciers of the Padar region show however two more sets of moraines. The highest can be detected only in a few places. They are cut by the erosion of the side-streams and very often completely washed away. Quite obviously they belong to a more remote period. It is unfortunately not possible, with the scanty material at our disposal, to collaborate signs of former glaciations in the Padar region and in Lahoul.

The main problem is to determine the *age* of the secular movements. Judging from the well preserved moraines, the advances connected with them must have taken place fairly recently. In fact they look exactly like the " 1850 " or " 1820 " moraines of the Alps. But if we take into account the extent of these variations and the amount of erosion which has taken place since, we must conclude that many hundred years have passed since.

It is possible that the stages represented by these old moraines correspond to the " postglacial advance " (named " V "), mentioned by De Terra and Patterson[1], which, in their opinion, can be compared with two of the retreat stages of the ice age in the Alps (Gschnitz, ab. 8000 B.C., and " Daun ", ab. 5000 B.C.). They also proved that the lowest terrace, " V ", of the rivers Jhelum, Chenab and their tributaries is connected with this " postglacial advance ". The height of these terraces above the present river level 15 to 20 ft., gives an indication of the amount of erosion which has taken place since.

But one question still remains to be solved : Why are these retreat stages of the ice age so clearly marked in the Western Himalaya[2], (in spite of the much stronger erosion), whereas they are by no means so easily discernible in the Alps ?

All depends on the question how much erosion takes place in a certain material in a given time—a question which cannot be answered accurately with our present knowledge. De Terra gives examples of the amazing amount of accumulation and erosion in some of the interglacial periods. At another place he says :" " One generally tends to over-estimate the time for relief making in unconsolidated formation. From my own observations I know that gullies 60 feet deep have been cut within a period of 10 years into postglacial valley fills at the foot of the Rocky Mountains in Colorado ".

Taking everything into account it is therefore not very likely that the various sets of old moraines observed in the Padar region and in Lahoul correspond to the retreat stages of the ice age in Europe. We probably have to assume that postglacial developments have taken a different line in Europe and in the Himalaya.

PASSES OVER THE GREAT HIMALAYA.

1. ***Chilung La.***—(ab. 17000 ft.), between Fariabad and Ringdom Sankpo. Not visited by us.

2. ***Haghsu La.***—(no height given). This pass is closed to the

[1] **H. De Terra and T. T. Patterson, Studies on the Ice Age in India and Associated Human Cultures.**

[2] **I don't know whether similar investigations have been carried out in other parts of the Himalaya.**

general traffic because of some sapphire mines near the pass, which are however not worked at present. We heard that the crossing is very difficult and only seldom undertaken.

3. ***Umasi La,*** 17370 ft. This is the main route from Padar to Zaskar. I doubt whether any other pass of such a height and equal difficulty is crossed so frequently. Practically on every clear day from the middle of May to the end of September some people will tackle the long, crevassed glacier to the South of the pass and the very steep, sometimes icy slopes of the northern side, taking grain or tea with them to Zaskar and bringing back salt or borax. It is really amazing to observe how men and sheep (the latter carrying two bags to five seers on their back) negotiate the dangerous passages. Often the pass is crossed very early in the season, especially by workers of the sapphire mines near Machail (only Tibeteans, mainly from the Kargil area, are used in the mines; the local people are said to be not reliable). These early crossings are of course rather risky ; accidents are frequent.

4. As already mentioned, the *Muni La* of sheet 52 C does not exist. The " Old Deserted Route " marked on the map refers very likely to a crossing from " Huttra " (north of the Umasi La) over a side ridge into the Seni valley.

5. ***Poat La.***—(18752 ft.). Judging from the snow line on both sides of the pass, the height given on the map is probably 1000 ft. too high. It is of course possible that the snowline there is somewhat higher than in the north-western part, as this region is protected against the monsoon by the high mountains of Chamba Lahoul.—We crossed the pass in bad weather.

This pass is used occasionally by people from the Tsarang Lingti to fetch wool from the gaddis in the Darlang Nala. The crossing is difficult and involves a climb along the serrated ridge, which is definitely unpleasant in bad weather. There are long glaciers on both sides of the pass. It may be mentioned here that there are no permanent settlements in the whole length of the Darlang valley.

6. ***Kangla Jot*** (17317 ft.).—The position of this pass is not quite clear on the map. It is actually not a crossing of the main range, but of the Padar range, from the Chenab *via* the Niyar Nala into the Darlang. It is said to have been crossed only once by a European. The northern side does not show a clearly defined pass-route and the path may be rather involved.

All the crossings from the Chenab are now-a-days more or less abandoned. This is probably due to a *retreat* of the glaciers, which causes a breaking up of the surface. More crevasses and seracs are formed, so that it becomes more and more difficult, or even impossible, to negotiate the glacier any longer. A good example is the Sersank pass (10 miles west of the Kangla Jot). From what we have seen it is more than doubtful whether the northern slope of that pass represents a practicable route at present.

7. There is a low saddle—between 17000 and 17500 ft.—about 10 miles north-west of the Haghsu La (Fig. 3). The saddle itself is formed by a curious little snowbasin, enclosed on three sides by low walls, which looks nearly like a frozen lake. It can be

approached by the southern branch of the Eastern Donali valley. The final ascent to the snowbasin is at present barred by a hanging glacier, which can perhaps be circumvented in the rocks to the East. We have however not seen the northern side of the saddle. It is even not certain whether it leads to the Kungi valley or into the Durung Durung ; the map is, as far as the northern valley are concerned, as unreliable as regarding the southern approaches. Many surprises await the man who first looks into the northern side valleys of the Zaskar between Padam and the Pensi La.

I hope these lines will show that there is still some "real exploration" to be done in this part of the Himalaya. Special attention is drawn to the region between the Prul glacier and Nun Kun and to the practically unknown mountains and valleys east of the Kangla Jot.

LAND UTILIZATION AND ITS REGIONAL ASPECTS IN PAKISTAN

BY

KAZI SAIED-UD-DIN AHMAD

With the increase of the pressure of population and economic competition, the question of land utilization or the use of land has acquired a special importance and significance in various countries in recent years. The object is to develop the productivity of the land to its maximum capacity with a view to increase the wealth of the country and to improve the standard of living of its population.

With us in the new state of Pakistan, where the whole economy has undergone a radical change and the old order based on the regional and economic unity of India, is yielding place to a new economy based on the economic self-sufficiency of the two component units of the West and East Pakistan, the question of proper land use is of supreme importance. New policies are being formulated and plans are being worked out for the future development of the State. New Inter-Dominion, inter regional and international economic relationships are in the process of evolution. We are now laying the foundations of an economic structure on the strength of which will depend the prosperity of 70 million people of Pakistan. We have to see that the foundations are well and truly laid and that our economy is based on uniform and co-ordinated plans of development rather than of disjointed scale.

Land utilization in the past.—Land utilization schemes had formerly a unitary aim, some particular aspect of land development-drainage, reclamation of marshes and usar lands, irrigation, prevention of soil erosion afforestation and various forms of agri-cological development. So we find that the governments in various countries have been devoting themselves to those aspects of land use which form their special problems and affect them most seriously, *e.g.* reclamation of marshes in the low lying areas of Italy, or Holland, improvement of land in the infertile plains of Germany and irrigation in North-West India.

The new concept.—Various problems of land utilization are however, inter-related for these require integrated action. There has, thus recently evolved the new concept of land utilization, the integral improvement of a region or the country. It includes the reclamation alike of population and of the soil in their mutual relations. Land utilization in the new sense is a comprehensive expression connoting the use of the land, inland waters and minerals of a country in such a manner as to provide :—

(*a*) For the rational distribution of the available area among various uses of its most profitable exploitation.

(*b*) For the prevention of misuse or over-exploitation.

It then denotes a composite programme of the development of a region in its various geographical aspects, mineral, edaphic, hydrological, climatic, agricultural, and industrial.

Recently there has been included within the meaning of the term "Land Utilization" the idea of land-use planning, that is the formulation and administration of land policies aimed at the employment of the land resources in the uses for which they are economically and locally best suited.

Most studies of land utilization have so far been of small areas. Such studies include a description of the use of the land and classification of the land based on physical and economic conditions influencing its use, the productivity of several classes of land when used for pastures, forest or agriculture.

Italy.—Land use policies may best be formulated on a regional or natural basis. Regional utilization of resources has recently been applied with great success. The Italian "Consortia" for specific regions led the way in this kind of integrated work. The new conception of land utilization as the integral land reclamation incorporates the principles that "It is no longer a question of carrying out this or that work by itself or for itself be it the drainage or irrigation or protection against malaria or reafforestation etc. but of considering organically in their technical, agrarian and economic aspects the aggregate of all the works and measures required in the several sections, be they land settlement, social measures, the reconditioning of mountain land, the control of water-courses drainage, irrigation, aqueducts, the breaking up of new lands, the reconditioning and improvement of the soil, experimental work, road making, the erection of villages, buildings, power stations, the laying of electric lines etc., for the purpose of preserving but much more for the purpose of introducing the productive systems likely to ensure the most advantageous results with due regard to the physical condition of each zone and to national interest".

Germany.—Germany undertook a comprehensive programme of co-ordinated land-use planning by forming "Wasser and Borden Verbande" which are corporate bodies working in a particular region and exercising all the functions about land improvement including regulation of water-course, drainage, irrigation, collection and utilization of waste water, improvement of cultivation and reclamation of waste-land.

Britain.—Dr. Dudley, Stamp organised a land utilization survey of Britain covering all land in the country. Its aim is given in the monograph on the subject. The first is to make record of the existing uses of every area in England, Wales and Scotland. It is believed that such a record will serve as standard of comparison with the past permitting the study of the geographic and economic factors influencing change in utilization in any given area, and at the same time will form the proper basis of planning for the future, since any plan must start from the present position and justification must be sought for any change of an existing utilization to a new one. The second aim is to invite native interest in the land and its uses and thus to secure the support of well informed public opinion for the work of planning the land for the future in the interest of all.

China.—In China Prof. Buck carried out investigations on the various aspects of land use. The aim for his work was "First to train students in the method of research in land utilization, second to make available knowledge of Chinese agriculture for its improvement and as a basis of national agricultural policies and third to make available to people of the countries interested in China's welfare certain elementary information about land utilization.

Russia.—In Russia problems of proper land use are given due consideration in the unified economic plan. The State Planning Commission or Gosplan in their five years plans provide not only for the effective increase in the productivity of various kinds of land but go a step further and coordinate the land with the factory. They visualise not merely the integral development of land but that of the whole economy.

America.—In America studies in land utilization have of late assumed great importance. Sample small areas have been selected to evaluate the productivity of the several classes of land when subjected to various uses. Recently Tennesse Valley Authority has attracted attention all over the world. It is now regarded as a model of co-ordinated development of National Resources. It provides a good example of integrated regional development. It is a development as well as a research planning agency concerned with the drainage area of the basin of river Tennesse. It is charged with the planning and execution of the extensive programme of river control of the Tennesse and its tributaries involving construction of dams and reservoirs and their operation in such a manner as to produce the maximum of navigation, flood control and incidental power. In addition broad powers of research and planning to promote the better use, conservation and development of the Natural resources of the region are authorised in section 22 and 23 of the Tennesse Valley Act. The authority makes Engineering studies, investigations, surveys, maps, reports and recommendations involving basic hydraulic geologic, topographic and cadastral data needed to determine the necessity and feasibility of projects required in the Authority's integrated programme of river control.

India.—In India, the question of land utilization was recently taken up by the Government of India and its importance in planning was recognized. The policy Committee on Agriculture, Forestry and Fisheries in 1944 recommended that a central land utilization Board should be set up to plan and co-ordinate work on an All-India basis in respect of soil erosion, forestry, land reclamation, irrigation works and other forms of land improvement. A land utilization Committee was appointed to formulate a scheme. It recommended the constitution of Land Utilization Boards at the Centre as well as in the Provinces and states. Regional boards were to be created in respect of the development of homogeneous areas falling under two or more provinces.

The idea of integrated development was also independently pursued by certain departments of the Government. The central Technical Power Board of the Government prepared the Damoder-Valley Project modelled to some extent on the Tennesse Valley Authority, to control the devastating floods, provide immense

hydro-electric power and irrigate 76,000 acres in the rice growing province of Bengal. The Damoder river and its tributaries are being harnessed for the purpose and the construction of several dams is provided : Kosi-project is another scheme of similar character. Kosi is one of the most destructive rivers of India. It is proposed to build a dam that will not only control floods but also provide for irrigation and various ills to which the Kosis' vagaries have given rise. Three Governments are co-operating in this enterprise.

Pakistan.—Land utilization and planning in Pakistan, as in India, has so far proceeded mostly on the basis of political and administrative divisions (Provinces and districts and Tehsils) Various departments of the Government have undertaken independent works of development according to the funds available but their programmes of development have lacked co-ordination and there has been no attempt for the development of regions as a whole. The need for regional development cannot be over-emphasised. Regional plans would be extremely useful for the integrated development of certain tracts which may lie within a province or spread over the boundary into an other province or state. Such tracts or regions may be selected on the principle that the problem of the area can be dealt with effectively only, if the whole area is taken into consideration.

Problems of land use in Pakistan: River Control.—Problems of land use in Pakistan are manifold but they are mainly connected with river control, with a view to provide water (*i*) for irrigation (*ii*) to develop water-power for light and industrial purposes (*iii*) to guard against floods. The first is more important in the West Pakistan and the last in the East Pakistan. Flood control becomes more and more important in the lower courses of rivers in the rainy season. These problems naturally vary from one river to another. But the whole has been made very complex by the partition of India, and the question needs careful consideration. As it stands, the heads and catchment areas in the mountains of practically all the Pakistan rivers lie in non-Pakistan territories. In parts of West Pakistan Sutlej and in East Pakistan Brahmputra and the Ganges traverse large plain areas in Indian territory before they enter in Pakistan. The Bari-Doab, an obvious geographical unit has been divided into two parts—the upper one goes to India and the lower to Pakistan. The headworks of the upper Bari-Doab canal on the Ravi lie in the Indian territory. Similiarly the headworks of the Chenab canal lie just inside Kashmir. In the case of the Sutlej, of the four headworks the one at Ferozpur has been assigned to India, but further up the stream two gigantic irrigation schemes, the Bhakra Dam project and the Nangal project are under construction, which will create problems of water-supply lower down the Sutlej. Only during the last Rabi season water was stopped in the Pakistan section of the Upper Bari-Doab canal as well as in the Dipalpur canal taking off from Ferozepur, which led to a great damage to crops. Although canal links to the Ravi and the Sutlej within the Pakistan territory are being constructed the question of adequate water-supply in the lower sections of the river still remains to be solved.

