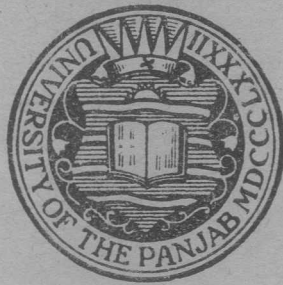


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THE PHYSIOGRAPHICAL PERSONALITY OF BALUCHISTAN

BY

S. ZOHA, M.A. (AUG.); LECTURER IN GEOGRAPHY,
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1. Introduction

United India certain parts of the Sub-continent had suffered a great deal of political, economic and other negligences. Among those Baluchistan had suffered most. It was partly due to its great distance from the then capital of the country partly to the mountainous nature of the land and the so-called "hostile" attitude of the inhabitants towards an alien Government. The Afghan invasions in 1839, and 1878, proved the strategic importance of Baluchistan and, after the subsequent British occupation, some form of development were naturally taken up. But these developments always remained a part of the wider defensive measures adopted on the western front of India and the British rulers of the Sub-continent hardly cared for the economic or social uplift of the people. Indeed, it is not uncommon to hear that it were they who made Baluchistan a backward country.

After the partitioning of India the old edifice was thoroughly destroyed and for better. A new order set in, a new history began. Necessarily, the old geographical aspects and their practical values also changed. What was distant and remote yesterday for the old capital at Delhi became close and near for the new one at Karachi. Measured in a straight line, Quetta was about 700 miles from Delhi, now it is less than 500 miles from Karachi. And, the "hostile" nature of the inhabitants of Baluchistan naturally turned into a melodious harmony with the new government which was their own. Again, with the birth of Pakistan, Baluchistan no more remained only a military outpost. It acquired a new importance as an integral territory of Pakistan. There is little wonder, then, that Baluchistan has already embarked upon its new career. Political reforms have already been introduced, agricultural, industrial, and other practical developments will necessarily follow soon.

In the new enthusiasm, however, we are apt to forget one thing—the region itself, as constituted by nature. We sincerely welcome and rejoice at the new era introduced in Baluchistan but we have to constantly remind ourselves, and remind others as well, what Goblet wrote in his 'Twilight of Treaties'. He said, "There can be no policy without political geography and no political geography without full knowledge of physical geography and human geography".

In the following pages, therefore, an effort is made to present some of the physical aspects of Baluchistan which may best be described as "the land of tomorrow."

2. Orographical relation with West-Pakistan

From orographical point of view, West Pakistan can conveniently be divided into two major units; (a) the Plains of the Indus and the tributaries, and (b) the huge complex of mountains and plateaus lying in the west and north-west of the former unit. Of the second, the mass to the west of the Indus Plain can again be subdivided into two unequal sections, roughly demarcated by the gorge of the Gomal river. South of the Gomal there stretches an enormous plateau or tableland with complicating ranges of mountains running all over and enclosing a multitude of basins—generally situated at a height of 1,000 to 3,000 feet above sea-level. Some of these are 5,000 feet or more in elevation. Broadly speaking the plateau slopes gently to the south-west and merges into the desert of Iran; while to the south, across the low ranges of hills running parallel to the coast, it finally meets the Arabian Sea.

With the exception of a small re-entrant between the eastern most axes of mountains formed by the Suleiman and the Kirthar, the entire region forms a part of the Iranian Plateau which is the most dominant feature in the orography of S. W. Asia. Including the re-entrant, however, and covering a total area of 1,34,000 sq. miles, it forms our geographical province of Baluchistan.

3. Geological Origin

It is a significant coincidence that Baluchistan being a political unit of Pakistan is united with it by dint of a common geological origin. The forces and the movements

of our Earth which initially formed other lands in West as well as East Pakistan also caused the birth of Baluchistan.

Both the orographical units mentioned above came into being as a result of gigantic crustal movements which took place in the remote past. Millions of years ago, even before Man had appeared on the Earth, the western mass of mountains and plateaus, the northern Himalayas and their continuations in the East Pakistan and Burma, as well as the Plains of the Indus, the Ganges and the Brahmaputra simply did not exist. Instead, the sites were occupied by a mid-Asiatic SeJ. called the Tethys. We can imagine it as an over-extended Mediterranean sweeping across the heart of the Old World in mighty meanders and linking the Atlantic with the Pacific Ocean. Perhaps these oceans, too, did not then exist in their present context.. However, this classical sea of Tethys separated the Laurentia in the north from the Gondwana in the south. These ancient land-masses were the primeval crust-blocks of the Earth and their subsequent history is much confused. But we can safely maintain that Peninsular India is a geological legacy of the Gondwana-land which, according to the geologists, extended from the Brazilian plateau through Africa, Arabia and Southern India to West Australia or, at least, it formed an aggregation of these widely separated and "drifted" regions of the Earth. Similarly, on the north, we now have the "Russian Platform" and the Central Siberian massif, which is called the Angaraland, as remnants of an older crust-block. We are further led to conclude that the bed of the Tethys formed a great basin of sedimentation for the rock-debris, mud and other material contributed to it by the bordering land-masses.

During the tertiary epoch of the Earth the isostatic equilibrium of the entire region commended by the Tethys was vehemently disturbed. Naturally, the processes for restoration of the equilibrium set in and movements in the bordering blocks of the crust started. As a result of these movements the bed of the Tethys sea was gradually buckled up; slowly, but steadily land appeared above the water in gentle folds; the folds increased in amplitude until in the Pliocene Age they attained their present distribution and mien. And thus the broad outlines of Pakistan and beyond were defined and" so too, the land of Baluchistan emerged out of its watery embryo.

But the course of subsequent development of Baluchistan as a region essentially differed from that of the Indus and the Punjab plains. In the case of the latter, a smooth and passive deposition of materials by the Himalayan rivers surpassed all other processes of land formation. In Baluchistan such a simple deposition never assumed great prominence although it had its local, and, therefore, negligible regime.

4. Physiographical Development

The evolution and development of the region in question was the composite result of three basic factors or "forces" as we may call them. These were, firstly, orogenic forces which had, as aspects of a wider phenomenon, caused the emergence of Baluchistan; Secondly, the igneous and the volcanic forces; and, lastly, the forces of weathering and land-erosion. It will not be possible for us to enter into a detailed study of these forces which shaped Baluchistan. Nevertheless, we must pay some attention to a few outstanding processes of these forces which seem to have directly controlled and contributed to the physiographical growth of Baluchistan.

5. Orogenic Forces and Their Regional Respondents

We have already mentioned the crustal movements which folded and raised the bed of the Tethys into one of the loftiest systems of young Folded Mountains. Now, it is believed that the movements followed a definite pattern on a wide scale. On the Western side, it is believed, the African "hinterland" moved towards the European "Fore-land"; on the eastern, the Angaraland moved against the stable-block of Peninsular India. In other words, we find, the Tethys sea was divided into two zones; each zone subjected to similar movements of one of the bordering crust-blocks, but with opposite directions of movements. It may, therefore, be concluded that between the two well defined zones there existed a Central zone of the Tethys representing an area of Criss-Cross movements. Here, then a confluence was formed for the "ripples" which were set up in the two separate zones. The folds advancing from the eastern and the western zones commingled with one another and formed into new series of folds often quite different in trend from their "parent" folds in the distant zones.

At this place mention must be made of the decisive role of another crust-block, namely, the Peninsula of Arabia. Situated between the African and the Peninsular Indian blocks, Arabia acted as a resistant mass for the approaching folds and forced them to change their initial directions. Once the folds changed their directions the tendency repeated itself to establish an orogenic fashion. Or, we can say that the successive folds gradually accommodated themselves to the nature and degree of resistance offered by the Arabian Peninsula. Together with this certain inexplicable sub-terranean obstructions also affected the run of these folds.

The net result of all these was a peculiar disturbance in that part of the Tethys-bed which raised itself to form Baluchistan. It was squeezed, so to say, between a number of diverse movements and, consequently, the rising folds, *i.e.* the mountain ranges, were somewhat twisted into a spiral form. The statement, although speculatively made, is clearly supported by the general configuration of the mountains which resembles the letter S. "On the east, the Suleiman range stretches upwards in gradually ascending steps to the Takht-e-Suleiman. The mountains then curve round in a westerly direction on the northern side of the Zhob river along the Toba K'akar Hills till the Central Baruhi range is reached. Near Quetta the direction becomes north and south but, from about 66th degree of longitude, the general trend is again in a westerly direction through Makran and Kharan".* The Central Baruhi range lies between 27°57' and 30°36' N. and 66°31' to 67°52' E. and includes "the whole mass of mountainous country between the Mula river on the south and the Pishin Lora and Zhob rivers in the north".

On a closer study, it will appear that the Harboi Hills, in Kalat, form a knot. From this knot ranges of mountains shoot out in almost all directions. One goes towards the north; towards the south-west three or four ranges radiate from the Siahan and the Makran ranges which run more or less parallel to the coast and to one another. In the far north the Chagai and particularly the Ras Koh range, running east to west, complete the

*Baluchistan—Imp. Gaztt. India (Provincial) p. 2.

picture; while, towards the south-east, the Pab range may be described as a distant outpost or offshoot of the same Harboi knot. In the north-east of Quetta, there appears another knot, higher in elevation, which shoulder; the lofty peaks of Zarghun (11,738'), Khalifat {11,440'} and others. In the east extends the longitudinal wall of the Suieiman and the Kirthar which continues under the Arabian sea as submerged range and eventually turns west to proceed towards the Gulf of Oman.

Within the laps of these diverse mountain ranges lie the basins, the valleys and the plains of Baluchistan. Beginning from the north-east, we have the Zhob and the Loralai valleys which are about 5000 feet above sea-level; in the north we have the Sha'l (commonly known as the valley of Quetta,) above 5,000 feet; in the extreme south-east we have the plain of Lasbela; while towards the west we have a succession of sandy deserts and stony plains separated from one another by the parallel ranges. The larger valleys and basins are frequently made up of smaller valleys, each of which contains one or two principal streams which remain dry for the greater part of the year.