The harnessing of the river for irrigation needs a unified comprehensive plan covering the whole length of the river, and calls not only for inter-provincial but also inter-Dominion co-operation. The Indus flows through two provinces and both Panjab and Sindh have interest in its waters, which is exemplified by the long drawn-out dispute between the two Governments of these Provinces. There should be proper balancing of the distribtuion of water in the various sections of the rivers, irrespective of the political and administrative boundaries. The Sutlej and the Ravi on emerging from mountains flow through the two new dominions and some sort of settlement between them about their waters is necessary. In our own country proper exploitation of the rivers can best be obtained through a central coordination of the work of regional units. The Doabs in the West Pakistan provide excellent regional units for corporate development. In N.W.F.P. the vale of Peshawar, plains of Bannu and Dera Ismail Khan, drained by the Kabul, the Kurram-Tochi and the Gomal respectively provide a suitable opportunity.

Even a doab or a river basin may have to be sub-divided into smaller sub units which have some sort of physiographic unity (*i*) the Bet or Khader lands, *i.e.*, the flood plains of the river (*ii*) Usar lands and (*iii*) water logged areas, and (*iv*) Areas commanded by canals. The basis of such sub-regions may vary from one river basin or Doab to another according to the particular needs and natural and man-made resources that may be available for improvement. Each of these physiographic sub-regions should have secondary or tertiary land-utilization programmes suited to their special needs, and the whole co-ordinated.

Flood control.—Flood waters can easily be made to serve instead of harming agriculture by suitable methods of control. This requires a unified control from the Catchment areas in the hills to the mouth of the rivers. Floods in the lower courses should be to a great extent controlled in the Catchment areas by the conservation of the moisture. In West Pakistan the river Indus flows through a dry region and is flanked by desert and dryland for a long distance. Flood canals have been built to divert some of the water of the floods. Water could be further diverted into depressions on either side of the river and such artificial lakes could be utilized later for irrigating suitable land. The East Pakistan lies in the lower delta regions of the rivers and has no control in the regulation of flood waters in the upper courses. Here the problem can properly be faced by the construction of suitable drainage channels.

Water-Logging.—There are regions both in East and West Pakistan which suffer from water-logging. In the former they are mainly connected with seepage from canals. Such areas have developed with the spread of irrigation. Such areas may be tackled as an allied problem to irrigation. Special plans for the utilization of such lands may however be prepared according to the local conditions as part of the development of the greater region. Construction of tube-wells in such areas may be a good remedy. They will perform the double function of (*i*) Lowering the water-table and (*ii*) providing water for surface requirements.

In East Pakistan water logging presents a different problem. It is an area of abundant rainfall and is submerged during the floods. Many depressions are filled with water and form lakes and water-logged lands when the water table is high, suitable drainage channels may be constructed.

Power.—Pakistan both the West and the East, is practically devoid of good coal and the quantities of petroleum obtained are insignificant but nature has made full compensation for this deficiency in the availability of vast opportunities for the development of water-power in its several perennial rivers. The rivers have been dammed at various places in the Indian basin for the construction of Canals. I' is of immense interest for us that from these water-power should be developed as much as possible. Various grids should be planned and power-houses should be developed all along the rivers and the canals. Hydro-electirc power should be available not only for lighting and industrial purposes but also for the running of railways Italy before the last war tried to make up her defeciency of coal by the electrification of railways. The problem of transport in Punjab, N.W.F.P and Sind as well as in East Bengal could be solved to a great extent in this way. Suitable reservoirs could be built in several places in Baluchistan for the generation of electircity for irrigation, light and industrial purposes.

Reclamation of Land.—In various countries there are many areas which are at present unfit for utilization for productive purposes. With the increase of pressure on land, such areas are being reclaimed. These problems vary with different countries. A very familiar example is Holland where land has to be reclaimed from water for agriculture. In Denmark the main problem has been to reclaim and cultivate heath land. In Italy the soil has recently been reclaimed for cultivation practically foot by foot from the malarial marshes. It may be noticed that this aspect is different from that of land improvement.

In all the Provinces of Pakistan there are large blocks of land which are at present waste for one reason, or the other, but are classified as 'culturable wastes in the agricultural statistics. There are above $11\frac{1}{2}$ million acres of such lands in West Punjab, 3 million in N.-W.F.P., 6 million in Sind, and about 4 million acres in East Bengal. Such areas could be studied from region to region and reclaimed by appropriate methods for agriculture or cattle farming, or they may better be utilized for afforestation. No progressive state can allow such large area to remain waste.

Besides culturable waste-lands, there are other large areas, which, though they may not be available for cultivation, may be very profitably utilized for afforestation and sites for industrial purposes. Such areas are of different kinds in East and West Pakistan. In the arid West these lands are entrusted with various Salts, which provide great scope for chemical industries, Proper establishments for their utilization can be located in such areas. Desert wastes in Thal are already being reclaimed.

In the East there are many marshes and numerous depressions filled with water called Bhils. Many such areas could be reclaimed for the cultivation of rice.

Soil Erosion.—The soil of a country is one of its vital resources. Its depletion, deterioration and inadequate replenishment is going on over wide areas and is responsible for throwing out of use many lands and reducing the yield in others. Both sheet and gully erosion have affected large areas in the hills and in the sub-mountain areas in the north and west of the Indus basin. It is wide spread in the plateau of Potwar, the whole of which presents a dissected land-scape. Tiny deep gullies at once attract the attention of those who go along the Grand Trunk Road from Jhelum to Rawalpindi. This problem is intimately connected with reckless deforestration, unlimited grazing, and floods. The regime of rainfall, in heavy showers concentrated in a small period, adds to the damage by removing the top layer. Such lands could be reclaimed, brought into use and their fertility increased by various processes, such as reafforestration, planting of trees, terracing, strip cropping, contour cultivation and the bunding of the fields. The Potwar plateau has incidentally a good rainfall. Its agricultural productivity could be greatly increased if the whole area could be levelled and arrangements made for the bunding of the fields.

Regional soil studies are necessary for any comprehensive planning. In any scheme of agricultural development it must be the first step to ascertain the most suitable way in which the available land can be best utilized. Survey of soil types should determine the suitability of land for arable and non-arable uses.

A preliminary study of different types of soil, based mainly on the geological formations is already available. For proper land use it has to be supplanted by a further study of the characteristics of the soils in different parts, such as physical constitution, moisture retaining capacity, alkalinity etc. Studies of soil profiles in various regions and sub-regions will be helpful in the final estimate of the productive capacity and utility.

Forestry.—Forestry should form an important part in any integrated plan of land use in West Pakistan. Here the rainfall is generally deficient to promote forest growth. But there are areas which though unfit for cultivation may be well utilized for the growth of useful trees with the help of irrigation. Many sandy and alkaline lands are amenable to such treatment. In relation to land-use forest may be classified into four types.

(1) Protective forests :—Those necessary on climate or physical grounds, *e.g.*, prevention of floods, erosion or desiccation. These are situated in hilly regions and contain the head waters of several rivers. The interest that these forests protect are beyond the imagination of an ordinary man. The prosperity and interest of large areas of West Punjab and Sind lies in the proper management of these forests in the Himalayan region in the north.

(2) Timber forests :—Those meant principally for timber supply and revenue. Such forests can be located on the hills as well as on the plains.

(3) Minor forests :—Those meant principally to supply local needs of wood and fuel.

(4) Pasture forests :—Those meant principally to supply local needs for fodder. Both the minor and pasture forests need encouragement in various areas to supply the local requirements of timber, fuel and fodder. Such small scale forestry puts infertile lands to good use.

Afforestation is also desirable to mitigate the rigours of climate.

In East Bengal the Chittagong hill tract could be better utilized by developing plantations of commercially useful trees, after a proper evaluation of the temperature and rainfall condition of the windward and leward slopes.

Mining. –There are many areas in Baluchistan where prospecting should be carried on for various minerals such areas are incidentally not suitable for other forms of land use on account of the stony nature of the soil and the deficiency of rainfall. Every effort should be made to develop power near such areas or as near as possible for the location of industrial sites to utilize the minerals.

Land Colonization and Resettlement of Refugees.—The country is faced with a huge task of the resettlement of the people who have migrated from across the border. Settlement of refugees should not be left to chance. There should be a planned economy behind it. Vast areas have to be reclaimed. Labour is needed in various parts of the country. Families should be settled in such a way that we have a balanced economy in various parts and that suitable personnel and labour is available for the requirements of the area. People should be settled in vocations for which they are trained. New settlements –villages and towns, to accommodate the surplus population, should be built in areas not useful for other purposes.

It will be thus seen that in this arid West and the humid East we have great resources, a land spread over a wide range. They only need proper utilization and this can be effectively done by regional studies. Knowledge of geography can be further utilized in the survey of the conditions of water-supply, relief, soil, and climate with a view to make the best use of the land for agriculture, animal husbandry or forestry.

Conclusion.—It will be clear that the various problems of land use are so interrelated that a central organization is necessary to examine the different problems from various aspects and to coordinate them. It may function as a standing planning Committee to which all plans of development, central or provincial be referred for proper direction. It is suggested that there should be a central Board of Land Utilization with Provincial, regional and Sub-Regional boards working under it. All the departments concerned with development should be represented in them and no new scheme should be implemented till it is approved by these bodies.

FROM MANDI TO ROTANG PASS—THROUGH THE KULU VALLEY

BY

MISS MUZAFFARI QURESHI

From Mandi to Rotang, a distance of 79 miles is followed along the upper course of Beas river—popularly known as the Kulu Valley. It presents beautiful mountainous scenery of great interest to a geographer. The relation between the structure, relief, agents of erosion, and the type of landscape resulting, together with the interaction of man with his environment is very clearly brought out.

Physiography :— The Kulu Valley is encircled by snow-covered peaks of lofty ranges. On the north and east is the Pir Panjal which is the southern branch of the Great Himalayan Range. It separates Kulu from Lahul and Spiti. To the north-west, west and south runs the Dhaula Dhar Range—a branch of the outer Himalayas. After a short distance to the north, it bifurcates, one branch continuing southward divides Kulu from Mandi State and terminates on the Beas. The other turns west-ward and separates Kangra district from Chamba and sinks on the southern bank of the Ravi, near Dalhousie.

The relief of the country itself consists of rugged steep-sided and sharp-crested ridges. The height ranges from 2,550 ft. in Mandi to 13,050 at the top of the Rotang, (the lowest pass on the Pir Panjal Range). Wherever there are relatively level areas, hamlets are built. These hamlets by the side of the river form stages on the way.

The main stages are :—

Pandoa	2700′—10 miles from Mandi.		
Larji	3000′—11 ,, ,, Pandoa.		At Larji the direction of the river changes from East-west to North-south.
Bajaura	3,500′—12 ,, ,, Larji.		
Kulu	4,000′— 9 ,, ,, Bajaura.		
Katrain	4,800′—12 ,, ,, Kulu.		
Manali	6,200′—12 ,, ,, Katrain.		Manali is the motor road terminus. Beyond Manali a mule road continues.
Koti	8,500′— 7 ,, ,, Manali.		
Rahla	8,800′— 2 ,, ,, Koti.		
Rotang	13,050′— 5 ,, ,, Rahla.		

The main rock formations of the area are, sandstones, conglomerates, granite, basalt, gneiss, shales, and other metamorphic rocks. Both biotite and muscovite mica bearing rocks are common. Unconformities occur at places, e.g., at one place one

series of sedimentary rocks with a steep angle of dip was overlain by almost horizontal strata, with a vein of quartz in between. The signs of folding and faulting are evident wherever the different banks of rocks have been exposed by the river, and its tributaries. The rocks show excellent examples of having been weathered along their joint planes. Mostly the sandstones and granite formations show two sets of joints—horizontal and vertical or slanting. Splitting along these joints is very common.

At Bashist, on the left bank of the Beas, about 3 miles north of Manali there are three hot springs. They have a high content of sulphur dioxide and a temperature of about 150° F. The water bubbles from the ground into a small tank and is let off into baths. These baths are very frequently visited by pilgrims and people suffering from certain diseases. Hot springs are usually associated with a junction of varying rock structures but here, at least on the surface, no such junction is visible. Other hot springs are known to exist at Kalat, 20 miles north of Kulu and at Larji.

The most important feature of the Valley is the Beas and its tributaries. The valley is asymmetrical for most of its parts with a gentle slope on the right bank and presenting a much steeper face on the left bank. From Mandi to Pandoa—a distance of 10 miles—the valley is narrow with steep vertical sides. From Pandoa to Larji though still a gorge it is comparatively wider. After this it continues broadening till Manali. This is partly because here the river is consequent and flows in a faulted valley, while in the lower gorge section it flows transverse to the folds and consequently cuts a narrow valley. Partly the width is determined by the rock structure. Between Mandi and Pandoa the presence of sandstone with vertical joints accounts for the steep walls. The wider stretches and gentler slopes of the valley correspond with softer rocks like conglomerates. From Manali to Koti the river flows through a wide valley enclosed between two great mountain walls. Near Koti the river flows in a chasm enclosed by sheer cliffs not more than 20 ft. apart at the top. From here onward the valley is a narrow glen with precipitous crags on either side. At Rahla there is a very magnificent fall. From this point the river tumbles rapidly through open mountain pasture. Looking eastwards from the top of the Rotang we see the source of the Beas.

The river has begun to adjust itself to the structure of the region. It has started cutting the interlocking spurs and has a tendency to straighten out its channel. Although there is not much flood plain, yet the river has built in its lower and more level reaches, valley side scrolls. Having a large volume of water it brings a heavy load of big boulders which at some places forces it to aggrade its bed.

The innumerable small tributaries joining the Beas are rushing torrents flowing down short very steep courses and nearly all of them have waterfalls. They are either fault guided subsequents or they take advantage of the softer bands of rocks. Some are insequents while others issue from springs. The most important of them on the right bank are, Manalsu Nala joining the Beas at Manali, and further up, Beas Khund or Salong—a glacier-fed stream-falling into Beas at Palchan almost opposite Koti. On the

left bank the most important tributary is the Rainihal joining at Jagat Sukh—a village almost opposite Manali. A few miles from Manali there is a tributary on the left bank with a very marked discordant junction. Some of the tributaries have built fans at their entrances into the river *e.g.* about 4 miles from Manali on the left bank.....The Beas Khund while joining Beas builds a huge fan on the right bank.

Most of the tributaries have interlocking spurs which are not so marked in the main valley. These are very clearly seen along the Manalsu Nala.

The river appears to be doing most of its work during flood times. Huge boulders in its bed testify to the enomous carrying capacity at times when the snows melt and monsoon rains are the heaviest. Logs and deposits of sand along the banks, lying much above the present level of water, prove it. On the whole the gradient of the river is quite steep. In a distance of 80 miles between Mandi and Rotang there is a fall of about 10,500 feet which means an average of about 130 ft. per mile. However, in its upper portion—between Manali and the source—it is much steeper, being about 500 ft. a mile. Between Manali and Mandi it is only 55 ft. a mile. As the river has not yet graded its channel, almost level stretches alternate with rapids. In the level stretches where the movement is hampered, braided channels occur. There are small islands in the river where the channel bifurcates. The extremely damp nature suggests that in flood time these are submerged in water. On the whole we can say that the river has attained early maturity. The interfluves show marked signs of youth being completely ungraded. This clearly shows that the stages reached in the landscape and the river do not necessarily coincide.

A very noticeable feature is the valley-in-valley form of the tributaries as well as the main river in places. This is especially marked above Manali. Paired terraces also occur above Manali and at many other places. At Manali there are two series of terraces—a higher one and a lower one. However, in some places there is no pairing of terraces. This may be due to the asymmetrical form of the valley or to the burying of terraces under later deposits. This suggests rejuvenation.

Action of frost, as a weathering agent is also visible on higher slopes. The upper peaks are sharp and jagged, as are also the exposed rock surfaces other than the rounded granite boulders. The rounded boulders are due to spheroidal weathering. Large quantities of scree testify to the frost action. Within two miles of the pass snow begins to appear, first in patches, while the last half mile or so is through snow 4 to 5 ft. thick. Looking beyond the pass we can see Lahul, with Chandra river fed by many tributaries from glaciers.

VEGETATION

(*a*) ***Natural Vegetation*** of the valley varies with altitude and type of soil. In the lower parts deciduous trees are prevalent interspersed with Chir-pines. Palm trees grow in sandy patches along the river. The deciduous trees are mulberry, alder, wild

cherry, and symbal.. The alders are mostly along water courses. There are also long and short grasses. At a higher level above Kulu, there are Himalayan oaks, chestnuts, walnuts, apricots, deodar pines, cedars and :6.rs. At places apple trees and tea bushes also grow wild. Higher up, above 9,000 ft. grasses replace the forests and above 11,000 ft only bare slopes glitter in the sun. However, along the river different kinds of flowers grow.

(b) ***Cultivated trees:-*** Trees are also artifiCially planted like the deciduous fruit such as apples, pears, and apricots. Tea estates are common in the lower parts of the valley, although the tea is not of a very good quality.

Agriculture :-All available flat land suitable for agriculture is cultivated. River terraces constitute the most fertile tract~. \)\iater supply from rivers as well as from rainfall is abundant. . The size ot the fields depends upon the size of the flat land available. The hill slopes are carefully terraced: the height being dependent upon gradient. Irrigation channels called Kuls or Guls are taken from the tributary streams from the hillside. The main river is much below the level of the fields and consequently is not used for irrigation. The irrigation water is utilized mostly for the rice crop. Other crops depend upon rainfall:. The rice fields are left fallow in winter while the other fields are fertilized and sown with winter crops. The chief manure consists of pine-needles mixed with farmyard manure. The fields are ploughed with the help of small wooden ploughs drawn by bulls. Men do the ploughing and sowing while women do the harvesting.

Summer crops are planted at the beginning of the monsoon rains, i.e., about the beginning of July: and harvested in October or NovemjJer. The exact time being dependent upon elevation. Winter crops are planted in November and harvested in early summer, presumeably before the rains.

CROPS

SUMMER CROPS :- *Rice* is the main crop of the whole valley. It is one of the major food crops. First it is sown in heavily manured nurseries early in May and is planted out in the fields in the latter half of June or July according to elevation. The men prepare the fields very carefully while the planting and harvesting is done by women. The grain is quite thick and is mostly consumed locally. Rice is the only irrigated crop, *Maize* is another summer crop. It is sown at the end of May 'or June in succession to wheat or barley. The field is left fallow once in three or four years. Be"n, monkeys, and birds destroy the crop so it is harve;ted in the beginning or end of September before it is quite ripe, and is dried on the house tops. There it can be better guarded. Nearly every house top has a bright orange hue in October.

Other inferior gra:ns like Kudra, Kangni, Chini and Siara are widely cultivated.

Tobacco.-Tobacco is generally grown in richly manured plots close to the houses. First it is sown in beds and afterwards planted out. Mainly grown for home-consumption.

Hemp.-Hemp is largely grown on high lying villages. The produce is high-5 to 10 mds. an acre. Generally there is a surplus of fibre.

***WINTER** CROPS.-Wheat* is the chief winter crop. It is cultivated in fields formerly occupied by maize or at her minor crops. The time of sowing varies from September to November according to elevation, and it is harvested in June.

Barley.- Barley is also sown in large quantities. Often acreage is as much as under wheat. It is harvested in May.

Opium.-Opium is the most paying produce in winter harvest. It is grown in almost every village till 8,000 ft. It is sown in November in highly manured plots and extracted in Mayor June. Its cultivation and manufacture requires laborious work.

Potatoes.-Mostly in higher villages are sown in April and dug out in August.

Sarson.-Sarson is largely grown.

Tea.-Tea has been tried but the climate is not suitable. The yield is low. In lower parts of the valley rainfall is uncertain and in higher parts it is too cold. The estates have been abandoned except at Raison Bagh and Nagar.

Vegetables consisting of cabbages, brinjals, lad iesfingers. tomatoes, beans, pumpkins. shero (spinach) and chillies, only suffice the home needs. Only potatoes are grown in large quantities.

The large variety of crops is due to altitude varying from 2,500 to 9,000 ft. (the limit of hamlets). Four agricultural zones may be distinguished practising different kinds of rotation. These are ;-

1. The Lower Zone from 2,500-5,000 ft. Rice and Maize are the chief summer crops and wheat the winter crop. In addition much Barley, Opium, Sarson, and pulses are produced. In the best manured lands maize and barley, or maize and wheat are grown in rotation, while in less highly manured soil maize alternates with inferior grains like Siara, Kudra and Chini. .

2. The Middle zone from 5,000-7,000 ft. Maize is not so extensively cultivated because of cold. Its place is taken by the inferior grains. Mostly the land yields two harvests. More barley is grown than wheat because it ripens quicker and the field can be utilized for summer crops. Some opium, Sarson and pulses are also produced. Wheat, Kodra, and a fallow is one system of rotation with barley in place of wheat the next year. The other system is wheat, fallow, barley, and the next year buckwheat. fallow and barley.

3. The highland zone 7,000-8,000 ft. Siara and buck-wheat are the summer crops. Hemp is grown in patches near villages. Only a small portion of land yields two harvests. Barley is the chief winter crop with wheat in some fields. Potatoes are grown.

4. Higher than 13,000ft. only wheat as a winter crop and buckwheat as a summer crop is grown· They succeed one another in one single year or once in two year~.

Animals.-In Kulu there are many wild animals. Two kinds of bear are found, black and brown. The black bear damages the maize crop while the brown bear is an enemy of the sheep. Another danger to the sheep and dogs and cattle and ponies is the leopard. In higher ridges ibex is found and lower down barking

deer and musk deer are plentiful Wild cats, hyenas, wild pig, jackals and foxes are common Flying squirrels are numerous in the woods. They are sometimes tamed. There are also many kinds of game-birds. Pheasant and rartridge types are permanent residents. Ducks, geese and teals pass down the valley~ in spring and autumn on their way between their summer home in the high mountains and winter home in the lower regions. Pigeons, wood-pigeons, snow pigeons and blue-rocks abound. Birds of prey like eagles, vultures, kites and hawks are numerous. Also there is an infinite variety of ~mall birds like blackbird, cuckoo and maina. Snakes and vipers are also numerous and trout fishing is carried on to a certain extent in the Beas.

Livestock.- The domestic animals are mainly sheep, goats, cows and ponies. Sheep and goats are kept mainly for their wool and skins and also as pack animals. Cattle are kept for ploughing and milk. Transhumance is a characteristic feature. Goats, sheep and cattle graze on the upper slopes above the villages in summer and are brought down to Mandi in winter. . A few however are kept in the villages. Ponies are used mostly as pack animals.

Settlements.-Population is mainly rural.. The villages are situated near the flat cultivable areas where there is adequate supply of drinking water from fresh streams or springs, but the land is not worth cultivating. Generally a rocky spur projecting from a wooded hill side or a stony hillock on the edge of forest is utilized. The form of the villages is dependent upon the contours of the land-the houses are often built one above the other on the sloping ground. No villages are found in the wooded areas higher up. The sizes of the villages vary from 5 to 30 houses depending upon the land available for cultivation. They are generally detatched and are independent of any method or plan.

The houses are generally double storied and consist of stone walls with wooden beams. The upper storey floors are also wooden. The sloping roofs are either wooden or of rough hewn slates. The doors and balconies are mostly of carved wood. The balconies jut out from. the walls and are supported on wooden pillars. Each of the houses has a paved threshing floor. The roofs are very low and doorways are about 4 ft. high being almost ~quare. Neanly every house has several bee-hives let into its walls in the shape of square boxes. There is an orifice on the outside of the wall where flowers are placed in order to attract the bees. Once attracted the bees form hive and come and go by making use of the opening. On the inside there is a moveable lid by which the honey is extracted when the bees have been driven out through the opening.

The upper storey of the house is used for living purposes while the lower one is used for animals and storing purposes. Beds are the only furniture. Mostly the people sit on the floor.

Population.- The population of Kulu consists of settled agriculturists, and the fluctuating population of people from other localities.

The settled people are the characteristic hill people called Gaddi. Racially they belong to Aryans. They are short statured and sturdy with highly developed leg muscles. They have black hair,

sharp features with dark brown eyes, fair complexion but due to hard work sunbrowned. They are mostly Hindus worshipping various gods and goddesses such as Durga, Kali, Bhagwati, Radha Krishna and others. There are a few Muslims and Christians as well.. Mostly the people speak a form of Punjabi. The *dress* of the men consists of a pyjama, shirt, waistcoat, and an overcoat, and small round caps. They tie a cloth round their waist to keep themselves warm. Usually they are barefooted but some wear shoes made of rope. The women wear tight pyjamas and shirts and wrap themselves in woolen hand woven blankets. They cover their head with red or black ,handk~rchief called "Thapu". All the clothes are woollen and hand woven.

The women are very fond of ornaments and jewellery, which is generally made of silver, and sometimes of gold, nickel and copper. They have several small and one big earing in each ear, and at least two in the nose. Besides bangles and rings they also wear necklaces of semi-precious stones from Lahul..

Festivals like Divali, Holi, Lori and Dusehra are celebrated. Dusehra is the most important. On these days big fairs are held and men, women, and children dnnk excessively. The men smoke and dri·nk wine or "Louri" on other days too but women are allowed these pleasures on festivals only.

Joint family system is not common. Polyandry is widely practised but in some cases polygamy also exists. The main occupation of the people is agriculture. Pasturing spinning and weaving and extraction of oil from apricot, Sarson and other seeds, is also carried on. Mostly each villag~r builds his own house and cuts his own wood for building and fuel purposes. They thrush their rice on the stone-pavements outside their houses and remove the husk by poundmg the grain in hollowed stones with large wooden poles. Wheat, maize, and Kudra are ground in small mills run by water..

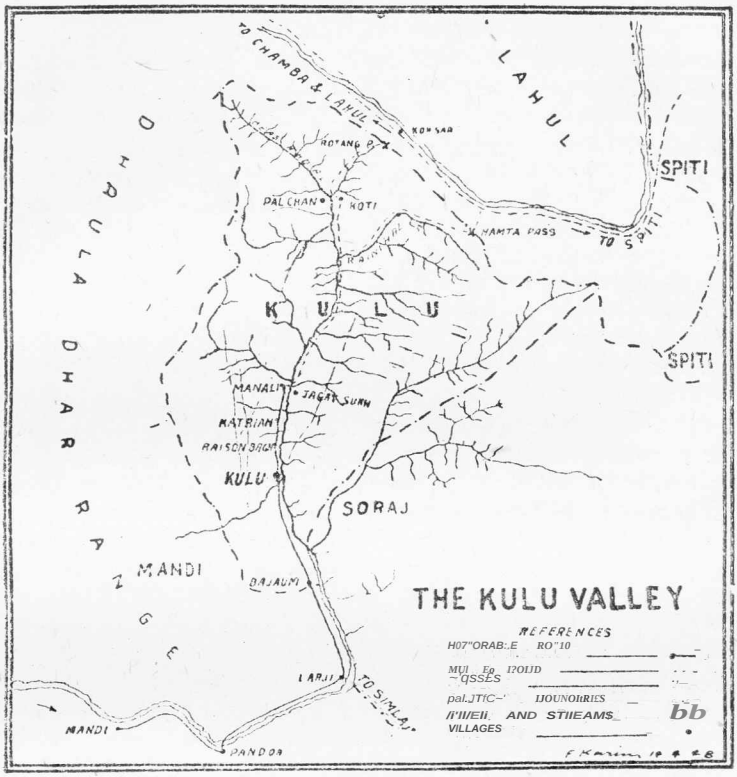
Maize and vegetables are dried in the sun for use in winta. Grass is dried for the winter feed of the few -cattle kept in the villages in that season.