The enormous "squeezing" of the belt, which caused the characteristic configuration of the mountain ranges and formed their connected valleys, resulted in an extensive development of thrusts, overthrusts, faults and fractures in the rock-masses themselves. "Dislocations, mostly vertical to the strike of the ranges prepared the course (in the first instance) for rivers, as for example the Bolan, the Nari, etc.* "In fact, northern Baluchistan lies on the Great Boundary Fault of the Himalayas and the coast itself coincides with a line of faulting. We may close this section with the following words which amply convey the immensity of the effect. "The western edge of the Sarlath and Toba plateau is a great fault along which the eastern edge of the great Registan has subsided several thousand feet relatively to the elevated ranges. Faulting probably still continues and has not yet attained a condition of stability."

With such a background of crustal instability there is little wonder that Baluchistan is a land of recurring

*Memoirs of the Geolog. Survey, India, Vol. XVIII, Part 1, of 1881.

earthquakes. Earthquakes themselves, certainly, are not among the major forces of the Earth nor have they ever produced great landforms. But they, undoubtedly, have an importance from human point of view. In Baluchistan some of them have been particularly destructive, as for example, the ravaging quake at Quetta on May 31, 1935. In the severe earthquake of December 20, 1892, apart from general destructions, the distance between Quetta and Chaman lessened by 21 feet. But a few of these have also had constructive effect; for example, the frequent shocks felt in Quetta in 1888 had the effect of increasing the water supply in Chachezai Karez in Shorarud. Similarly the shocks in 1900 caused a spring to appear in the Sraghuri village on the slopes of Takatu.

6. Igneous and Volcanic Forces

The general effects of igneous forces can best be summarised in the following words "The triassic shales and limestones, forming an extensive outcrop south of the Zhob valley, are profusely injected by great intrusive masses of coarse-grained gabbro, often altered into serpentine, and innumerable dolerite or basalt veins and dykes of the Deccan trap age. To this period also belong many of the igneous rocks, both intrusive and eruptive, which occur abundantly in all the regional types. A second group of igneous rocks is represented by deep seated intrusions, without any connexion with volcanoes *". Besides the purely geological interest, these igneous forces have imparted an economic significance to Baluchistan. The serpentines, mentioned above, contain valuable loads of chrome-iron ore; while lead, copper, sulphur, ornamental stones etc occur abundantly elsewhere, chiefly in the Chagai ranges.

The alteration of rocks by igneous forces, or metamorphism, is not easily visible to the common eye nor the results of it can be fully appreciated by the untrained observer. Nevertheless, these are among the fundamental aspects of the region and, as we have just noted, these had often been closely associated with the forces of volcanicity.

*Baluchistan, Imperial Gaztt. (Provincial). P. 7.

Baluchistan is situated in the Alpine-Himalayan volcanic belt and although most of the volcanoes have become exhausted they are directly related with those of Persia, Turkey and the Mediterranean. Physiographically, these volcanoes have lent a distinctiveness to Baluchistan; while as a landform they stand out in bold contrast with the rest of Pakistan.

These volcanoes, recent and sub-recent in origin, form a series of scattered hills in the triangular strip of country lying to the west of Chagai and known as Western Sanjarani. First of all we have the Koh-i-Sultan, separated from the main Chagai Hills by 30 miles of sandy expanse; farther west, are the Damorlin Hills and several other isolated peaks of volcanic origin; twenty miles more to the west is another peak called Koh-i-Dalil. All these are between 4000 to 8000 feet high and some of them rise abruptly out of the sandy plains with precipitous slopes. Among them the most impressive is the Koh-i-Sultan, named after Sultan Pir Kaisar who is a mythical patron saint of the Balochis. We are obliged to Mr. Vredenburg for the following description of the Koh.

"The Koh-i-Sultan is an oval shaped mountain whose longer axis striking west-north-west is about 17 miles, the transverse width being 10 miles. It is an extinct volcano consisting of rocks very similar to those of the Koh-i-Tafdan, but instead of forming one cone the centre of eruption seems to have shifted several times, so that the mountain is really an aggregate of three distinct cones, now greatly denuded, whose centres are disposed along a straight line The original summits of the three cones have been entirely denuded, away. The western cone has been denuded to such an extent that it now forms a great circular plain 4½ miles in diameter, surrounded by a beautiful amphitheatre of cliffs. It is an instance of the kind of feature termed by Lyell 'a crater of denudation'. The cliffs that surround this amphitheatre consist almost entirely of accumulated ash-beds. They do not everywhere rise to the same height in one broken line, but have been variously shaped by the agencies of denudation; some portions which have been less

denuded stand out as isolated masses or as outstanding pillars, like the Neza-i-Sultan". Vredenburg further adds: "The three cones appear to have succeeded one another in the direction of west to east, but the eruption may have been partly simultaneous

Besides these massive volcanoes, which are happily dead we have a number of mud volcanoes in Makran and the Kunder valley of the Zhob District which remain bubbling up even for to-day. Like earthquakes, these volcanoes also remind us that all is not yet quiet with Baluchistan. The initial forces are still operating within; and considerable changes in the surface pattern may possibly take place in the long run.

7. Weathering and Land-Erosion

We now turn our attention to the role of weathering and erosion in determining the physiographical personality of Baluchistan. It will not be an exaggeration to say that the economic, human, and scenic values of the region are the direct products of the forces of weather, wind and water. By disintegrating the rock masses, weathering has produced the scree beds which form the reservoirs of underground water used through karez; by transporting the finer constituents of rocks and by re-depositing them in the valleys, winds have given us the loess without which most of the valleys, now fertile and green, would have remained barren; last but not least, weather, wind, and water by eroding the land extensively and producing the weird panorama have considerably affected the mental outlook of the people as well. Here, in Baluchistan, the mind of man is still a clean mirror of the immediate material environment; man is still the child of nature in Baluchistan.

"Weathering" implies the breaking up or decomposition of exposed rock masses, thus rendering them fit for transport by water, ice, or wind. Erosion is distinct from weathering; it refers to the process of "gnawing away", the "carving" or "sculpturing" of the land. The natural epilogue of erosion is deposition of the material eroded away. Obviously this implies transportation. Weathering, transportation, erosion, and deposition, therefore, are the complex processes of the same general

phenomena. However, we shall consider them somewhat separately in order to appreciate their collective control or effect.

8. Weathering

Before entering the field of weathering, we must keep in view the geological and the climatic background of the region at large. The mountains of Baluchistan, as a rule, are composed of limestones, shales, conglomerates, or of white clay as in Southern Makran. Limestones are well-jointed and pervious to water and are characterised by a high degree of solubility; and the jointing factor renders the hydrology and topography of limestone areas highly distinctive and peculiar. The removal of the rock from the general surface takes place largely through solution; joints are widened into gaping fissures or clefts while cylindrical "pipes", "swallets," or "swallow-holes" may also be dissolved out. Shales and clays belong to the argillaceous class of rocks which is characterised by general softness and the absence of clear-cut divisional planes. They are resistant to chemical weathering and erosion except under the extreme conditions of tropical climates, but they yield readily to mechanical agents. Conglomerates are coarse fragmental deposits. They show few signs of bedding and have ill-developed jointing. Their resistance to weathering processes often depends more upon the hardness and solubility of the material occupying the interspaces than on the characters of the larger fragments. If the former is of low resistant power, the rock readily falls to pieces. In short, the general destructibility of the rock-masses is characteristic of Baluchistan. On the climatic side, so far as weathering is concerned, we have only to remember that it is a land of large diurnal range of temperature.

The general destructibility of the rock-masses and the large diurnal range of temperature have naturally resulted in a tremendous disintegration of the entire region. Masses of rocks everywhere, initially compact, have been cleanly cut through into huge blocks and these, in turn, have been broken up into boulders and large fragments of angular dimensions. The complete "shattering" of the rock-masses, due to alternate expansion and contraction of the rocks set up by acute diurnal range of temperature, has been considerably helped by the mechanical

action of frost in certain restricted areas particularly, in the upper highland part of Baluchistan.

The ultimate result of such extensive disintegration is seen in the formation of scree beds which are one of the salient features of the country. These are locally called "dolan" or skirt of the mountain. In order to give a satisfactory description of these "damans" we can do no better than quote Mr. Vredenburg. He says, "Owing to the absence of any powerful drainage, these deposits attain a considerable size and 'daman' reaches proportions almost comparable to those of the mountains whose debris have formed it, reaching higher and higher upon its slopes. The gradient of these taluses is so low that the eye can hardly realize the great height which they reach up the mountain slopes, and this explains the dwarfed appearance of many of the hill ranges notwithstanding their considerable altitude." Many of these boulders and fragments torn from their parent mass are carried into the plains by unusually heavy showers of rain. These boulders and pebbles are thus spread over the surface of the plains and finally form the "dashts" of Baluchistan. Writing about these Vredenburg adds, "The outer surface of nearly all the pebbles is coloured black through the oxidation of iron compound. This is an instance of chemical weathering or decomposition which is not unfamiliar at all. Besides, chemical corrosion due to evaporation of water containing mineral matters in solution is particularly noticeable in the western desert portion of Baluchistan."

Erosion

As in other arid regions, the essential factors controlling erosion in Baluchistan are the absence of vegetation and the excess of evaporation over rainfall. In Baluchistan vegetation is conspicuously absent while rainfall hardly averages ten inches. Naturally the erosive work of water decreases whereas that of wind increases in proportion.

The winds in Baluchistan are characteristically dry and are often powerful and steady in flow, particularly the "gorich" or the northwest wind. These winds are naturally armed with quartz which is the dominant mineral of ordinary sand. Striking against the masses of limestones, shales, conglomerates etc. of which Baluchistan is made, these quartz-laden winds have performed an

immense amount of corrasion and have produced a myriad of minor features often resembling the characteristic "mushroom-forms", "Zeugens", "yardangs, windows" and even small hollows on the ground. Some reference has already been made to the eroded aspects of the Koh-i-Sultan. Here we may note that one of the principal peaks of this koh has been so eroded that it bears a resemblance to the sphinx.