The Kulu pCQple are generally hospitable, cheerful, and polite and helpful if carefully handled. The standard of living on the whole is poor. The people are lazy by nature, content with what they can easily get. The villages and villagers are generally dirty. The people are mostly illiterate.

The main constituents of tbe temporary settlers are people from Lahul, Chamba and Tibet who come in winter and return in spring. There is also a population of tourists who come during the summer season.

The Lahulies come down before the Rotang Hampta passes close in winter. They are different from the Kulu people in race, religion, and language. Racially they have a mixture of Mongolian blood in them. They are short statured, slanting eyed, with very little hair on their yellowish faces. They are Buddhists in religion and worship "Lingu." They come in order to spend winter and bring with them wool, rocksalt, kuth, sohaga, zeta, semi-precious stones, namdas, and horses, which they sell or exchange for grains, gur, clothing, and shoes.

Some of the Lahulies provide manual IClbour and act as porters besides .keeping ponies for purPoses of hiring out and transport.



Communications. -The Kulu Valley may be approached from the plains by three routes: (1) *Via* Pathankot and Nagrota, (2) *Via* Simla and (3) *Via* Hoshiarpur. Of these only the first one is mostly us<>d.The route *via* Simla is not motorable. In the north the Rotang and Hampta passes lead to Lahul and Spiti respectively. From Mandi to Pandoa the road follows the left bank of the river and then crosses to the right which it follows right upto Manali. The road is metalled upto Kulu only. All along the road the distances are measured from Amritsar, which is 264 miles away by road. This is because from the very old days the Lahulies and Tibetans have used the same route for bringing their wool to the plains, and Amritsar was the chief woolen manufacturing centre. Also Amritsar supplied the commodities like utensils and other luxuries of life with which they exchange their wool.. The condition of the road is not satisfactory at all. Other means of comrnunications are mule roads and footpaths.

Industries. - Agriculture is the main industry of the whole region but it is also of the subsistent type. Only potatoes are exported. The raising of fruits for export is important. Tea growing, bee keeping for honey are other industries of some importance.

Fruit Growing.-Apples, pears, and apricots constitute the chief exports. They are grown in big orchards mostly owned by the people who do not belong ro this valley; They are gathered and packed in small baskets and are sent by bus to Nagrota-the railhead, from where they are distributed all over India.

Beekeeping.-It is carried on in special bee farms as well as a cottage industry. The honey from the bee farms is exported whereas the produce of the cottage industry is consumed locally.

Timber. -It is cut and floated down the Beas. It consists mainly of deodar, Chir and fur. Large quantities are consumed locally for construction purposes and fuel.. There is very little wood work. The *woolen* industry of this area is mainly a cottage industry, there being only a few factories producing woolen material.. The wool is obtained from the Lahulies as well as from the local sheep. Only coarse cloth is produced for home consumption with little or no export. Goats hair is manufactured into a coarse material used as a waterproof. . Rope is also made from it.

Hemp is manufactured into ropes and shoes. The shoes are made by women and are embroidered. There is always a surplus for sale after the home requirements have been met With.

Trade.-It is mostly with the Lahulies and others who come into the valley. Salt, borax, kuth, wool, and semi-precious stones brought in by the Lahulies are exchanged for grain. Fruit, tea, honey, and timber are exported. Imports comist of cooking utensils, iron and steel goods, cotton goods, kerosene oil and other manufactured goods. The main trade route is t he road.

Potentialities. - The Kulu Valley has great potential wealth. The most important undeveloped resource is hydro-electricity. Most of the streams are permanent streams with steep gradients and waterfalls which could be utilized to produce power. The power could be utilized for industries like woolen goods, saw mills, grain mills, and cutting of wood etc. Paper industry could be started because large supplies of soft wood are available. It could also provide greater attraction for the tourists.

The tourist industry could be greatly developed because this region has great natural beauty, good climate with further attractions of trout fishing, game and fruit. It also offers many opportunities for mountaineering. The greatest drawback is the absence of satisfactory communications, beyond the rail-head at Nagrota. The improvement of the present road and construction of new ones and good hotels with addition of electricity would attract many who are now daunted by the tiresome journey. Advertisements would also have a good effect. The increase in the number of tourists would benefit the population by providing market for the local produce like vegetables, fruit, woolen goods etc. Fruit canning and jam making could be developed because the large quantity of fruit which is not exported goes bad for lack of Hlarket.

Wood industry could be much improved as it is in Kashmir. Dairying industry has a great future because above the trees there are natural grasses and there is scope for growing crops like turnips and other fodder crops which would also help in

ferti.lizing the land. Poultry farmi.ng can be another source of income for the villagers. Industries connected with hides and skins have scope for future development.

The Mandi State which separates the Kulu Valley from rhe Panjab plains levies heavy custom duties on exports from Kulu. Thus Punjab aI).d Mandi State are both responsible for the underdeveloped state of the valley. This is further due to the lack of initiative among the inhabitants. There is need for educating these people. With a well developed transport system, educated inhabitants, and adequate accommodation for the tourists the valley is sure to develop. It needs improvement and a further utilization of its natural resources.

THE PANJAB BOUNDARY COMMISSION'S AWARD

BY

ALI ARSHAD

The announcement of Lord L~UiS Mountbatten, the last Governor-General of undivided India, ted the 30th of June 1947, was the authority under Wl1ich the P jab Boundary Commission was constituted. The political partt€s had by this time arrived at complete dead-lock and it was a foregone conclusion that their nominees who were to constitu t:,e the Commission would not agree on any point. Out of four members of the Commission, two were Muslims, and two I)on-Muslims and subsequently Sir Cyril Radcliffe was appointed Chairman of the Commission. The terms of reference of the Commission as set out in tbe announcement were as follows :-

> The Boundary Commission is instructed to demarcate the boundaries of the two parts of the Punjab on the basis of ascertainiI1g the contiguous Jmajority areas of Muslims and non-Muslims. In doing so it will also take into account other fact ors " •

The last sentence in the terms of reference was dangerously elastic; since every body knew that it placed in the hands of the Chairman, who was finally to give the award if no decision W8.S reached by the Commission, the power to distort the judicial award so as to suit political ends, *i.e.*, ir case he was so disposed.

Map No. 1 was submitted by Punjab Muslim League Boundary Commission, a non-ofl:icial body fighting Leagues' case. The Map shows the Muslim majority districts and Tahsils and also contiguous strips of Muslim majority areas extending into adjacent ~Tahsils (ruled horizontally on the Map). The Muslim Leaguel pointed out the great geographical importance of **taking** Doab as a unit and as Bist Jullundur Doab up to Si waliks had a clear Muslim majority, it claimed this area. The proposed boundary in the North-East ran along the Siwaliks so that at least in one direction a definite geographic Boundary was ensured. In Ferozepur and Ludhiana Districts.cnot a Doab area), this proposed boundary ran along the Bikaner Canal, along the Boundary of Ferozepur Tahsil, along the Railway line connecting the city ofVl Ferozepur with the City of Ludhiana, and then along the Sir hind canal.. Such a Boundary would have included some parts of the non-Muslim majority Tahsils of the Bist Jullundur Doab in the West Punjab.

<The Maps and Memoranda submitted by Hindus and Sikhs claimed areas upto River Chenab and River Jhelum respectively (though not exactly bounded by these rivers), and their demands for the Muslim majority Districts and Tahsils were based on religious interests, monetary investments, pioneer settlement in canal colonies, and past history. The Muslim League argued thatl

such a division would contravene the very principle explicitly laid out in the terms of reference to serve as the basis of division and that human souls are infinitely more valuable than money and material possessions.

As was expected the Commission could not arrive at any decision and ultimately the Chairman proceeded to give the award which was made public on August the 17th, 1947.

The Boundary between East and West Punjab, according to the Award (***Map 2***) commences on the North at the point where the West Branch of the Ujh River enters the Punjab Province from the State of Kashmir. This branch of Ujh, like the East Branch, is a short submontane torrent which swells after the rains but is otherwise a dry channel that can be crossed dry-shod for most part of the year. The Boundary follows the line of that river down the Western Boundary of the Pathankot Tahsil to the point where the Pathankot Shakargarh, and Gurdaspur Tahsils meet. From the point of meeting of these three Tahsils the Boundary follows the line of the Ujh river to its junction with the River Ravi. "The Tehsil Boundary" reads the Award, "and not the actual course of the Ujh river shall constitute the Boundary between the East and West Punjab". The Boundary then follows "the line of the River Ravi along the Boundary between Tahsils of Gurdaspur and Shakargarh, the Boundary between the Tahsils of Batala and Shakargarh, the Boundary between the Tahsils of Batala and Narowal and the Boundary between the Tahsils of Ajnala and Shahdara, to the point on the River Ravi where the District of Amritsar is divided from the District of Lahore." In other words the entire Eastern and Southern Boundary of Shakargarh Tahsil now serves as a part of the Inter-Dominion Boundary. Furtheron the Boundary is identical with the Boundary between Sheikhupura and Amritsar Districts and runs to the point on the River Ravi where the District of Amritsar is divided from the District of Lahore. From this point the Boundary between the East and the West Punjab turns southward following the Boundary between the Tahsils of Anjala and Lahore and then the Tahsils of Tarn Taran and Lahore, to the points where the Tahsils of Kasur, Lahore and Tarn Taran meet. The line then turns South-Westward along the Boundary between the Tahsils of Lahore and Kasur to the point where that boundary meets the North-East corner of village Theh Jharolian. The sinuous boundary beyond this point (***shown on Map 3***) is determined and described in the following words quoted from the Award :

> "The line will then (*i.e.*, from North Eastern corner of Theh Jharolian) run along the Eastern Boundary of that village to its junction with village Chathianwala, turn along the Northern Boundary of that village, and then run down its Eastern Boundary to its junction with village Waigal. It will then run along the Eastern Boundary of village Waigal to its junction with village Kalia, and then along the Southern Boundary of village Waigal to its junction with village Panhuwan. The line will then run down the Eastern Boundary of village Panhuwan to its junction with village Gaddoke. The line will then run down the Eastern border of village Gad-

doke to its junction with village Nurwala. It will then turn along the Southern Boundary of village Gaddoke to its junction with village Katluni Kalan. The line will then run down the Eastern Boundary of village Katluni Kalan to its junction with villages Kals and Mastgarh. It will then run along the Southern Boundary of village Katluni Kalan to the North-East corner of village Kals. It will then run along the Western Boundary of village Kals to its junction with village Khem Karan. The line will then run along the Western and Southern Boundaries of village Khem Karan to its junction with village Maewala. It will then run down the Western and Southern Boundaries of village Maewala proceeding Eastward along the Boundaries between village Mahaidepur on the North and village Sheikhupura Kuhna Kamalpurah, Fattihwal and Mahewal. The line will then turn Northward along the Western Boundary of village Sahjra to its junction with village Mahaidepur and Machhike. It will then turn North-Eastward along the Boundaries between the villages Machhike and Sahjra and then proceed along the Boundary between villages Rattoke, and Sahjra to the junction between villages Rattoke, Sahjra and Mabbuke. The line will then run North-East between the villages Mabukke and Rattoke to the junction of villages Rattoke, Mabbuke and Gajjal. From that point the line will run along the Boundary between villages Mabbuke and Gajjal, and then run South along the Eastern Boundary of village Mabbuke to its junction with village Nagar Aimanpur. It will then turn along the North-Eastern Boundary of village Nagar Aimanpur and run along its Eastern Boundary to its junction with village Masteke. From there it will run along the Eastern Boundary of village Masteke to where it meets the Boundary between the tehsils of Kasur and Ferozepur.....The line will then run to a South-Easterly direction down the Sutlej river on the Boundary between the Districts of Lahore and Ferozepur to the point where the districts of Ferozepur, Lahore and Montgomery meet. It will continue along the Boundary between the districts of Montgomery and Ferozepur to the point where the Boundary meets the border of Bahawalpur State. The Districts Boundaries and not the actual course of the Sutlej river, shall in each case constitute the Boundary between the East and West Punjab".

Having thus drawn the Boundary the Chairman places the Sulemanki Canal Headworks under the jurisdiction of West Punjab with the words "if the existing delimitation of the Boundaries of Montgomery district does not ensure this (*i.e.*, the inclusion of Headworks in West Punjab) I award to the West Punjab so much of the territory concerned as covers the Headworks, and the boundary shall be adjusted accordingly".

The Sulemanki Headworks suckle three canals one of which serves the West Punjab and the other two serve the Bahawalpur State, a state that has acceded to Pakistan.