In addition to the gorch, strong currents of dry air are produced during summer by the thermal condition and these currents, in turn, produce violent dust-storms which precipitate the normal process of wind-erosion. Such duststorms are common everywhere in Baluchistan, but are particularly frequent and damaging in the west and the south. Writing of these sand-storms in the western areas Sir Henry McMahan says, "The earth and sky become one mass of flying sand. It fares ill at such times with anyone who struggles even a few yards from the line of March. Five minutes of a sand-storm would obliterate the deep tracks of an army corps". And some idea of the spectacular changes in the initial surface conditions brought about by the deposition of the mass of sand, carried by a wind or a storm, can be had from the following description of the hills of Chagai. "These hills", writes McMahan, "are all being gradually covered up and buried in sand which is relentlessly creeping further and further up their sides. Many are already completely buried, and a high mountain of sand marks their burial place. Others have their black peaks appearing out of the white expanse of sand slopes. Here and there a loftier mass still towers with its black crags high above the devouring waste around, but the sand, banked up on their sides in places sometimes 1000 or 2000 feet above the level of their base, foretells a similar fate in store for them."

Closely connected with the above is the phenomenon of sanddune. In his "wanderings in Baluchistan". Charles McGregor has graphically described these dunes. "All are Bhaped alike, and are of the form of a crescent, the horns being to the south, and the toes to the north, They vary a good deal in height, the top of the largest one being about 60ft above the plain and sloping down gradually to the horns, where they mingle with the sand. The outer slope is at an angle of about 30°, bulging a

little in the centre and the inner at about 45°, or as steep as sand will stand. At the top of the outer slope and at the toe of the crescent is a steeper slope about 3 ft. in depth and this gradually disappears at the horns where the whole outer slope is uniform". These are, par excellence, the *Barkhans* or crescentic dunes of which we read so much in our books on Physical Geography. *Barkhan*, is also the name of a tehsil in the Loralai District of Baluchistan. It may not be improbable that the naming of the tehsil bears a symbolic relation with the crescentic dunes of the western deserts which is a most impressive natural feature of the country.

A very high degree of mechanical corrasion, powerful sand-storms, dunes and *bat'khans*, then, are some of the outstanding achievements of wind in shaping the physiographical personality of Baluchistan. To these we may add yet another. Most of the valleys consist of loess deposits and these, as we know, are formed by accumulation of wind-blown dust. Even in the plains the alluvium is mixed with loess. In a land composed entirely of limestones, shales, clay, sand and gravel the importance of such a fertile soil, as loess, cannot be overrated.

Besides wind, water has also affected the Physiographical development of Baluchistan. Unchecked by surface vegetation and readily guided by the joints (If limestones, rain water has caused countless "gullies" on the sides of mountains and, elsewhere, has carved the country into "bad-land". We have already mentioned the stony plains or "dashts" formed by the transportation and subsequent deposition, by flood water, of pebbles and boulders originally belonging to the huge taluses. Floods, irresistible and sudden floods, are not at all uncommon in Baluchistan; but, paradoxically enough, there is no "flood-problem" in the region. "The conformation of the surface of the country renders much damage from floods impossible". The real problem is the rushing hill-torrents which wake up after a local and comparatively insignificant rainfall. In Baluchistan even a paltry shower may result in torrents which, though short-lived, are particularly destructive to the land and the people. III the past these torrents, cutting through the ranges, formed deep and narrow gorges which become "deeper" and deeper as the level of the river sinks lower and lower every year. Such narrow gorges and denles have often attain •

ed terrific depths, for example the Zao and the Gat defiles in the Suleiman range are about 2000 feet deep and in most places, are only a few yards wide. In the memorable words of Sir Henry McMahon "it is hard to imagine anything finer than some of these gorges".

Broadly speaking these defiles and gorges have formed the main lines of communication with the valleys within as well as the world without. A few of these, have become the classical mountain passes as the Bolan or the Mula Pass through which a detachment of the army of Alexander the Great marched back, under Crateros, from the Indus valley in 325 B.C.

The process of water-erosion, is not confined to the surface; it transcends into the sub-surface and gives rise to equally important features—perhaps more important ones from economic point of view. The characteristic attributes of limestones have already been noted above, but for the sake of emphasis we may repeat that the outstanding characteristic of a limestone is its solubility in rain water which is only accentuated by the system of joints in it. Naturally, surface water in Baluchistan finds easy and spontaneous percolation downward and works up a number of marvels. The most obvious result is that a river after its first appearance on the surface in its usual manner and having moved along its channel for some distance will disappear underground and re-emerge a little lower in its course. This hide-and-seek play is characteristic of the hydrology of the land and has resulted, partly at least, in the formation of dry-valleys and dry river-beds which are so numerous in Baluchistan. Percolating in the scree-beds, these underground waters have become the main source of karezes and, under favourable circumstances of rock-conformation have formed springs which, in turn, have become the foci of human settlement and economic activities. There is another related feature, artesian well, which is now assuming a greater and practical importance in Baluchistan, particularly in the Quetta-Pishin District. An artesian well is not a new discovery in Baluchistan. There are many such wells in Quetta town as well as in Quetta Tehsil and, as the Irrigation Commission of 1903, had pointed out, "Baluchistan holds, more hope of securing artesian supply of water at moderate depth than in any other part of the Sub-continent. The real

AFGHANISTAN

RELIEF

4 Miles

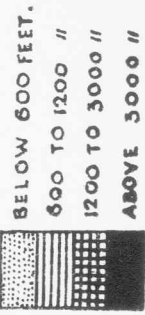
INDIAN OCEAN

AFGHANISTAN

PUNJAB

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object discovered of late is the fact that these hidden fountains of Nature and symbolically all other natural resources of the land have to be searched out and exploited. Only then the economy of the land and the prosperity of the people can be ensured and developed to the required level. And for this we shall have inevitably to depend on the twin sciences of the earth-Geography and Geology.

Conclusion

So far, we have briefly discussed the chief forces of the earth which shaped our Baluchistan as a region quite distinct from any other region of Pakistan. Born out of the Tethys-bed, folded and faulted by the orogenic forces, frequently attacked by earthquakes and tormented by volcanoes, Baluchistan underwent, and is constantly undergoing, heavy disintegration rendering it easier prey to the forces of wind and water.

The nature of drainage and climate and their respective consequences on the land and the life of the people we shall study next.

(To be Continued)

THE ROLE OF GEOGRAPHY IN OUR NATIONAL PLANNING

BY

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AS a result of the partition of India, Pakistan got 361,000 sq. miles with a population of 72,103,000 persons, divided into two zones-- West Pakistan and East Pakistan. East Pakistan which is one-seventh in area has four-sevenths of the population. The area of Pakistan is about one-third that of Bharat while the population is about 22 per cent. But we inherited only a small fraction of the known mineral resources and a very small number of industrial concerns and technical institutions. Even these were mostly manned by non-Muslims who migrated to India, thus leaving us in a sort of industrial and technical vacuum. The Government and the people have faced the initial troubles admirably. We are now in a position to think and apply our mind to problems of organisation and reconstruction. Our natural resources are immense and potentialities great. We have only to plan for the discovery, proper exploration and utilization of the wealth which we possess. If we set ourselves to it with a will and determined effort our future is assured and there can be no doubt that Pakistan shall occupy a very important position amongst the nations of the world--much higher than what our area or numbers may suggest. Our resources coupled with our traditions, guarantee our people a standard of life which may well be an envy to so many other countries.

But planning is the crux of our present problem. There are only two ways for the proper rehabilitation of a country, specially when it starts almost from scratch like Pakistan. It should either have at its head a person with absolute powers, commanding undivided allegiance from the people. Or there should be effective planning with all the resources of the people and the state behind it. We have lost in Quaid-i-Azam our Kamal Attaturk and we are now left with only the other alternative.

For a proper assessment of our resources and their better utilization we should marshal our scientific talents

in the service of our young country. Along with other sciences geography has its own part to play.

Its great importance lies in the fact that in it the natural and social sciences meet. "Geography uses the methods and discipline of natural sciences and yet it is also a human study, dealing with activities of man and is specially concerned to set them in their natural environment." It is a subject which coordinates the two groups of sciences. Through its medium many of the results of the physical sciences may be intelligently applied for the welfare of mankind, more particularly in spatial relationships and distributions.

National planning necessarily implies coordination between various plans to bear the best results. For example planning for afforestation or irrigation cannot be properly undertaken independently of the planning for agriculture. Similarly planning for transport has to be coordinated with production, resettlement and rehabilitation. A Geographer is best fitted to have a comprehensive picture of the area under planning, not only in respect of the various aspects of development within the same region but also in mutual relationship between one region and the other. A Geographer possessing a good knowledge of the physical and human conditions is well equipped to analyse a particular region and recognise the functional relationships between its component parts. He is able to carry on field-mapping and land-use surveys rapidly and accurately and evaluate and coordinate existing data of all kinds relating to any area concerned.

Planning is a way of doing things, its details will vary from one place to another and from circumstances to circumstances. A Geographer with a grasp of the fundamentals of the relation between man and land is quite competent to make necessary adjustments.

To be more objective let us examine how geographical knowledge is likely to be helpful in planning for the needs of our young but potentially resourceful country. We need quick planning for :-

1. Defence.
2. Power Resources.
3. Agriculture.

4. Industry.
5. Transport.
6. Trade, and
7. Rehabilitation and Resettlement.

Defence

Geography has been truly said to be the bed-rock of all calculations in war. Our military problems, our strategy and tactics are all based on geographical conditions. Topography plays an important role. Military operations are planned sufficiently far in advance with the help of the topographical maps. Topography is a basic factor in the defence of our western frontier.