Broadly speaking boundaries can be of two types—— Natural and Conventional. Conventional boundaries just divide areas into parts irrespective of the Physiography of the territories concerned. Thus for instance the boundary between Canada and U.S.A. is a

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ALI ARSHAD

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conventional boundary which runs right across Lakes, Plains, Plateau and Mountains and is maintained at a heavy cost. Natural boundaries seek to stabilize the relations between States by utilizing some sort of geographical barrier between them. In the Modern World conventional boundaries are more common than natural boundaries because man has learnt to overcome barriers and some barriers such as Rivers and Lakes in times of peace even become unifying rather than separating agents. Political stability or un-stability of a boundary however, depends more on the mutual relations between the two states separated than on mere geographical nature of the boundary. The conditions prevalent in India were extraordinary. After a long a period of Foreign rule she was undergoing rejuvenation and at the same time being divided into two parts, each of which would start its career as a "young" state. Though young states are generally too busy with "setting the house in order", in their attitude towards each other the two young states of India and Pakistan were bound to be somewhat precocious. The incidents preceding the division had amply proved it and particularly so in the Punjab. The task of drawing a boundary in the Punjab was fraught with gravest economic and political consequences. The line of division was not only to serve as boundary between the two parts of the Punjab, which was a single economic Unit, but also as Inter-Dominion boundary between two States which were parting, though by mutual agreement, yet not in a friendly spirit. In order to avoid constant friction the boundary should have been placed along some definite geographical feature. By awarding contiguous Muslim majority areas to East Punjab the Chairman was further aggravating the unstability of the line of demarcation because such an award was bound to leave the Muslims very much discontented. In all, nine Muslims majority Tahsils, a part of Kasur Tahsil and the contiguous majority tracts of other Tahsils, have been transferred to East Punjab and not one Non-Muslim majority Tahsil falls to the lot of West Punjab.—Thus at last the mysterious vagueness of " other factors " melted away !

Starting from the North, the line divides Shakargarh Tahsil from the other three Tahsils of Gurdaspur District which go to East Punjab, and though, for the most part it runs along the rainy torrent of West Ujh and along River Ravi, crosses them more than once to the East and West of these rivers because the Tahsil boundaries and not the actual courses of the rivers are to be regarded as the line of delimitation. Gurdaspur was a Muslim majority district of Punjab for which population figures (according to 1941 census) stood as follows :

Gurdaspur District		Muslims 51·1%	Non-Muslims 48·9%
Gurdaspur Tahsil	...	52·1%	47·9%
Batala Tahsil	...	55·06%	44·94%
Pathankot Tahsil	...	38·8%	61·2%
Shakargarh Tahsil	...	51·3%	48·7%

If the Chairman had adopted the District as a unit for determining majority the whole of Gurdaspur District should have

become a part of West Punjab. If he was awarding the area Tahsil-wise three out of four Tahsils should have been placed under the jurisdiction of West Punjab. But he has been rather reticent in explaining the legitimacy of this portion of the award. By transferring three Tahsils of Gurdaspur, Batala, and Pathankot to the territory of East Punjab he has given India a direct contact with Kashmir State. Further, he has thereby extricated Amritsar from its position of a pocket surrounded by Muslim majority areas; for in the East the Muslim majority State of Kapurthala (56·5 per cent Muslims) and in the south the Muslim majority district of Lahore and the Zira Tahsil of the Ferozepur district segregated Amritsar into a discrete pocket. When the three Tahsils of Gurdaspur went over to East Punjab, Amritsar became contiguous to the territory of East Punjab.

The boundary line having reached the North Western corner of Amritsar ceases to travel along Tahsil boundaries and henceforth the "district" becomes a unit for determining majority. The boundary runs along River Ravi and thus Ajnala Tahsil of Amritsar with 59·4 per cent Muslims becomes a part of East Punjab. The line follows the District boundary between Amritsar and Sheikhupura and then between Amritsar and Lahore till the point is reached where the boundary of Kasur Tahsil takes off to South-west. Thenceforward first the canal, known as Upper Bari Doab serves as boundary. and then the unit degenerates into Muslim majority and non-Muslim majority villages." An extremely irregular portion of Kasur Tahsil (57·2 per cent Muslims) is thus sliced off and given to East Punjab. As a result a continuous strip of disputed land devoid of much population has been created on either side of the boundary and both dominions are attempting to settle martial" tribes all along this border as no peace-loving man would volunteer to live under constant peril to his life, property and honour The boundary line meets the district boundary of Ferozepur near the village Masteke and then turns south-west along the District boundary between Ferozepur and Lahore and Ferozepur and Montgomery. "The District boundaries", reiterates the Award, " and not actual course of the River Sutlej, shall in each case constitute the boundary between the East and the West Punjab ".

Two important results follow from this :

(1) Since the boundary between the districts named above does not exactly follow the river each dominion has outposts in the territory across the river. Thus Pakistan has a right on 9354 acres of land to the East of Sutlej and India claims 1200 acres to the West of that river.

(2) Near the Ferozepur Headworks the district boundary makes a detour to the West of the river placing the Canal Head works entirely at the disposal of East Punjab. The Dipalpur Canal which, except for a strip of about three-quarters of a mile exclusively serves the West Punjab takes off from Ferozpur Canal Head works. Thus the entire canal belongs to the West Punjab but its source is controlled by East Punjab. The Chairman was conscious of this peculiar situation and he says " I must call attention to the fact that the Dipalpur Canal, which serves areas in West Punjab takes off from the Ferozepur Head works and I find it

difficult to envisage a satisfactory demarcation of boundary at this point that is not accompanied by some arrangement for joint control of the intake of the different canals dependent on these Headworks." Having found it " difficult to envisage a satisfactory demarcation," he leaves the matter where it was and the entire Headworks go to East Punjab. This was shutting eyes to facts or just trying to do so; because, he knew that in the situation obtaining in the Province there could be no hope of amicable settlement over such points and that once a key position was given to one side that side would jealously strive to exploit the other's weak position. If he was suret hat a joint control at the Headworks was the only solution he should have at least drawn the line of demarcation across the Headworks so that a joint control was thereby necessitated and both sides could assert their claims with equal right.

Regarding the Muslim majority areas over which according to the terms set out to serve as the basis of division the Muslims had an inalienable right the Chairman says in his report " I have hesitated long over those not inconsiderable areas East of the Sutlej River, and in the angle of Beas and Sutlej Rivers in which the Muslim majorities are found. But on the whole I have come to the conclusion that it would be in the true interest of neither State to extend the territories of West Punjab to a strip on the far side of the Sutlej and that there are factors such as the disruption of Railway communications and water systems that ought in this instance to displace the primary claims of continguous majorities".

If the present demarcated boundary does not run along any definite lines nor strictly along rivers it is inconceiveable how a similar boundary to the East of Sutlej could be '*more*' against the interests of either State.

If the League's demand in the Chairman's opinion was unjustifiable because it claimed parts of non-Muslim majority Tahsils (although it is quite obvious that the boundary proposed by Muslim League would have entailed no disruption in Railways or Canals except for the Railway strip from Pathankot to Jogindar Nagar) the boundary could be placed along Sutlej river and the Siwaliks, which would have compensated the non-Muslims with more than equal Muslim majority area to the east and south of Sutlej and in addition given a more definite boundary minimizing frictions.

The present demarcation has seriously disrupted two canals, Upper Bari Doab and Dipalpur, which brought life-blood to the districts of Lahore and Montgomery and consequently the West Punjab Government have been forced to draw water from Sutlej and Ravi where these Rivers pass through their territory and to dig new channels to tap that water into Dipalpur and Upper Bari Doab Canals. It has also disrupted the Hydro-Electric Transmission system. The transmission line proceeding from Jogindar Nagar comes to the West Punjab *via* Amritsar and then branches off to the East to feed sub-stations in Ferozepur District. After long drawn suspense, during which the talks between East and West Punjab Governments threatended to fail every moment a temporary agreement was signed according to which East Punjab would supply Hydro-electric power to West Punjab

till 31st March, 1949. After that date West Punjab must tap her own resources, and East Punjab must connect Ferozepur District with Ludhiana or else install thermal plants for generating Hydro-eletricity if they are to avoid complete Black out.

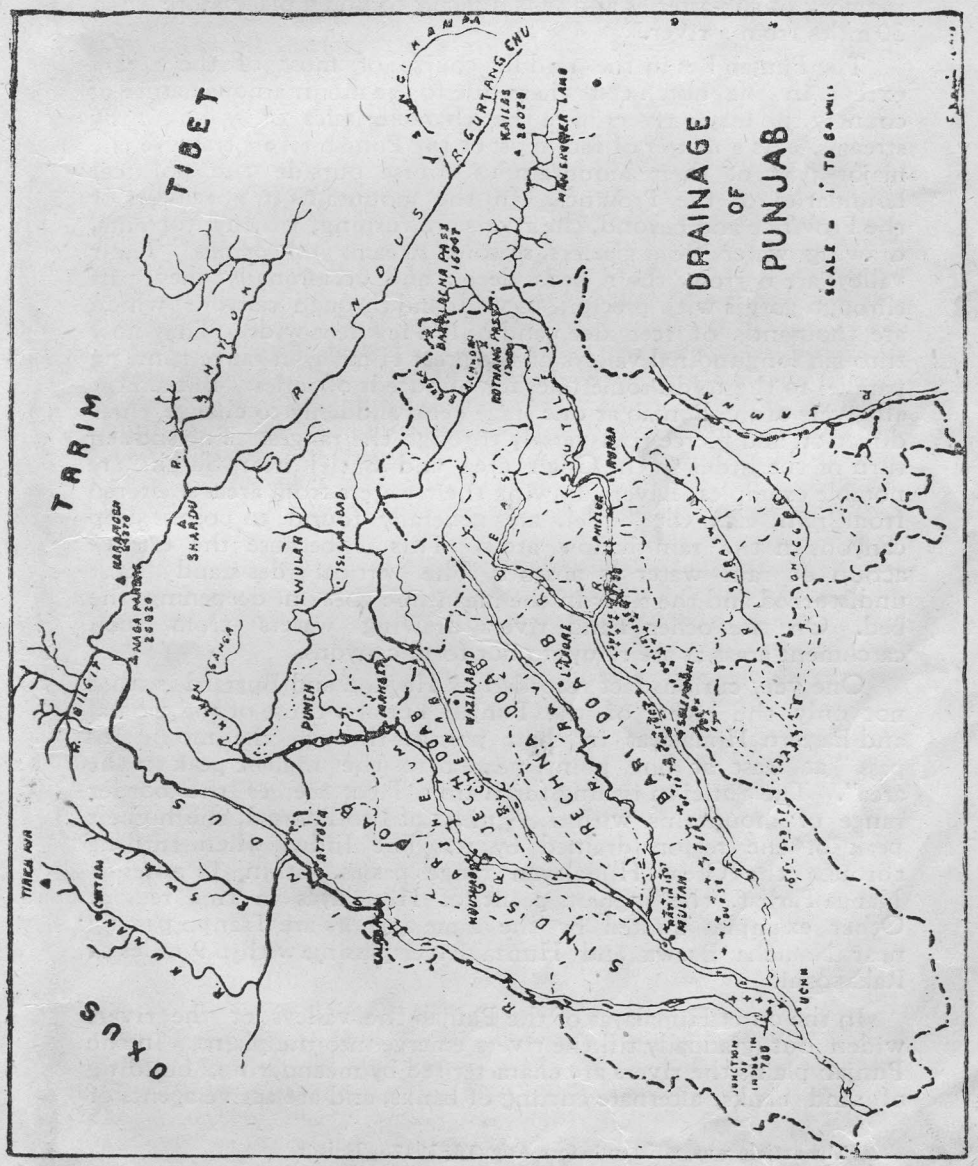
To conclude, the Boundary Commission's award, or to be more precise the Chairman's award, is essentially a political award, which follows no principle. He has brushed aside all geographic and human considerations. The real geographic, economic, agricultural and cultural sub-unit in the Punjab which ought to have been considered, was a 'Doab' and all Doabs West of Sutlej and the Siwaliks had a clear Muslim majority.

DRAINAGE OF THE PUNJAB

BY

ALTAF AHMAD

Punjab is a Persian compound word which means "Five Waters". Thus, strictly speaking, the word denotes the country lying between the valley of Jhelum and the valley of the Sutlej. The intermediate rivers from west to east are Chenab, Ravi and



Beas. Beyond the south western corner of Multan the five rivers flow as a single stream and here the resultant stream is called Panjnad, which ultimately discharges its water into the Indus 44 miles away. Modern Punjab[1] however extends from the valley of the Jumna river to the valley of the Indus and the District of D.G. Khan and the Isa Khel sub-division of Mianwali district lie even beyond Indus. The first Aryan Settlers knew this part of India as Sapt-Sindhvas, the land of seven and not five rivers, thus adding Indus and Saraswati to the five mentioned above.

The Punjab has a river system characterized by the abundance of surface drainage. The six main arteries of Punjab are fed by a network of sub-arteries and it is difficult to find a place more than 30 miles from a river.

The Punjab lies in the middle course of most of the rivers except in the north east where due to the mountainous nature of country the major rivers have the characteristics of young hilly streams. As a matter of fact most of the Punjab rivers traverse the major part of their mountainous course outside the political boundaries of the Province. In the mountains in north-east of the Province and beyond, the rivers are rushing, roaring torrents, drawing water from glaciers, seasonal streams and springs. Their valleys are narrow, their beds deep; and occasionally they pass through gorges with precipitous walls and through canyons which are thousands of feet deep and only a few feet wide. They flow through longitudinal valleys of the great Himalayan range running parallel to the folds, sometimes for hundreds of miles. But almost all rivers of the Punjab at one stage bend suddenly to change their direction and pierce transversely through the ranges. The sudden turn of the Indus in the Gilgit area and Sutlej near Shipki are notable examples. Rivers drawing their waters from areas sheltered from rain, *e.g.*, the Sutlej, are generally found to possess deep canyons in the rain-shadow areas. This is because the erosive action of rain water is absent. The vertical sides stand almost undisturbed and the river in the meantime goes on deepening the bed. On the other hand rivers drawing waters from such catchment areas as are rainy do not form canyons.

One very curious fact recorded by Heydon and Burrard is that not only the rivers of the Punjab but also those of the central and Eastern Himalayas in their passage through the mountains pass "at least at one point nearest to the highest peak in the area". The Sutlej in issuing forth from Tibet pierces the border range of mountains within $4\frac{1}{2}$ miles of Leo Phargyl, the highest peak of the region drained by it. The Indus when turning through the Great Himalayan range passes within 14 miles of Nanga Parbat, the highest point of Himalayas in this region. Other examples quoted by the same authors are Tsanpo passing near Namcha Barwa and Hunza River passing within 9 miles of Rakaposhi.

In the outer Himalayas of the Punjab the valleys of the rivers widen out gradually till the rivers emerge into the plains. In the Punjab plains the rivers are characterised by meandering, building of sand banks, alternate cutting of banks, and are active agents of

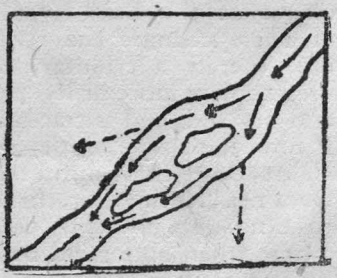
[1]The article was written before Aug. 15, 1947.—Editor.

deposition. In short they show all characteristics of mature streams. The plains of the Punjab have a very gradual gradient, rarely exceeding two feet in a mile. The slackened speed results in the formation of sand banks and sandy islands. There now exists a balance between the supply of transportable material and the transporting power of the river. If this balance is somehow disturbed owing to excessive rains or landslides etc. important results follow indicating a tendency on the part of the river to regain the state of balance.

A characteristic of the Punjab rivers in the plain stage is the large amount of underground seepage of water into the adjacent plains. As a result the " Doabs " or inter-riverain tracts are favourably situated as far as supply of water through wells is concerned. Near the rivers the water table is only a few feet below the surface while the depth of water table increases as we move away from a river.

As the rainfall regime of the whole drainage basin as well as catchment areas is seasonal with a marked maximum in summer so all the rivers have floods in the period of maximum rainfall The floods are further accentuated by the melting of the snows in the higher portions of their drainage basins. The volume of water starts rising in March due to the higher temperatures and consequent melting of snows in the Himalayas. The maximum volume of water is obtained in the period July-August due to heavy torrential rains in upper reaches of the rivers which reinforce the work of melting snows. In October a rapid fall of flood level sets in. In November, December and January the rivers dwindle into thin ribbons of water meandering in the main bed of the stream itself. During this period the volume of water remains more or less stationary, swelling temporarily after a winter shower.

Alternate cutting of banks causes a constant lateral shifting of rivers and in Indus lateral shifts of 50'-100' in a day have been recorded. This shifting takes place in summer while winter is the period of rest.



In course of time each river has cut for itself a wide valley well below the level of the plain. Within this valley the stream meanders in ill defined channel. During floods the water frequently over-flows the main valley and when the waters abate at the end of rains, a valuable, rich deposit of loam or, at times, of less fertile sand is left along both banks. If we approach a Punjab river in the plains we can notice a gentle or sometimes sudden descent to the bed of the river. The shifting of river beds is due to three main forces. The first, as mentioned already, is force acting on banks of rivers due to alternate striking of the current at the left and the right banks. The second is the force directed outwards from the centre of the stream where there are strings of sandy islands. The current here bifurcates and has tendency to move outwards, which tendency gains momentum with the approach of the flood.

The third force is the effort on the part of the rivers to move to their right according to Ferrels law. The old bed of the Indus is thus traceable about 80 miles to the east of the present bed of the river.

Origin and development of the present system.—In Pleistocene period the Siwalik river is said to have drawn its waters from the Eastern Himalayas. It flowed through the whole of northern India to the south of Himalayas and making a loop in the extreme north-west of the Punjab turned to the south to discharge its waters into the receding Arabian Sea. Post Siwalik movements in north-western Punjab brought about a dismemberment of this river system. One separate river system developed in the Punjab. Jumna was at this time probably a tributary of Indus. During sub recent time some interchange took place between the easterly affluents of the Indus and the westerly tributaries of the Jumna by minor shiftings of watershed. The Potwar plateau building movements probably served to rejuvinate the small rivulets of the Punjab which further gained in volume as a result of headwater erosion and river capture in the sub Himalayan Region. The Punjab portions of the present Jhelum, Chenab, Ravi, Beas and Sutlej have originated after the uplift of the topmost stage of Siwalik system and the subsequent severance of the Indus from the Ganges.

There have been many changes in the direction and the beds of the rivers in the past. Even in Vedic Times the river Jumna, the sacred Saraswati of Hindu Shastras flowed to the sea through Eastern Punjab and Rajputana by a channel that is now occupied by an insignificant stream which loses itself in the sands of Bikaner desert. In course of time the Saraswati took a more and more easterly course and ultimately became a tributary of the Ganges. It then received its present name of Jumna. In the time of Akbar the Chenab and Jhelum joined the river Indus at Uchh, 25 miles above the present junction of the same rivers. Multan was then situated on the Ravi. Now it is 36 miles from the confluence of that river with Chenab. Prominent changes have occurred in the course of the Beas river even within historic times. As a result of these changes the river has lost its independent course and is now merely a tributary of Sutlej. In the 7th C. A. D. the river used to flow more or less parallel to the present course of Sutlej and its old bed is traceable in Montgomery and Multan districts. It now joins the Sutlej near Hari-ke-Paton. An old bed, the Hakra, Sotra or Wahind more than 600 miles in length is traceable from near Hoshiarpur, through Bhatinda, Bikaner, and Bahawalpur to Sind. It probably used to be the old bed of Saraswati at a time when Sutlej and Beas flowed independently into the Indus beyond Multan.

The tendency in the Punjab rivers to shift their course to the west has a marked influence on the situation of the cities. Thus in most of the cases the larger towns of Punjab are on the left banks of the rivers. Ludhiana and Ferozepur on the Sutlej, Kapurthala near the Beas, Lahore on the Ravi, Chiniot and Jhang on Chenab and Ambala on the once great river Ghaggar are examples.

We will now pass on to a closer examination of individual rivers. River Indus flows along the boundary of the Punjab for a considerable distance and then turns into the Punjab. Though strictly speaking Indus does not fall within five rivers of the Punjab we cannot trifle with its importance to the province.

River Indus.—Since 1907 all doubts concerning the source of the Indus have been removed by the exploration of Sven Hedin. In southern Tibet the Indus is formed by the junction of two streams Singi Kampa and Gartang Chu. It is further fed by the glaciers of Karakoram and the Hindukush, after a course of 200 miles or so it crosses into the Kashmir State. From here it flows for about 350 miles to Gilgit. Having passed Skardu the river rushes down a deep gorge breaking through western Himalayas. Indus touches the boundary of the Punjab about 16 miles to the north-east of Attock. At Attock the river passes in a narrow deep rocky bed, hemmed in on both sides by rocky, hard and low hills devoid of vegetation. These hills continue for some 90 miles below Attock after which distance the hills suddenly recede and disappear on either side. Just near Attock the Kabul river joins the Indus and this scene is of great turmoil in summer. At Attock there is a railway bridge, a bridge of boats and a ferry. Indus emerges into the plains from the Gorge above Kalabagh where the salt range impinges on the left bank. At Kalabagh another bridge bestrides the river. Attock and Kalabagh are the only two places where the Indus has been crossed by bridges. Elsewhere the passage has to be made by ferry boats or boat bridges which are taken down in the rainy season. When it passes the western extremity of the salt range the river spreads out into a wide lake like expanse of water. From this place onwards it receives no addition from the East till the Panjnad in south-western corner of the Mazaffargarh district brings to it the whole tribute of the five rivers of the Punjab. The river slowly meanders through the Punjab plains—The current often dividing to encircle little sandy islands in the bed. The Valley is wide and subject to the inundation of the River. Opposite Dera Ismail Khan the valley is 17 miles across. Indus further continues through the arid Sind to throw its waters in the Arabian Sea. The discharge of the River Indus proper, *i.e.*, the Sind Indus minus the Panjnad, varies from 9000 cusecs to 1 million cusecs in winter and summer respectively.

Jhelum.—This, the most westerly of five rivers of the Punjab issues from a deep pool at Verinag to the east of Islamabad in Kashmir. It becomes navigable just below that town and flows north west in a lazy stream for 102 miles through Sirinagar into the Wular lake and then beyond it to Baramula. From Baramula the character of Jhelum suddenly changes, and for the next 70 miles to Kohala where the traveller crosses by a fine bridge into the Punjab it rushes down a deep gorge. A little above Kohala it takes a sharp turn to the south continuing its character as a mountain stream hemmed in by the hills of Rawalpindi on the right bank and of the Poonch State on the left. At Jhelum there is a splendid railway bridge. When the river proceeds from Jhelum City it is of the usual plain type. The water spreads out and becomes shallow. The speed is

checked and material in suspension is deposited in the plains. It finally falls into the Chenab at Trimmu 450 miles from its source. There is a second railway bridge at Haranpur and a bridge of boats at Khushab in the Shahpur district. The river is subject to floods in summer. Total annual discharge of water is $5\frac{1}{2}$ times that of Ravi.

Chenab.—It is formed by the union of the Chandra and Bhaga two streams which rise on the opposite side of Bara Lachcha pass which is 16047 ft. high. Chandra and Bhaga unite at Tandi 7500 ft. above sea level. Chandra Bhaga as the united stream is called, flows through Chamba and the S. East of Kashmir. Near Kishtwar it breaks through the Pir Panjal Range and thenceforwards receives the drainage of its southern slopes. At Akhnur it becomes navigable and soon after it enters the district of Sialkot in Punjab. A little later it is joined from the west by Tawi, the stream above which stands the town of Jammu. The Chenab parts Sialkot and Gujranwala districts on the left bank, from Gujrat and Shahpur on the right. At Wazirabad it is crossed by a railway bridge. It further flows through Jhang to its junction with Jhelum at Trimmu. In this section there is another railway bridge at Chund Bharawana. The united river now runs under the name of Chenab to be joined on the northern border of the Multan distirct by the Ravi and at its south western corner by Sutlej. Below its junction with the latter, the river is known as the Panjnad. The silt of the Chenab deposited by the river in the plains of Punjab is less fertile as compared to that of Jhelum and lacks some of the salts which the latter possesses.

The water annually discharged by the river is $5\frac{1}{2}$ times that of the Ravi, *i.e.*, it is equal to that of the Jhelum.

Ravi.—It is the smallest of all the five rivers of the Punjab as far as volume of water is concerned but it is well known as the river of Lahore.

"Ravi has its sources in a remarkable mountain knot formed by a conjunction of lesser Himalayan ranges. The Nag Tibba Range appears to have been forced from the south west against the *Dhaula Dhar* range and the latter has combined with the Pir Panjal Range to form the rock-basin of Bangahal which has the shape of a rock cauldron. This cauldron is about 60 miles in circumference. Ravi rises in the basin of Bangahal, and drains the southern slopes of the Pir Panjal and the northern slopes of the Dhaula Dhar. Numerous tributaries of the Ravi flow down the Bangahal basin's inner walls, almost all of these tiny streams having steep gradients. Thus *Bhadal* rises on the north west at 16000 ft. and falls 314 feet a mile for 35 miles and the *Nai* which rises in the mountain known as Kali Devi has a length of 30 miles and an average fall of 366 ft. in a mile."[1]

The height of the bed of the Ravi at the lowest point of the Bangahal Basin is about 5000 ft. Gathering all the water brought by the swift streams Ravi flows out to the west.

"The gorge by which it escapes from Bangahal may without

[1] **Heydon and Burrard, Geology of the Himalayas, Vol. II.**

exaggeration be described as inaccessible. It appears to have been scooped out of solid rock and its sides are perpendicular. After leaving Bangahal the Ravi flows through the valley of Chamba in a north westerly direction parallel to the Dhaula Dhar Range. West of the Chamba Capital it makes a sudden bend at right angles and cuts its way through the Dhaula Dhar to south-west. The defile that it has carved through the range is a few miles north west of the hill station of Dalhousie."[1]

The Ravi leaves the Himalayas at *Basaoli.* The length of its course in the mountains is 130 miles and its total drop 15000 feet. Its fall therefore averages 115 feet a mile.

At this point, *i.e.*, Basaoli the river is 2000 feet above sea level. It now for some distance forms the boundary between Kashmir and Gurdaspur and finally near Madhopur where the headworks of the Upper Bari Doab Canal are situated, it passes into the Gurdaspur district. Shortly after it is joined from the north by a large torrent called the UJH which rises in the Jammu hills. After reaching Sialkot border the Ravi parts that district first from Gurdaspur and then from Amritsar and passing to the west of Lahore divides Montgomery and Lyallpur districts and flowing to the north of Multan joins the Chenab river. The story of its meandering is the common story of all Punjab plain rivers. The bed is sometimes sandy and sometimes of finer clay. The river bed islands are again a prominent feature. The waters of the river being for the most part drawn from the rain in the Himalayas the floods in this river are as uncertain as the rain itself. But when they come they do considerable damage, to the villages and the crops and are afterwards of great value too because of the rich silt which they deposit. The *Degh*, a torrent which rises in the Jammu hills and has a long course through Sialkot and Gujranwala districts, joins the Ravi, when in flood, in the north of the Lyallpur district. Lahore is on the left bank of the Ravi. It is a mile or so from the normal bed of the Ravi but in high floods the river water comes right up to the fort.

There is a railway and a road bridge on the Ravi at Lahore. There is a second bridge at Multan. Though the Ravi like the Jhelum has a course of between 400-500 miles its catchment area is much smaller. The catchment area of Jhelum is 13000 sq miles while that of Ravi is only 3100 sq. miles. In the cold weather the canal at Madhopur used to take a heavy toll from the river and in Montgomery the river could be crossed dryshod for months together. But now the upper Chenab canal after crossing the Rechna Doab pours its water into the river Ravi which gives it some semblance of a river in winter. The valley of the Ravi is far narrower than the rivers described above.

Beas.—It rises in the Pir Panjal range near the Rohtang Pass not far from the source of Ravi. Its several affluents combine to pierce the Dhaula Dhar range at *Larji.* In the 75 miles from its source to Larji its fall averages 125 feet a mile but after Larji the gradient rapidly decreases and in the valleys of the outer Himalayas is hardly more than 10 feet a mile.

The upper Basin of the Beas encloses the subdivision of Kulu

[1] **Heydon and Barrard, Geology of the Himalayas, Vol. *ii.***

and in its course through the hills it traverses Mandi and Kangra.