West Pakistan is bounded on the West by a belt of mountains across which several passes negotiate between the Indus plain on the one side and Afghanistan on the other. These passes, more particularly Khyber, have borne the brunt of the invasion of the various people from Central Asia and the West, during historic and pre-historic times. With expansionist Russia located not far off and impressionable Afghanistan making common frontier with us for about 4,000 miles, these passes are militarily even more important today than before. An appreciation of the terrain, the nature of the ground, the manner in which the physical features could be turned, to account all deserve careful consideration and need the assistance of a trained Geographer. The Pathan Tribes have always defied and frustrated all attempts to conquer them. They are renowned for their fighting qualities. That they have been so successful in protecting themselves and preserving their independence may be accounted for by their being thoroughly conversant with the terrain. It is a military axiom that Victory comes to them who make the best use of the ground.

In East Pakistan rivers and their deserted channels which may be filled with water are the chief features of Landscape and should constitute an equally important feature of our defence strategy in that area.

Weather or climate is another important geographical factor in the planning for defence. Napoleon and Hitler were unsuccessful in Russia because they had not provided adequately for the Russian Winter. West Pakistan has

an extreme climate and has a desert frontier with Bharat for over 8 hundred miles on the east of Sind and Bahawalpur. . East Pakistan may not be suitable for an army recruited in West Pakistan unless proper precautions are taken. Army units are to be formed not only on the basis of their efficiency on various types of terrain but also on the capacity of the individual soldiers to adapt themselves to the conditions of climate. In the formation and classification of such units the services of a Geographer may be extremely useful.

In Coastal defence and naval and amphibious operations the nature of the coast line, sand-dunes, beaches, tides, currents and waves are all important geographical considerations. The coast-line of both West and East Pakistan is characterised by the formation of big deltas, fringed with islands. The Gangetic delta is covered with dense almost impenetrable forests. They form important natural defences. Approaches through these forests should be carefully located and defended at suitable points.

Regional studies are very important for strategic intelligence and planning of military operations including food, clothing and means of transport. Each individual environmental factor must be carefully studied with a view to determine the limitations that it may impose on men and equipment. . Special significance attaches to the question of water-supply.

Construction of maps and physiographic diagrams, climatic charts and their interpretation is the work of a Geographer. . In the modern era of aerial warfare a knowledge of Geography is necessary for the analysis and the interpretation of aerial photographs. In military operations the emphasis is on map-work and not on text. This makes the Geographer almost indispensable both in planning and operation.

If the military rule "know your battle-field" has any truth the importance of geography in military planning is obvious.

Power-Resources

With limited supplies of coal and petroleum so far available, Pakistan has to depend mostly on water-power for light and industrial development. . Possibilities for

running electric rail ways may also be considered. Our bordering mountains, perennial rivers and a well-distributed system of canals in our plain area provide immense opportunities for water-power. River and canal surveys should be undertaken with a view to determine suitable sites for the generation of electricity, in addition to the places where they have already been dammed, and a coordinated plan laying down the order of priorities should be prepared. The river Indus has several very good sites in its upper reaches. One of the best sites is located in the Amb State in the foot hills where there is a fall of about 48 feet. There are other sites near Attock where the river cuts through the eastern spur of Chirat Hills and where it cuts through Kala-Chitta Range. The Chenab breaks through the archeen hills near Chiniot and is divided into two. This is an excellent site for damming and producing electricity. The gradient of the Panjab plains is higher than that of western U. P. where hydro-electricity has been generated from canals at many places and has been gridded.

The Industrial Conference held at Karachi in December 1947 recommended that highest priority should be given to the generation of hydro-electricity. It laid down a target of 500,000 K. \tV. to be aimed at during the next 5 or 7 years, including 100,000 K. \iV. in East Pakistan. Several hydro-electric schemes have been taken up-Rasul, Mianwali, Malakand, Dargai and \Varsak in \Nest Pakistan and Karnafuli in East Pakistan. But it is desirable to concentrate on multi-purpose projects providing for irrigation, hydro-electricity navigation and flood control. The Valley of some of the rivers like Kabul may be developed on the lines of the Tennessee Valley Authority. A knowledge of Geography will considerably help in the preparation of multi-purposes in various regions. Strong southerly winds in summer and northerly winds in winter suggest the possibility of making use of these winds for running wind-mills. With the help of geographical knowledge suitable places for the location of such mills could be determined.

Agriculture

Agriculture is the most important occupation of the people of Pakistan and is the back-bone of its economic structure. Agricultural production is the chief source of

our wealth and the mainstay of international trade. Pakistan depends for its prosperity almost entirely on agriculture. While industrialization should occupy a prominent place in any scheme of national planning agriculture shall continue to remain our main concern. A comprehensive plan for the development of agriculture on scientific lines embracing various aspects is greatly needed to increase production not only to meet the requirements of our growing population, but also to maintain our exports to a level high enough to pay for all the needs of this young country. Our agricultural plans should provide for (1) increasing the yield from the lands already in cultivation, (2) bringing into cultivation as far as possible all the lands so far called as cultivable-wastes and (3) reclaiming lands suffering from erosion, salination and water-logging. To effect these improvements on land with any substantial success a knowledge of geography is essential. Climatic, edaphic and hydrographic factors need careful study. Geographers may help in conducting surveys to determine the conditions of soil, water-supply and drainage with a view to make the best use of land for agriculture, animal husbandry or forestry. Regional studies should be undertaken to find out suitability of land to various crops as well as to determine the nature of damage that is being done to land in various parts. The results of these surveys and studies should be properly mapped.

The yields of crops in our country are very low when compared with that of progressive parts of the world. They should be increased by bringing water to the lands which are dry, increasing use of manures, introducing new methods of dry farming, co-operative and mechanised farming, proper planning for crop rotations, preventing the cultivation of unsuitable crops, providing good seeds and necessary technical advice. Demonstration farms, research centres should be opened in each region.

There are over 25 million acres of land in Pakistan which have been classified as cultivable waste. These lands should be properly surveyed and put to the uses for which they are best suited. Similarly a survey should be undertaken of the lands which have been spoiled by erosion through reckless deforestation; encroachment of sand, specially in the sub-Himalayas in the belt of the

'chos; and salination and water-logging in the canal are;ts. Attempt should be made not only to reclaim such lands but also methods should be adopted to prevent more lands from being spoiled. In all these various operations the services of a Geographer will be quite valuable.

Baluchistan needs our special attention in our plans for agricultural development. It is said that at a depth of about 300 feet below the desert there is a sub-tratum of gravel which holds considerable quantities of water. If means could be found to pump this water to the surface, the desert could be transferred into a garden.

Industry

Location of industry is an important geographical problem. Optimum location in a planned economy depends upon several factors which in the main include nature of land, water-supply, climate, sources of power and fuel, sources of raw materials, markets, transport and labour. The theory of industrial location as developed by Alfred vVaver and other economists is largely related to the dynamics of various forces which pull an industry towards different geographical points. The relative importance of these factors varies with individual industries. Although at the present level of development none of the natural factors are decisive, yet they deserve adequate consideration. For example we are quite familiar with the attraction of the basic iron and steel industry to the vicinity of coal and iron-ore. But we cannot also ignore the fact that a modern integrated iron and steel plant is a large consumer of water and hence such an industry cannot be located in an arid area. In Pakistan where planning for industry is to be done *ab initio* military considerations are no less important than natural and economic factors. Taking various things into consideration the Hindu Bagh area, in the Valley of the Zhob in N. Baluchistan offers very good facilities for development as an industrial region more particularly in heavy industry. Besides chromite, large quantities of good iron-ore and some coal has been discovered. But it is away from the more densely populated parts which provide the markets. Our main rivers run north and south and the problem of bridging them at suitable places has to be kept in view in our industrial planning. There is an obvious conflict between demographic, physical and

economic considerations in the determination of our industrial sites and a knowledge of Geography will be extremely useful in resolving this conflict. A geographical approach to our industrial problems is likely to show *excellent* results. It implies the discovery of relationship between man and his work on the one hand and the natural environment on the other. A proper understanding of this basic relationship between various distributions is a guarantee for the success of any industrial undertaking.

A survey of the extent of land suitable and available for industry is another geographical problem. Such lands are to be located and mapped. There should be first a regional allocation of various industries and then the requirements of each industry are to be estimated and proper lands allocated to it. The Industrial use of land should be limited by the proximity to a rail or road, level and a raised site. Sub-soil conditions are important where deep foundations are required.

In an industrially undeveloped country like ours there is a considerable scope for securing any desired pattern of industrial location by encouraging the development of new industries suited to different regions. A preliminary survey of the potentialities of the various regions is necessary. Such a survey should form the basis of any plan of balanced development of industry. There should not only be an even development of industry between various regions but also a planned development of industrial towns so as to prevent the social evils arising from excessive concentration.

Transport

A knowledge of Geography will be extremely useful in planning for the future expansion of transport for determining new roads and railways and locating the site of air-fields. The capacity of a geographer to interpret topographical maps, climatic charts and statistical data and the requirements of various regions, distribution of market towns, nature of trade and the relative importance of urban centres may be a great asset.

The question of rail and road competition may be dealt with according to the nature and volume of traffic. A Geographer may give a sound advice about the priority

of any plan of road construction and metalling according to the climatic conditions prevailing in various areas, the nature of topography and the requirements of trade.

West Pakistan has a good system of metalled roads but certain gaps are to be filled up. Some of them may require the construction of bridges over canals and rivers. Our principal roads run north and south and transverse East and west communication is a matter of careful planning. The mountaineous area of Kashmir, N.-vV. F. P. may be brought nearer by the construction of air-fields at suitable places and building of feeder roads from important areas.

The question of military roads also needs reconsideration in the light of our new frontiers. Hyderabad-Mirpur Khas, Bahawalpur-Fort Abbas, Lahvre-Kasur, Lahore Vagah and Sialkot-Narowal sections have become of great military importances. Lahore-Vagah section bids fair to be the most important trade-link between Bharat and Pakistan on our eastern frontier.

With a heavy rainfall and a number of rivers running north and south which became swollen during the rainy season, East Bengal presents entirely different problems in road construction. Future planning of roads in East Pakistan has to be considered in relation to their utility when compared with water-transport or as feeders to railways.

Our railways also require to be fitted into a new pattern demanded by our new military and commercial requirements. There is only one railway between Bahawalpur and Sukkur and that too to the east of Sutlej and Indus. For some distance it runs within 20 miles of our frontier and where the plain becomes quite narrow. The construction of a railway line from Kashmir in the west of the Indus on the Sind border to Tank deserves urgent attention. The total length of our railways is very small considering the size of our country and population-about one mile for 630 persons in West Pakistan and for 2900 persons in East Pakistan. In order to distribute the population to less thickly populated areas more railways should be opened in such regions. In the formation of these plans a geographer will be of great help. In East Pakistan the direction of traffic has now changed from

Calcutta to Chittagong, various parts are therefore to be linked with the Chittagong, Dacca and Mymensingh sections.

Water-ways are of great importance in East Pakistan in view of the flooding of large areas in the rainy season. The rivers should be carefully surveyed to find out their capacity for the transport of various barges. They should be canalised wherever necessary. Chittagong, our chief port in Pakistan, being located at the thin distant end, requires very cheap transport to it, more specially so in the case of the lute which cannot stand high freight charges.

Plans should be prepared for the reviving of navigation in the Indus and its principal tributaries in West Pakistan. Indus is navigable upto Attock (about 1000 miles) and the Chenab upto Vazirabad (about 800 miles) and Sutlej beyond our frontiers upto Ludhiana. Navigation locks should be constructed where the rivers have been dammed. Suitable reservoirs of water should also be made to ensure even flow of water not only for navigation purposes but also for irrigation in winter when the level of the river falls but the water is much needed by our *rabi* crop.

Air-transport needs our special attention in view of the fact that East Pakistan lies at a distance of over 1000 miles in the East and large areas lie behind practically impassable mountain ramparts in the north as well as at long distances in the distant west of Baluchistan. In planning for airways a geographer may help in selecting a suitable site for air-fields with reference to the surrounding, physical features and conditions of weather and visibility, and in laying down of runways in accordance with the direction and velocity of winds. He may also advise on the type of air-field to be suited. With his training in climateology and cartography he can be of great help in air-navigation.

Trade

Proper orientation of foreign trade is essential for the building of the economic structure and increasing the wealth of our country. Economic and commercial geography provide a sound basis for the general understanding of international commerce. Equipped with the

knowledge of the products and fundamental requirements of the various countries of the world in relating to natural environment, a Geographer is in a good position to direct our foreign trade to our best advantage. With the help of distribution maps, statistical charts and diagrams he can select the best markets for our products and the proper countries from which to import. He can give a sound advice for the formation of our national and international policies which may be indicated by the economic and commercial requirements of the country. For example lifting of the embargo on trade with the Union of South Africa was obviously the right step in view of the attitude of the Bharat Government's stopping the supply of Coal, a commodity so essential for our needs. Similarly the question of 'Imperial preference' may be reviewed in the light of the extent of our trade with the United Kingdom and other countries during the last 21 years and the possibilities of future expansion. Maps may be prepared showing the countries deficient in the products which we may export and their possible alternative means of supply as well as those showing the distribution and amount of production, in principal countries of the commodities that we may require. A comparison of these Maps may considerably help in planning for our international trade and the choice of articles for import from any country and the order of priorities.

Rehabilitation and Resettlement

Rehabilitation and resettlement of refugees from East Panjab and other parts of Bharat (about 6 million) is one of the major problems of our state. A good knowledge of Geography is essential for its proper solution. There are two categories of land available for settlement, (i) lands left by the evacuees who migrated to India, and (ii) lands in the thinly populated areas awaiting development. A regional system may be very usefully adopted in both of these cases. The land available may be classified into various types as regards its soil, suitability for various crops and water-supply. The refugees should also be similarly classified according to their agricultural efficiency and the type of land they have been cultivating. A farmer from dry sandy regions or Hissar can be more successful in sandy Thal area than one from the fertile

irrigated districts of Jullundur. Similarly, our illiterate farmer, used to ploughing light sandy soils is bound to fail if settled on hard clayey soils which need deep ploughing and turning several times. The refugees should also be classified according to their trades and vocations and settled in areas in such a way as to ensure best returns. The question of suitable labour supply for the various industries should also be kept in view. Refugees carrying on a particular vocation should be settled in regions when raw material required by them are easily available. Excepting those whose settlement in our bigger cities like Lahore, Karachi and Multan is necessary for the maintenance of industry and trade, we should prevent the further growth of our larger towns. On the other hand "rurbanization" of some of our rural areas will be much welcomed. Encouragement should be given for the development of towns to certain optimum size and new town sites may be created on lands otherwise unsuitable, proper regard being paid to communications. The towns may provide special professional services for which a large surrounding area may be served. Such a planned distribution of population is of fundamental importance to the building of a good social and economic structure of our country. Geography as a study of the distribution of population in relation to natural environment can make a great contribution to the solution of this complex rehabilitation problem. Thinly populated areas may be studied with reference to their potential resources and hazards and with a view to find suitable means for the settlement of refugees on them. A group of experts should be appointed to conduct such an enquiry. This should include Geographers, Agriculturists, Industrial Economists and Demographic specialists. The findings of such an enquiry should form the basis of our rehabilitation policy on such lands,

THE ROLE OF GEOGRAPHY IN OUR NATIONAL PLANNING

THE COMPARATIVE AGRICULTURAL GEOGRAPHY OF BARBARY (FRENCH NORTH AFRICA) AND THE PUNJAB (P) WITH SPECIAL REFERENCE TO THEIR COMMON PROBLEMS*

BY

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Introductory.- This study of the agricultural geography of Barbary as a largely semi-arid part of the Mediterranean Region was made side by side with comparable aspects in Punjab (P). It represents an attempt to look at the problems and distribution of crop-production in these regions from a fresh angle by interpreting them in the light of the common features of their physical and human background. While no effort has been made to force the individual pattern of these wide-apart regions into any identical mould, the community of many of their problems has been demonstrated on the basis of a first hand survey.

The Boundaries of Regions Studied.-Barbary comprises the three French territories of Tunisia, Algeria and Morocco which are referred to in French literature simply as North Africa (Afrique-du-Nord). The region has been called "Maghreb" by the Arabs meaning "The West". Both the French and Arabic names are unsuitable because while North Africa, as understood geographically embraces the entire region from Egypt to Morocco North of the Sahara, the Arabic term is simply a historical reminder of the fact that the region comprised the westernmost part of the Islamic countries and was also considered to constitute the western extremity of the known land mass. The name Barbary belongs to the region by ancient tradition and is derived from the dominant race-the Berbers. Its use is sometimes extended to cover Tripolitania, but throughout this study, it shall be applied to the region which covers the Protec-

* This is first of a series of articles based on the thesis submitted by the author to the University of Edinburgh for the Degree of Ph.D.

torate of Tunisia, Algeria north of the Saharan Atlas (comprising the three departments of Algiers, Gran and Constantine) and French Morocco. These territories constitute a geographical entity being linked by the Atlas ranges which dominate their relief. They lie between 28° and 38° N. latitude and between 11° E, and 12° W. longitude. Their areas are as follows :-

Tunisia	...	48,332 sq. miles.
Algeria	...	80,117 "
Morocco	...	154,375 "
		282,824 sq. miles

The Saharan parts of Morocco and Tunisia have also been excluded so that the Barbary of this study is bounded on the north and east by the Mediterranean, on the south by a line along the southern edge of the Anti Atlas and Saharan Atlas ranges continued in Tunisia along the north of the great Shotts (Jerid and Ferjaj) and on the west by the Atlantic Ocean. Out of the region thus bounded, Spanish Morocco has been excluded.

Punjab (P) consists of that part of the former British Indian Province of the Punjab which after the partition of the sub-continent of India in August 1947, has become a part of West-Pakistan. It has an area of 62,046 sq. miles and lies between 28° and 34° N. latitude and 69° and 76° longitude east of Greenwich. The latitudinal range of Barbary and Punjab (P), it may be noticed, is similar.

The Physical Bases of Comparison

Superficially, Barbary and West Punjab appear to be regions of contrast, the former largely mountainous with a Mediterranean climate and the latter consisting of an alluvial plain having a monsoonal climate. The contrast in orographic features is very real and has far-reaching effects on the amount of Cultivable land as well as on other aspects of the physical and cultural landscape. It is in climatic aridity that a striking parallel exists and from the agricultural point of view this factor is of supreme importance.

Certain similarities in the geographical position of the two regions may be indicated. Both Barbary and West

Punjab lie in warm temperate latitudes on the fringes of great hot deserts, the Sahara in the case of the former and the Thar Desert in that of the latter. In both cases, the desert has constituted a real barrier between the peoples to their south and the north. The races of Peninsular India differ almost as much from those in the Punjab as the negroid races of Tropical Africa from the Semites and Hamites of Barbary. The position of the two regions at the two extremities of a continuous block of Muslim countries is also of interest culturally. That the two regions might come closer economically was foreshadowed by the participation of representatives from Barbary in the Islamic Economic Conference at Karachi held in December, 1949.

Agriculturally, the main inherent weakness of the two regions has always been climatic aridity and as climate is the one element of natural landscape that is readily adaptable to quantitative analysis, a closer examination of this parallel can be undertaken.