Six miles from its source the Beas enters the Gorge known as Koti Gorge. Here the river plunges into a vast chasm, enclosed on either side by precipitous barriers of rock, 20 feet apart and often almost touching. "For some 300 yards the Beas races through this almost subterranean passage, when it again bounds into sunlight." The exit on the further side is strikingly beautiful.

South of Larji the Beas passes through another precipitous defile intersecting the Dhaula Dhar range; below this place the valley of this river widens out, Sir Alexander Cuningham estimated the minimum discharge of the river at not less than 3000 cubic feet per second. There are several galciers at the sources of the Beas and of its tributary the *Parbati* in the snowy mountains of *Sirtkand Dhar* where the Pir Panjal range breaks off from the great Himalayas. Through the Kulu Valley it flows for about 60 miles and after traversing half the distance, at least in winter, the stream is comparatively peaceful. This happens near *Sultanpur* the chief town of Kulu. Heavy floods however sometimes cover fields and orchards with sand and boulders. There is a bridge at *Manali* (6100 feet) another below Nagar and a third at Larji. Near Larji the river turns to the west down a bold ravine separating Kulu from Mandi State.

There is a bridge at Mandi and another further down at Dera Gopipur on the main road from Jullundur and Hoshiarpur to Dharamsala. Elsewhere in the south of Kangra the traveller can cross the river on a small bed supported on inflated skins. Sweeping round the northern end of Siwaliks the Beas turns definitely to the south forming henceforth dividing line between Hoshiarpur and Kapurthala on the left bank and Gurdaspur and Amritsar (on the right bank). Finally near Harike at a point where boundaries of Lahore, Amritsar, Ferozepur and Kapurthala nearly meet it falls into Sutlej. The chief affluents of this river are Chakki and the Black Bein. Beas has a total course of 390 miles. Only for about 80 miles or so it is a true river of the plains. The floods of this river do not spread very far.

The Sutlej.—The Sutlej river has its source in the Rakas Tal lake in Tibet. For some distance in its early course it flows underground. After emerging on to the surface the river, then a stream of modest size, receives water from streams issuing from glaciers and hot springs. From the source for about 200 miles it flows in a north westerly direction to the British Frontier near Shipki. From Shipki it runs for forty miles in deep gorges to *Chini*. A little below Chini the Baspa flows in from the south east. The fall between the source and Chini is from 15000 to 7500 ft. At *Rampur* 40 miles below Chini there is a bridge. Beyond *Luri* the Sutlej runs among low hills through several of the Simla hill states. *It pierces the Shiwalik at the Hoshiarpur border* and then turns to the south maintaining that trend till Rupar. Here are the headworks of the Sirhind Canal. For the next hundred miles to the junction with Beas the general direction is east to west. In its course over the plains the Sutlej is supposed to have flowed at one time through the Patiala and Bikaner

States. It is believed to have changed its old and straighter course to the Indus river for a more westerly course at the end of the tenth century A.D. The advancing sands of Rajputana deserts were the main cause in deflecting its course. As the river migrated to the west in a bed deeper than that of the Beas it gradually captured the waters of the latter river near Harike and old bed of Beas which is traceable down to Chenab river was deserted.

The fall of the Sutlej from its source to the plains of Punjab is very unifrom the average being 30-35 ft. per mile. The height of its bed near Rakas Tal is 15,000 feet, near Shipki 10,000 feet, at Rampur 3,000 feet and at Bilaspur it is 1,000 feet. There are railway bridges over the river at *Phillaur*, *Ferozepore* and *Adamwahan*. At Ferozepore there are head-works of the eastern grey, Bikaner and Dipalpore Canals. From this place onwards the meander loops in the river are characteristic of a very gently sloping plain. The current frequently bifurcates ; the two arms advance to embrace a sandy island in between and meet again as a single current. Dams have further been constructed at Sulaimanki and Islamabad Notwithstanding the heavy toll taken by the Canals the floods of the Sutlej often affect Jullundur and Ludhiana areas in the monsoon season.

Besides these main rivers there are some insignificant streams to be seen rushing down from the Himalayas which have had a glorious history in the past. Amongst these the most well known are Ghagar, Saraswati and Markanda. Ghagar Valley and the surrounding plains have given rise to hot controversies. The present remnant of that once great river rises in Sirmur State in the hills to the east of Kalka. A few miles south of Kalka it crosses Ambala district and there is a railway bridge over the Ghagar here. The rest of its course, till it loses itself in the sands of Bikaner, is chiefly in Patiala and the Karnal and Hissar Districts. It is joined by the *Umla* torrent in Karnal and lower down the Saraswati unites with it just beyond the Karnal border. It is hard to believe that the Saraswati of today is the famous Sarasuti of the Vedas. Though the little ditch like channel that bears the name certainly passes beside the sacred sites of *Thaneswar* and *Pehowa*. In the cold weather the beds of Saraswati and Ghagar are usually dry. In fact till the Sarasuti receives above Pehowa the floods of the Markanda torrent in summer it is a stream of little significance. The Markanda when in flood carries a large volume of water and below the junction the small channel of Sarasuti cannot carry the tribute received which spreads out into a shallow lake called *Sainsa Jhil*. This lake has been utilised to supply water to the little Sarasuti Canal. Formerly the work now done by this canal was effected by building embankments across the channel to help the water to overflow the banks. The same wasteful form of irrigation was used on a large scale on Ghaggar, and is still practised in its upper reaches lower down these embankments have been replaced by a masonry weir at Otu in Hissar district and northern and southern Ghagar canals take off from this weir.

GEOGRAPHICAL BASIS OF THE LEATHER TANNING INDUSTRY IN PAK-INDIA[1]

BY

SHYAM SUNDER BHATIA

Leather industry is one of the key industries of a country and attempts are being made to foster it with the aid of science and artificial devices, even where natural conditions are against its healthy development. Likewise, it is a major industry and of great economic importance to the sister dominions of India and Pakistan. It is estimated that the industry is capable of being developed to an annual production worth about Rs. 130 crores[2] in both dominions. The importance of leather industry in national economy and national planning is evident from the fact that while the annual consumption of pairs of shoes per capita in the western countries ranges from 1.95 in France to 3.37 in the United States of America, the corresponding figure for India and Pakistan is 0.09 only. This means that hardly one person in every ten can get a pair of shoes yearly while the remaining nine must go bare footed. Thus the importance of leather industry, with the increase of population, spread of civilization, and the improvement in the social economic conditions of the people, as a result of increased productivity and better distribution of wealth, is bound to increase. Therefore those, who are planning for the teeming millions of these lands of "scanty amidst plenty," should pay due attention to this industry which is of as vital an importance as the textile industry.

The leather industry may be divided into two sections (*i*) the manufacture of leather, *i.e.*, the tanning industry and (*ii*) the manufacture of leather goods such as boots, shoes, machine belts etc. The tanning industry which is the basis of the leather-goods manufacturing industry, forms the subject of this article. In order to realize fully the requirements of the tanning industry, it is essential as well as interesting to discuss briefly the process of tanning.

Leather, as we know, is the preserved skin of various animals. It "consists of hides and skins of certain animals separated from fleshy and fatty matter and prepared by means of Chemical agents in such a way that they resist the influence to which they are naturally subject." [3] The act of tanning therefore consists in the bringing of any hide or skin into an imputrescent form which will be permanent, under all conditions, without the continued

[1] **The name "Pakindia" has been used to denote pre-partition India. The article was written before August 15, 1947. Without the author's permission it was not possible to split the figures into two separate parts for Pakistan and India.—*Editor*.**

[2] **B. M. Das : "The Tanner," June 1946 ; p. 14.**

[3] **Watt : "Dictionary of Economic Products of India."**

application of agents. The pelts[1] undergo the following series of operations[2] before passing out as leather :—

1. The preliminary operations consist of cleaning the pelts to remove dirt and salt, and immersing them in clean water to bring them back to original form (as most have dried up). Common salt is next sprinkled and gently rubbed on the flesh side. Some five to seven seers of salt per hide are used. They are left as such over night after which they are fit for liming.

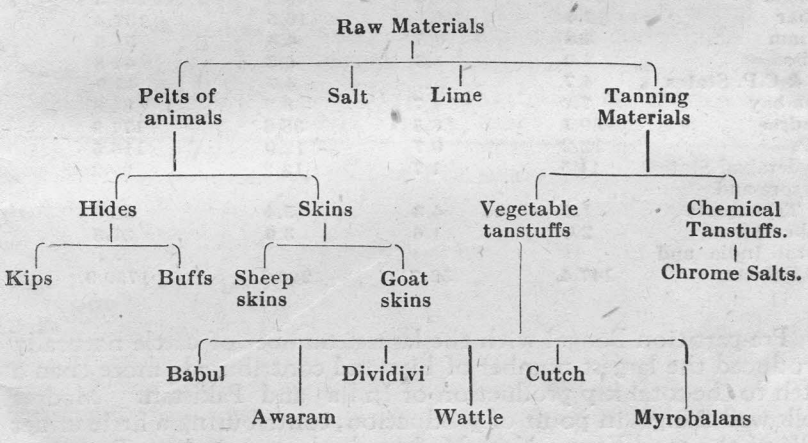
2. Liming : The pelts are next subjected to the action of freshly prepared lime water, the object being to loosen the hair and to make the fleshy and fatty matter separable easily.

3. The next operation is that of unhairing and fleshing *i.e.* exposing the true skin.

4. Deliming and scudding operations follow in order to remove all traces of lime and fatty matter.

5. Then comes the final process of tanning. There are various methods of tanning depending upon the materials used. The most common are (*i*) the vegetable tanning and (*ii*) the mineral or chemical tanning.

We may now classify the major raw materials of the industry and examine their resources in the two Dominions.



PELTS OF THE ANIMALS

The animal pelts are classified into two broad divisions—the hides and the skins. It is customary to call the pelts of larger animals like cows and buffuloes as hides, while those of the smaller animals like the sheep and goats are known as skins. In India and Pakistan the hides of cows, bullocks, bulls and calves are known by the trade name of 'Kips' while the buffalo hides are called 'buffs'.

[1] A common term for hides and skins.

[2] Based on Bardoli : "The Boot and Shoe Maker."

India and Pakistan's hide and skin production is one of the largest in the world. The output is greatest in cattle and buffalo hides and goat skins, while sheep skins are produced on a smaller, but nevertheless a large scale.[1] The production of hides and skins varies considerably throughout the countries as it depends upon the total cattle population in different regions and a number of other factors such as the religious sentiments of the people especially of India.

Kip Production :—The annual production of Kips in Pakistan and India is estimated at 200.1 lakh pieces. Of these 73% consist of fallen[2] hides and the remaining 27% of slaughtered hides.

ANNUAL PRODUCTION OF KIPS[3]

Region.	Annual Production (in lakhs)			Cattle Population in Lakhs.
	Fallen	Slaughtered	Total	
Kashmir	1.8	...	1.8	16.7
Punjab including states	6 8	2.6	9.4	132.1
N.W.F.P.	...	2.4	2.4	15.3
Sind	1.5	0.2	1.7	20.8
Rajputana States	6.6	...	6.6	150.3
U.P. & States	11.2	4.8	16.0	237.7
Western States	2.8	...	2.8	34.9
C. I. States	2.8	...	2.8	42.9
Bengal	24.9	18.3	43.2	258.3
Bihar	12.4	4.1	16.5	137.4
Assam	3.8	0.5	4.3	54.5
Orissa	4.0	1.3	5.3	44 8
E. & C.P. States	4.7	...	4.7	45.9
Bombay	7.2	1 7	8.9	84.8
Madras	30.1	8.5	38.6	177.9
C.P.	12.2	0.7	12.9	116.5
Hyderabad State	11.5	1.7	13.2	99.2
Mysore and Travancore	1.1	4.3	5.4	52 6
Other Areas	2.0	1.6	3.6	37.3
Total India and Pakistan	147.4	52.7	200.1	1759.9

Pre-partition Bengal with the largest number of cattle naturally produced the largest number of kips and contributed more than a fifth to the total kip production of India and Pakistan. Madras followed Bengal in point of production, contributing a little under 20% of the total Kips. Now Madras leads the Indian Provinces and East Bengal is the largest Producer in Pakistan.

Buff Production :—The annual production of buffs in India and Pakistan is estimated at 57.1 lakh pieces. Of these 77% consists of fallen hides and the remaining 23% of slaughtered hides. The total production of buffs is small compared with kips, as the buffaloes represent only about 28% of the number of cattle in the two countries.

[1] Imperial Institute : The Preparation of Empire Hides and Skins, p. 71.

[2] Hides of animals dying natural death.

[3] Report on the Marketing of Hides in India (1943), p. 7.

ANNUAL PRODUCTION OF BUFFS[1]

Region	Annual Production (in lakhs)			% of India & Pakistan's combined Production	Buffalo Population (in lakhs)
	Fallen	Slaughtered	Total		
Punjab	3.3	1.6	4.9	8.6	60.5
N.W F.P.	...	1.8	1.8	3.1	5.7
Rajputana	1.9	...	1.9	3 3	42.4
Sind	0.4	...	0.4	0.7	5.5
Western States	1.3	...	1.3	2 4	5.7
C. I. States	0.7	...	0.7	1 2	10.7
U. P.	3.7	1.9	5.6	9.8	15.3
Bihar	3.2	2.0	5.2	9.1	95.5
Bengal	1.2	0 5	1.7	3 0	9.9
Orissa	0.4	0.2	0.6	1.0	3.8
Assam	0.4	...	0.4	0.7	5.3
Bombay	2 3	0.4	2.7	4.7	29.1
Madras	11.8	3.3	15.1	26.4	54.3
Mysore	0 2	0.6	0 8	1.4	9.4
Hyderabad	2.2	nil	2 2	3 9	30.9
C. P.	6.2	0.2	6.4	11.3	21.9
E. States	3.0	...	3 0	5.2	11.8
Other areas	1.6	0.8	2.4	4 2	27.8
Total India and Pakistan	43.8	13.3	57.1	(100)	475.5

Madras produces the largest number of buffs ; contributing more than a fourth to the total buff production. Central Provinces follow Madras, forming a bad second and contributing only 11.3% and buffs 22% of the total production.