Two original maps of Barbary and West Punjab have been drawn on the basis of DeMartonne's index of aridity $Ar = P: (T + 10)^*$ According to this formula, indices below 5 characterize the true deserts. In Barbary, the aridity line of 5 practically coincides with the southern limit of the areas to be studied. In West Punjab again, only a small region to the south-west has an index of below 5. It is striking that in both regions, the indices of aridity range from 5 to over 30, the areas having an index of over 30 covering limited tracts in the north. In both regions, the greatest developments in irrigation have taken place in areas having an index of below 20. The influence of the more complex relief in Barbary is reflected in the trends of the various lines of indices. DeMartonne's formula is based on a simple combination of rainfall and temperature. Some of the well-known classifications of climate which derive their basis from a more refined and elaborate treatment of meteorological data may also be applied. According to Koppen's classification a large part of West Punjab has a hot steppe climate with a dry winter (BShw) while southern Barbary has a "hot steppe climate with a dry summer" (BSHs). In Thornth-

* E. DeMartonne "Regions of Interior-Basin Drainage", G. R. Vol. 17, 1927. These maps are to be reproduced with a subsequent article.

waite's classification the distinction has again been made between the summer and winter incidence of the dry periods in Barbary and West Punjab respectively otherwise large areas in both are included in the DB (Temperate steppe) zone. Both Koppen and Thornthwaite accord northern Barbary a more humid regime than any parts of West Punjab. This is because of the factor of evaporation is measured indirectly. Rainfall in West Punjab occurs in summer, a period of high temperatures so that it is less "effective" than the predominantly winter rainfall of Barbary. These observations on major classifications are made from small scale world maps and it is probable that the parallel would be closer if the respective formulas of Koppen and Thornthwaite were applied in detail. New refinements are continually being evolved with regards to the classification of climate and the availability of evaporation data would certainly facilitate a more definite comprehension of the real water requirements of crops in relation to the losses of moisture by evaporation and transpiration as determined by climate.

The climatic parallel may be summed up as follows :-

- (a) Both regions show a passage from humid and sub-humid conditions in the north through a broad semi-arid belt to desert conditions in the south.
- (b) Both regions have a pronounced periodicity of rainfall with a long season of drought occurring in the summer in Barbary and winter in West Punjab. Periodic drought and the insufficiency of total rainfall combined with high temperatures and consequently high evaporation are the main climatic hazards for agriculture in both regions. Apart from necessitating the development of irrigation and dry farming, high evaporation is responsible for the occurrence of many handicaps in the constitution of the soil--limestone crusts and salinity. Soil erosion is precipitated in both regions by the occurrence of rainfall in heavy showers during short periods. The climatic similarity is also reflected in the most important annual crops grown, these being wheat and other cereals.

Cultural Factors,—Agriculture and the associated modes of life are an aggregate of cultural as well as physical factors. It is in their cultural background that the two regions resemble each other most closely. Historical influences, present life and culture have all combined to produce a similar system of land-ownership and tenures and fundamentally identical problems with regard to the size and sub-division of holding; the traditional cultivation methods and the attitude to progress.

The history of both Barbary and West Punjab is a long tale of foreign invasions ending in the establishment of a European power. The impact of the west on these essentially eastern countries has had important repercussions on the increase of population, the improvement of communications, the linking up of their economies with that of the world and finally, most important of all, a slow evolution towards improved crops and production. In both regions, present life and culture is based on Islam, a religion which stands apart from all other creeds in the completeness with which it permeates every institution of a society and the enduring and even fanatical devotion to its tenets it inspires. The present native populations of Barbary and West Punjab retain few, if any traces of the pre-Islamic days. Their system of landed property and of tenancy is rooted in Islam and their choice of crops is influenced by religious tradition *i.e.* in their refusal to cultivate vines for wine-making in Barbary. Most of them are not only steeped in tradition, but are also illiterate so that they are resistant to progress as brought by the westerner. Their poverty is their greatest handicap towards the improvement of agricultural standards. Small holdings prevail. Thus the social and cultural problems of Agriculture in the two regions may be said to be identical.

Recent developments in both regions have been initiated by western powers. The French policy in Barbary and the British policy in West Punjab up till 1947 can be broadly compared and contrasted in this study in their relative success in improving the standards of agriculture. One important result of the influence of the West has been that the modes of life have been in evolution. The development of canal irrigation in West

Punjab has spread sedentary agriculture to all parts of the province. A slower, but nonetheless sure movement in the same direction has been in progress in Barbary though its cause is more the acquirement of land by Europeans than any comparable development in irrigation.

Scope and Limitations.- The physical and human back-ground has been studied and special attention has been paid to comparative aspects related to agriculture. European colonization in Barbary comes in for detailed discussion on account of its overweening importance in present-day agriculture and its impact on the native cultivators. Then follows an account of the outstanding agricultural problems, these including water-logging and saline lands, soil erosion and dry-farming. Thereafter the production of various crops has been treated. The agricultural regions of Barbary have been delimited in the final part on the basis of extensive field work. The micro-geographical account of several regions constitutes the important result of this work.

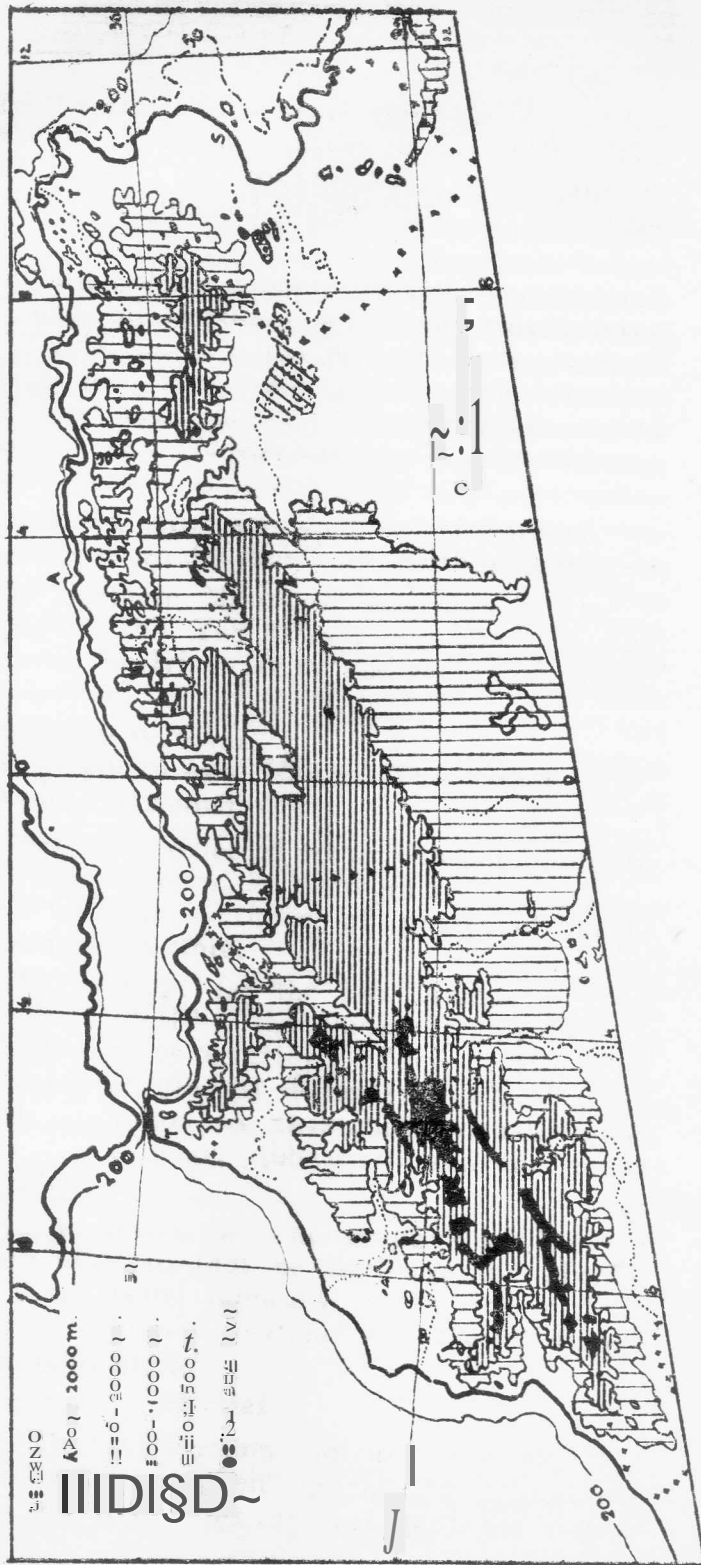
Throughout the following articles, the emphasis shall be placed on Barbary which was the region studied in the field and on which a large proportion of documentary research was carried out. The Punjab (P) stands, as it were in the back-ground. As the object of this work was to throw light on the problems of West Punjab through a comprehensive study of a kindred region, this arrangement appears to be the only appropriate one. For a detailed account of the agricultural geography of Punjab (P) the learned thesis of Dr. K. S. Ahmad, "The Agricultural Geography of the Punjab" * parts of which have been published as articles in the various Indian Geographical Journals stands as a work of monumental scope.

Structure and Relief

Barbary constitutes a compact geographical unit and consists of a massive "island" of elevated ground wherein mountainous topography is dominant. West Punjab, on the other hand is a segment of the great Indo-Gangetic Plain and only a sixth of its area has a hilly landscape, this being the Potwar Plateau in the north-west. This plateau has features comparable to the characteristic relief of Barbary. Similarly the extensive plains of eastern

*Submitted to the London University for the degree of Ph.D. 1938.

BARBARY - RELIEF



predominance of vertical movements which are responsible for the absence of any coastal plains in the north. The high Plateaux between the two mountain zones mark the region that was not affected considerably by the latter orogenic phase.

The denudation of the mountains and the deposition of sediments since the Alpine phase have resulted in the formation of alluvial plains and valleys and the integration of inland basins into river systems. The most extensive coastal plains have been formed in western Morocco and Eastern Tunisia. The Quarternary Ice Age affected only the highest mountains.

Summing up the structural features of Barbary, we get the three well-known divisions from north to south :-

1. The Northern Mountain System consisting of the Riff and Tell Atlas ranges and including several lowlying plains and valleys of alluvial formation.
2. The High Plateaux.
3. The Southern Atlas Ranges (The "Great Atlas" of older accounts).

This zonification is reflected not only in relief but also profoundly affects the climate, hydrography and vegetation and in the ultimate synthesis, all phases of human activity, including agriculture.