ANNUAL PRODUCTION OF HIDES[2] IN INDIA AND PAKISTAN

Type	Annual Production (in lakhs)			% of total Indian Production
	Fallen	Slaughtered	Total	
Kips	147.4	52.7	200.1	78
Buffs	43.8	13.3	57.1	22
Total	191.2	66.0	257.2	(100)
Percentage	(74)	(26)	(100)	

The proportion of fallen hides is 74% while that of the slaughtered is only 26%. The percentage of slaughtered hides is low due to the aversion of the Hindus to kill animals and also because India suffers from having a very poor meat market.[3]

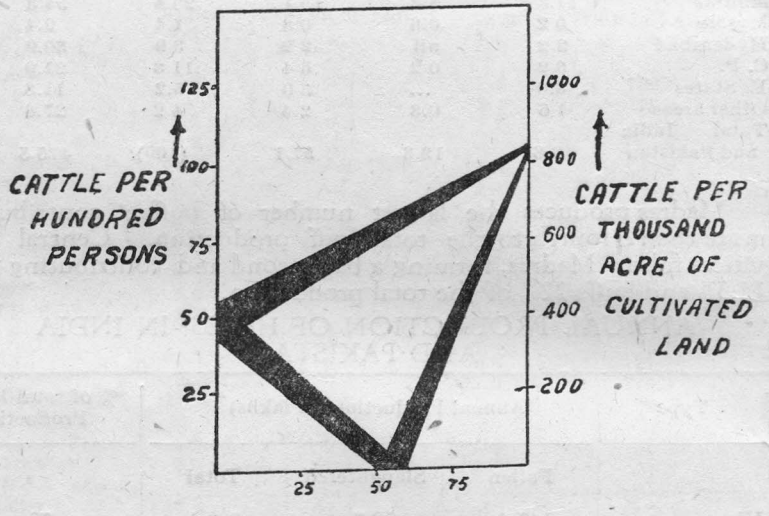
As stated above, a large quantity of Indian hides belong to the 'fallen' type. The production of hides must therefore depend upon the distribution of cattle. The cattle play an important role in the rural economy of these countries which are pre-eminently agricultural countries. The cattle distribution, therefore must be corelated with the agricultural activities of the people. In the

[1] Report on Marketing of Hides in India, p. 9.
[2] *Ibid.*, p. 10.
[3] Walton : A Monograph on Tanning in U. P., page 5.

following figure, cattle per thousand acres of cultivated land are plotted against percentage of cultivated land to total area well as cattle per hundred persons.

FIGURE 1

RELATION OF THE HIGHEST DENSITY OF CATTLE PER THOUSAND ACRES OF CULTIVATED LAND TO CATTLE PER HUNDRED PERSONS AND PERCENTAGE OF CULTIVATED LAND TO TOTAL AREA



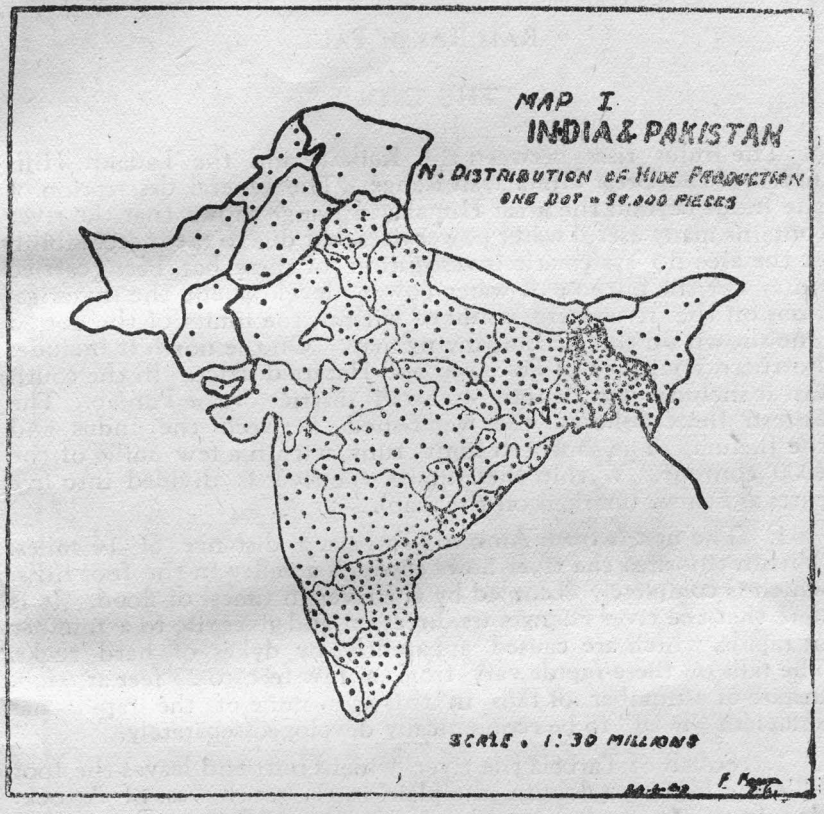
THE HIGHEST NUMBER OF CATTLE ARE FOUND WITH 52-60 % OF CULTIVATED LAND AND 43-56 CATTLE PER HUNDRED PERSONS.

F. Rasul
26.6.1957, P.U.

This figure shows that the highest number of cattle are found when the percentage of cultivated land to total area is 52.60% and the number of cattle per hundred persons is 43-56.

Hides produced in India and Pakistan are generally inferior in quality. The inferiority is in part due to the poorness of the cattle and in part due to the fact that they are branded and as many of them are used for draft work their hides show signs of

wear and tear.[1] In addition the lack of organisation and the defective methods of curing hides also play important part. The defects from which our hides suffer, have been critically examined



by the Hides and Cess Enquiry Committee.[2] The Indian Trade Enquiry Committee too, suggested various methods of improvement of the quality of the Hides.[3]

To be Continued.

[1] Chattertone Monograph on Tanning in Madras Presidency, p. 17.
[2] Refer Chapter IV of the Report.
[3] Imperial Institute : Report on Hides and Skins, p. 14.

POTENTIAL WATER POWER SITES ON THE INDUS

By

Ram Raksh Paul

THE INDUS

The Indus rises between the Kailash and the Ladakh Hills north of the Great Himalayan Range. The general description of the Indus beyond the great Himalayan Range shows that the river contains many useful water power sites, but due to the inaccessibility of the area no systematic investigation of these has been carried out. For the purpose of water power development the investigations on the river were confined within the limits of the dotted line shown on the accompanying map. On the north it includes northern boundary of Peshawar and Hazara district. In the south east it includes part of the Mianwali district of the Punjab. The eastern limit follows the water-shed between the Indus and the Jhelum. The southern limit runs within a few miles of the 1000′ contour. Within these limits the river is divided into five parts as below, (marked on the map).

1. The first is from Amb to Tarbela, a distance of 14 miles. Within this area the river flows through a valley in the foot hills, which is completely occupied by the river in times of flood. It is here that the river changes its direction and gives rise to a number of rapids, which are caused apparently by dykes of hard rocks. The falls on these rapids vary from a few feet to 23 feet at Amb. Inspite of a number of falls in this area none of the rapids has sufficient "head" to be economically developed separately.

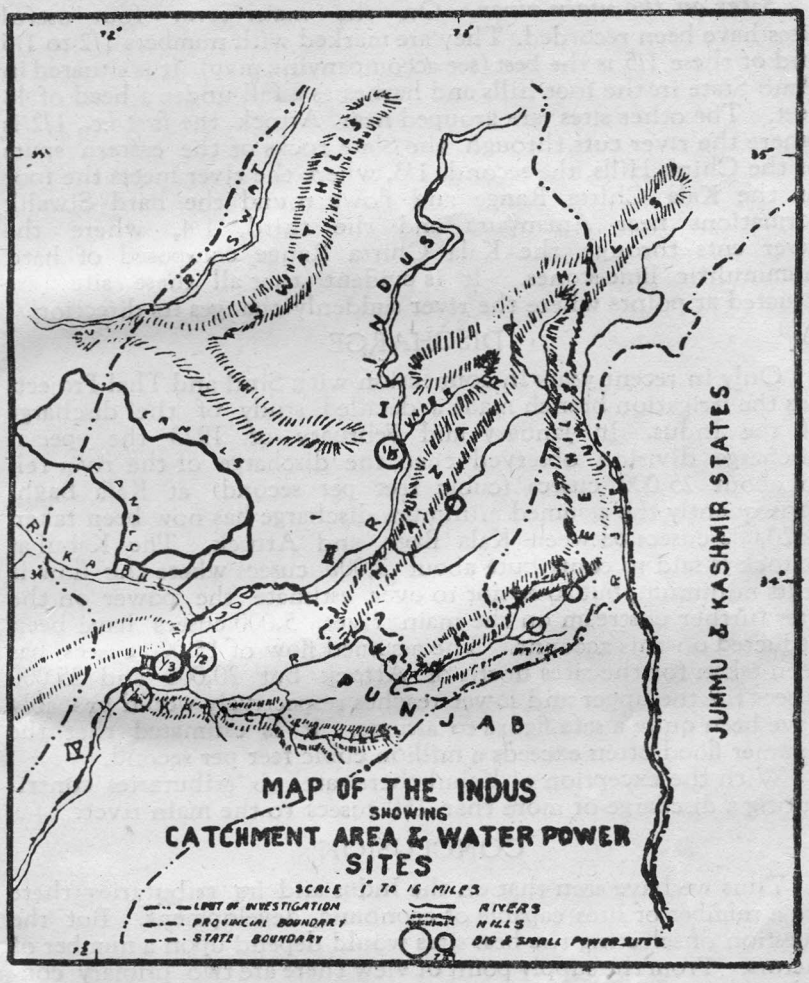
2. South of Tarbela the river widens out and leaves the foot hills and begins to flow in the plain in the south west of Attock. Here in the plain the river has a gradient of 7 feet to a mile as compared to 15 feet to a mile in the upper part. But river is constantly changing its course and so the banks are unsuitable for developing any power scheme.

3. The next length of the river is that between Attock and a point on the river on the southern side of the Kala Chitta Range. At Attock River Kabul joins the Indus where it changes its direction southwards and flows in a gorge four miles long. Beyond the gorge it again widens out to about 12000′, flowing for a distance of 5½ miles in the hills of the Kala Chitta Range. The average gradient of the river here is 4′ a mile but within this area of the river this gradient is not uniform and there are at least three places at three bends where the gradient is sufficient to give rise to economic development of power.

4. The next portion of the river is upto Kalabagh with an average gradient of 1.25′ per mile and due to this low gradient of the river no useful sites are possible.

5. Beyond Kalabagh where river is at an elevation of 1000′ above sea level the river runs out on to the plains. Here it widens out and its course changes from season to season over a width of

bed varying from 2 to 8 miles and has an average fall of less than one foot a mile.



TRIBUTARIES

On the tributaries in the inaccessible country in the Himalayas, there must be many sites where much power could be developed but within the limits surveyed only on three tributaries there are sites where economic development is possible.

The only tributary on the right bank is Swat, a tributary of the Kabul river, but its waters are already utilised in irrigating plains of the Mardan tract. So there are no possibilities of any power being developed on Swat itself. There are a number of tributaries of the Kabul, including the Kuna etc., but as the catchment areas of all these lie in a country which is quite unsettled, no scientific survey of the discharge and gradient of these tributaries has been possible so far.

On the left bank within the limits the Siran with its tributary Dor and HARO are the only two tributaries having a reliable perennial flow and on these a few useful sites have been located.

Sites on the main river.—On the main river four useful sites have been recorded. They are marked with numbers 1/2 to 1/5 and of these 1/5 is the best (see accompanying map). It is situated in Amb State in the foot hills and harnesses a fall under a head of 48 feet. The other sites are grouped near Attock, the first *i.e.*, 1/2 is where the river cuts through the Slate rocks of the eastern spurs of the Chirat Hills, the second, 1/3, where the river meets the foot of the Kala Chitta Range and flows round the hard Siwalik formations near Amanpura and the third, 1/4, where the river cuts through the Kala Chitta Range composed of hard nummulitic lime-stones. It is evident that all these sites are situated at points where the river suddenly changes its direction.

DISCHARGE

Only in recent years in connection with Sind and Thal Projects has the irrigation branch made a detailed study of the discharge of the Indus. In January and February of 1923 the special discharge division observed that the discharge of the river fell to about 25,000 cusecs (cubic feet per second) at Kala Bagh, consequently the assumed minimum discharge has now been taken as 20,000 cusecs between Kala Bagh and Attock. The Kabul at Attock is said to contribute about 3,000 cusecs where the flow is at its minimum, but so as not to over estimate the power on the sites further upstream on the main river, 5,000 cusecs have been deducted on this account. The assumed flow of 15,000 cusecs has been taken for the sites north of Attock but 20,000 and 25,000 cusecs for the upper and lower reaches respectively would probably have been quite a safe figure to assume. It is estimated that the summer flood often exceeds a million cubic feet per second.

With the exception of Kabul there are no tributaries contributing a discharge of more than 150 cusecs to the main river.

CONCLUSION

Thus we have seen that on the Indus and its tributaries there are a number of sites capable of economic development. But the question of selecting the best sites would depend upon a number of factors. From the supply point of view there are two primary considerations :

1. To provide for needs of local towns or industries,
2. and to supply for the general electrification of N. W. Punjab and Frontier Province.

Under the conditions at present prevailing in these areas the last one seems to be the only consideration and for this purpose the scheme to be developed should be only that which is located nearer the important towns and is cheaper in construction. For this purpose the best sites are on the three tributaries—the Swat in the north-west, the Siran in the north and the Haro in the south. The first could undoubtedly be most cheaply developed, but it is farthest from the existing load. The next best is on the Siran near Abbottabad. On Haro there are two schemes of equal capacity which are likely to be developed in near future.