Punjab (P).-Except for the few Archaean fragments of the Kirana Hills, the Punjab plains have a remarkably homogeneous structure. They consist of an immense thickness of alluvial deposits in which sandy and clayey beds alternate. A distinction is usually made between the older alluvium (bhangar) and the newer alluvium (Khadir).

The Potwar Plateau with its bordering ranges shows a structure comparable to that of Barbary, the Murree Hills to the north being intensely folded, the plateau itself showing a syndinal formation while the salt Range has acted as a stable block.

Relief

The physical sub-division adopted for the low regions take into account their agricultural importance and their individual role in the rural set up of the respective areas.

is drained by the Sebu river and its tributaries. The richest parts of the region are the Fez-Melmes plain occupying a lacustrine basin and the Gharb plain.

-) The Atlantic Lowlands :-This is a coastal plain extending from r~abat to Magador and bordered on the east and south east by a limestone escarpment. . Across it lie the lower courses of the Bu l\egreg, the Um-er-Hbia and the Tensift, the most important rivers of central Morocco. The plain is broadest in the centre and narrows down towards the north and the south.
-) The Moroccan Meseta.-Consisting of several massifs and the plains of -Tadla and Haouz lies between the middle Atlas and the Atlantic Lowlands, being bordered in the south by the High Atlas. The region is so called because of features comparable to the Spanish Meseta.
-) The middle and the f;Jigh Atlas separated from each other by the long north to south Muluya valley may be considered together. . The middle Atlas is the principal watershed of Morocco and gives rise to the largest rivers of Barbary, the Um-er-Rbia and the Sebu.
-) The Sus valley lies between the High Atlas and the Anti-Atlas to its south.

Western Algeria :-In vWestern Algeria, the mountain system the Tell Atlas can be divided ~rnating east-west zones of mountains and valleys. in this region is characterised everywhere by a variety and extreme youth, The following five bands of relief may be differentiated :-

- i) The coastal mountains including the Sahel of Gran and the massifs of Dahra and Miliana.
- i) The Northern Plains and Valleys include among others the plains of Habra and Sig and the Shelif valley.
- i) The Median Chain extends from the mountains of Beni Snassen in eastern Morocco to the massif of vVarsenis.

is drained by the Sebu river and its tributaries. The richest parts of the region are the Fez-Melmes plain occupying a lacustrine basin and the Gharb plain.

(ii) The Atlantic Lowlands:- This is a coastal plain extending from Rabat to Magador and bordered on the east and south east by a limestone escarpment. Across it lie the lower courses of the Bu Regreg, the Um-er-Hbia and the Tensift, the most important rivers of central Morocco. The plain is broadest in the centre and narrows down towards the north and the south.

(iii) The Moroccan Meseta.-Consisting of several massifs and the plains of Tadla and Haouz lies between the middle Atlas and the Atlantic Lowlands, being bordered in the south by the High Atlas. The region is so called because of features comparable to the Spanish Meseta.

(iv) The middle and the High Atlas separated from each other by the long north to south Muluya valley may be considered together. The middle Atlas is the principal watershed of Morocco and gives rise to the largest rivers of Barbary, the Um-er-Rbia and the Sebu.

(v) The Sus valley lies between the High Atlas and the Anti-Atlas to its south.

II. *Western Algeria* :-In Western Algeria, the northern mountain system the Tell Atlas can be divided into alternating east-west zones of mountains and valleys. Relief in this region is characterised everywhere by a great variety and extreme youth. The following five narrow bands of relief may be differentiated :-

(i) The coastal mountains including the Sahel of Oran and the massifs of Dahra and Miliana.

(ii) The Northern Plains and Valleys include among others the plains of Habra and Sig and the Shelif valley.

(iii) The Median Chain extends from the mountains of Beni Snassen in eastern Morocco to the massif of Varsenis.

(iv) The southern Plains occupy tectonic depressions converted into high plains by alluvial deposition. Among these are the plains of Marnia, Sidi bel Abbes and Mascara.

(v) The Southern Mountains border the High Plateaux.

To the south, the High Plateaux cover a vast expanse from the Muluya valley to the Hodna depression which borders vWestern Algeria in the south east. They are undulating high plains 3,000-4,000' high with an occasional low range to break the monotony. The centre of the plateaux is occupied by several great ephemeral saline lakes known as Shotts. The arid cycle of erosion can be studied in many of its features in this region.

The *Saharan* Atlas bounds the plateaux on the south and consists of several discontinuous mountain ranges that often exceed 6,000' in height. It presents a precipitous slope towards the Sahara.

II i. *Eastern Algeria* :- In this north-south segment, the Tell and the Sharan Atlas ranges tend to merge and there is no clear zonification into bands of mountains and valleys as that noticed in the West. On its two extremities lie the extensive and marshy plains, the *Mitija* in the West and the *Bone* plain in the east. Between these lie the crystalline massifs, of *Kabylie* of which the Jurjura range rises above 7,000 capped as it is by a limestone ridge.

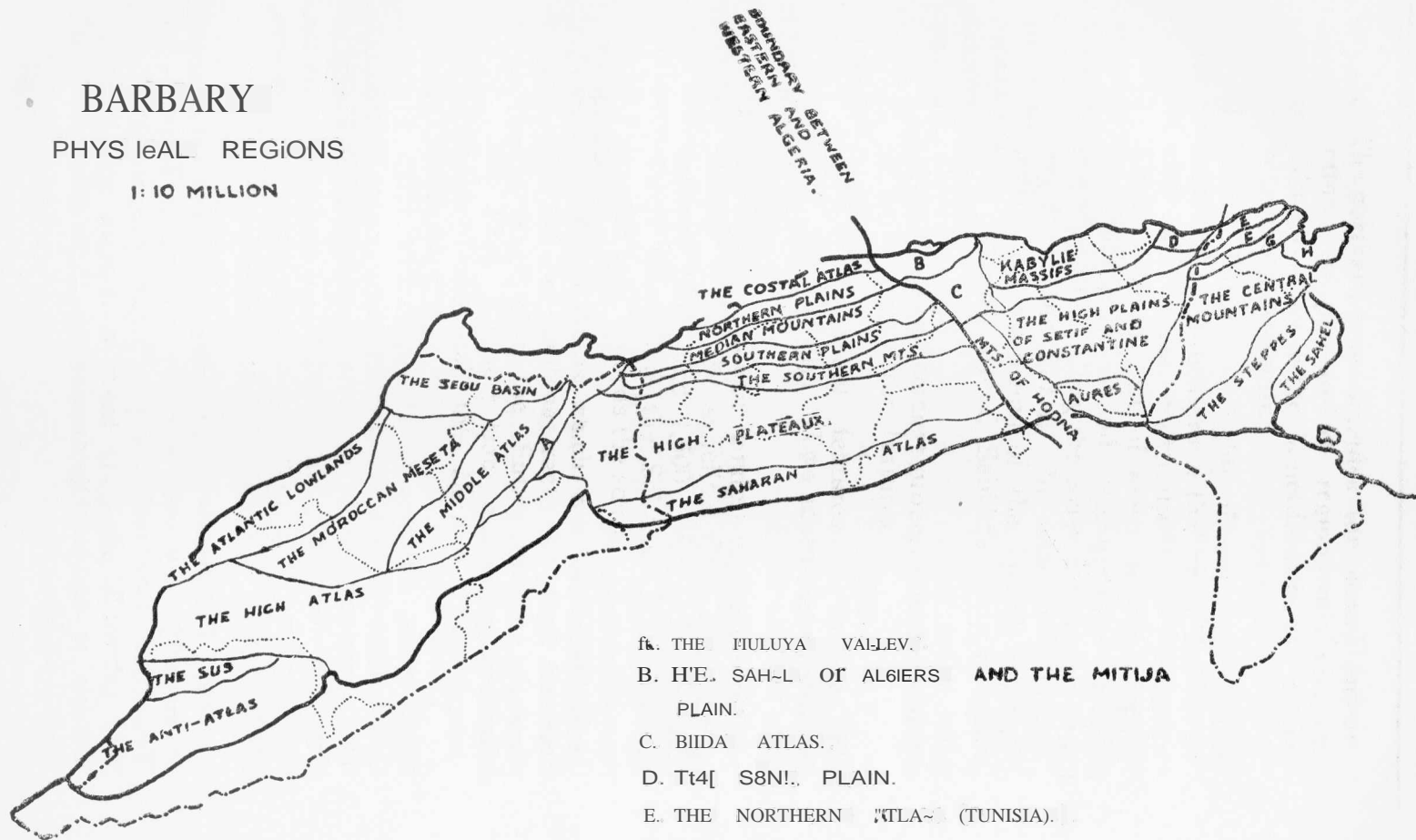
To the south of these sub-regions lie the ranges of Blida Atlas, Biban and Hodna. The High Plains of Constantine further south have several small "Shotts". Their continuation in the west form the High Plains of Setif and Mejana. The folded massif of Aures forms the southern limit of Eastern Algeria and contains the highest peaks of Algeria, many of them exceeding 7,000'.

IV. *Tunisia* :-Of the three broad structural zone~ of Barbary only one is really present in Tunisia-the Tell Atlas. Lowlands occupy a higher proportion of the area (above 80 per cent) than in Algeria and Morocco. Tunisia is customarily divided into three zones, northern, central and southern.

BARBARY

PHYSICAL REGIONS

1:10 MILLION



- A. THE MULUYA VALLEY.
- B. THE SAHARA OF ALGIERS AND THE MITIJA PLAIN.
- C. BIIDA ATLAS.
- D. THE SÉNIA PLAIN.
- E. THE NORTHERN ATLAS (TUNISIA).
- F. THE SUSA REGION.
- G. THE MEJERDA VALLEY.
- H. THE REGION OF TUNIS.

(i) The northern zone includes the coastal mountains, the plateau-like region of Beja, the alluvial valley of the Mejerda and the varied region around Tunis.

(ii) Central Tunisia is highly mountainous in the west where it comprises the main Tell range and the chains constituting the Tunisian Dorsal. South east of these lie the *Steppes* in which parallel and discontinuous chains rise abruptly. Along the coast lies the lowlying region of the *Sahel*. In spite of its coastal location, it is a region of the inland drainage and contains several *Sebkhas* (lowlying saline lakes).

(iii) Southern Tunisia belongs properly to the Sahara by virtue of its desert features.

Punjab (P).- The relief features of Punjab (P) may be passed over briefly. Two main regions can be differentiated :-

(1) The Potwar Plateau comprising the folded Murree Hills, the synclinal Soan Basin lying between 1,000 and 1,500 feet and the Salt Range which like the Sdharan Atlas has a scarp face towards the south.

(2) The Punjab Plains which can be sub-divided into the *Sub-montane* tract, the *East Central Plains* between the Sutlej and the Jhelum the *Thal*, a desert tract occupying the Sind Sagar Doab and the *Derajat Tract* across the Indus.

THE DISCOVERY OF DINA*

BY

FAZLUR RAHMAN, DEPTT. OF GEOGRAPHY, LAHORE.

Away from the madding crowds of urban agglomerations, there is a small dot on the map of Pakistan and against it Dina is printed. It is a small village 11 miles northwest from Jhelum in the Punjab. The village was selected for surveying this year. As we approached the banks of the Jhelum, we became aware of a radical change in the general topography. The unending plain and monotonous flatness of the central Punjab Plains began to give way to a confused medley of hillocks and hollows. To the northwest we got the first glimpse of gaunt outlines of the Salt-Range. Northwards we entered a country of stony moorlands. The nearer we reached our destination the clearer became the mountains in outlines like images in a telescope lens shifting slowly into focus. Badland topography attracts one's attention in the neighbourhood of Dina. Deep gullies presenting a dissected landscape due to sheet and gully erosions have effected large areas.

Wherever we raised our eyes we saw hills and found ourselves encircled by hills situated near the horizon and it seemed that Dina was surrounded by a ring of mountains.

The area that we covered has a wide variety of orographic features, a healthy climate, a very close relationship between landforms and the biological response. The area is a part of the plateau known as the Potwar. On the north the Kalachitta range stand out silhouetted against the distant Pir Panjal. In the distant north-west, the Salt Range extend in an irregular arc. Kalachitta (Black and white) is formed of two portions which are of different character and appearance, which explains the nomenclature. Nummulitic limestones predominate. Primarily it is a land of rocks and ravines. There is an extensive deposit of gravel sand and silt. The soil is rather light brown alluvial clay often containing "Kanker" and passing

*The article is a description of the area surveyed by the sixth year students together with a brief account of their activities during their stay at Dina-Editor.

in some places to fine silt.. Beneerth this, there is rt mass of sandstone and sand, enclosing boulders of large sizes. These boulders are not confined to pabble beds-many have been observed embedded in fine silt. The size of the blocks and the distance to which they have been transported have induced several observers to attribute the transport of the ltrger masses to glaciation. The area may haye been a lacustrine basin in the Post Tertiary.

In a land of such a topography the sustenance has to be drawn from rock, ravine and hill-and bullock and ploughman have to pick their way uneasily between boulders and stones.

Geographical conditions mould a people's destiny although at rare intervals economic or political usage makes man overthrow his environmental handicaps. Here, the climate is the best in Punjab rnd the system of irrigation, the worst.. The one b<l.lances the other.. The almost entire absence of irrigation-there is not a single canal-makes life a stern struggle with nature. Man has to fight hard to adjust his life to the environant.

Here, the soil is one of vital resources and the majority of the population of the vill<l.ge depends on soil for their living. The soil of the area is a fertile clayey alluvium and is capable of producing anything provided there is a good supply of water. The local people have their own classification of soil and divide it into six different kinds. They are "Hall," "Baraniawal", "Mehra", "Hakkar ", "Banjar-Qadeem" and "Ghair-Mumkin". Because of erosion, the top layers are liable to be removed. No fertilizers are utilised except some manuring in the soil "Hall" which is cultivated most. It is alluvial and is flooded by 5streams. The second ie, "Baraniawal" is capable of retaining moisture. "l\lehr<l." is calcareous and only grains and oilseeds are grown on this soil.. "Rakkar" is mostly waste land, top layer has been removed. The "Banjar-Qadeem" and "Ghair-Mumkin" are practically useless and nothing is grown on them. Some vegetables are grown on "Hall" with the help of well-irrigation and these vegetables are for k'cal consumption. They harvest two crops-Rabi and Khari£.. In I~abi season, the crops are wheat, barley, grams and oilseeds, while Kharif crops are bajra, jowar, maize and some rice near wells. In early November, patches of young wheat as green as emerald

attract one's attention. In the surrounding of Dina and especially towards Mangla, the soil is fertile and we observed American cotton fields, which were irrigated by wells.

The giant of soil erosion stalks along the fields of the area and the fields subjected to serious erosion have been rendered almost uncultivable. Extensive areas have lost their fertility by the formation of a network of ravines. The soil is usually protected by vegetation against the disintegrating effects of winds and rain. As soon, however, as the vegetation is removed, the soil is exposed to wind and rain, making it useless for cultivation by scooping out the ravines. The depletion of the soil, its deterioration and inadequate replenishment is going on over wide areas and is responsible for throwing out of use many lands. Reckless afforestation, unlimited grazing and floods, regime of rain in heavy showers concentrated in a small period add to the damage by removing top layer.

To study the agricultural problems of a nearby village we organised a land utilization Survey of Muflian. Though for many of us it was a relief from the grotesque instruments perched on three legged stands from the reading of verniers, which became all the more impossible for one of us, who got his spectacles broken and from the tiring job of carrying the levelling staffs, yet it was with a heavy heart that we bid good bye, to the rounded hillocks studded with small bushes which provided us with "non-serious eating in between the meals" in the shape of berries and to the temporary nomadic life that we led on them.

Land Utilization Survey will serve a very useful purpose in our national planning and is in fact the only solution of our varied agricultural problems. We studied the environmental conditions of the village Muflian, the type of the land and nature of the soil, climate, water supply and water table, population, its social and economic structure, and we collected some data like dates of sowing and harvesting, the number of cattle, ploughs and carts. We tried to know in the words of Dr. (azi S. Ahmad, "how they are using, or for that matter, misusing the land at their disposal" ?

It was during this Land Utilization Survey that we came to know more about the people of the place. We

saw them nearer to their hearth, home and field. We heard them telling us their varying conditions in heat and cold, drought and flood, abundance and want. The climate is dry and with its extremes of heat and cold, is largely accountable for the sturdy physique of the people. This natural gift of physique has made the people famous in the war-fields of the world. Ignorant as the average native the average man has all the virtues of a life spent in constant battle with the forces of nature. Life is hard, plain and rugged. Like all who live in primitive surroundings, the people are hospitable to strangers. However meagre their meals they will invite an outsider to share. "Look at the welcome in our eyes", they seem to say "and not the hardness of the coarse bread before you". Those to whom the fields have no attraction laugh their ways into the army recruiting offices.

To three things the villager is passionately attached—his religion, his family and his land. Ignorant as he is, he has become superstitious and believes in 'Pirs' and 'Mureeds' and there is what is known as 'Mazar' of Maqbool Shah Pir which is a favourite haunt of many a needy person. And for one thing the villager cares nothing at all—politics, though he is interested in the country's affairs—and the speeches of the leaders. This is due to the lack of good education, which enables one to worry about things in all parts of the world. Although twenty percent of the people are well versed in religious knowledge, only ten percent of the people are educated in the modern sense. The Ishmia High School Dina, provides education upto tenth standard.

The railway has brought the modern world to the villager's gate and the ideals of the Muslim League with the pollen of new ideas have percolated through its narrow and twisting lanes and in the dark and intimate evenings when the day's toil is done, and men gather together to smoke the "huqqa" and exchange the latest gossip, the talk is no longer centred on crops, cases and neighbours.

Medical help is practically lacking and malaria attacks are common. YeClrs back Voltaire said, "A physician is one who pours drug, of which he knows little, into a body of which he knows nothing". And the masses have been exploited by the village rowdy quacks, to whom the statement is applicable.

The women of the village do not observe 'purd~\h'. In the execution of their outdoor work they move about in the streets of the village quite freely. There are no refugees in village Muftian and ever before the partition, it was mostly inhabited by Muslims.

\Jinds need rotation like the crops and so after the completion of the said land utiliz~tion survey, we decided to take a day off from Dina and do a bit of surveying, in Azad Kashmir Territory near the Upper Jhelum Canal Headworks.

During all these nights we were burning midnight oil for plotting and calculations. Most of us are used to consuming the midnight current and this midnight oil had a slackening effect not only on us but also on our calculations so much so that the values we sometimes got were very much less than the actual "alues! To keep us up hot tea was there every night after dinner but some times achingly cold tea slipped in ~:IIIIdomnivoruous as we had become by that time we swallowed it too.

The morning after finishing the land utilization survey, we started for Mangla. Early in the morning after the frugal fare of one half-boiled egg, tea and the like, we got into the truck, the driver of which was very obliging and had a keen sense of humour. \Ve negotiated our way through clouds of dust towards the Jhelum. On the way the driver complained that the ro;td map tells a lll.torist everything he \Velnts to know except h~w to fold, it up again.

After cros~ing the Mangla Headwnrks we climbed rather crept upwards to Mangla Fort (as a c:Iterpillar creeps) to get a commanding view of the Jhelum. Here the Jhelum is a mountainous stream hemmed in by the hills of R,w:tlpindi on the right bank and of Mirpur and Jhelum on the left bank. From Jhelull1, the river is of usual normal plain type, water spreads out and becomes shallow, the speed is checked and materials in suspension are deposited in the plains. The Jhelum is used for floating timber from forests up in the mountains. Near Mangl<t it debouches from the hills and becomes a braided river. Sandly islands called "bheels" stud its wide *bed*. This visit to Mangh rounded up our short stay at Dina.

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