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(*See inside of the back cover.*)

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GEOGRAPHY THROUGH THE AGES

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A perspective on the history of any field of learning is essential to proper understanding of the nature and scope of that field. This statement cannot be better elucidated than in the following words of Wooldridge, the noted British geographer :

> "The University teacher of any subject must necessarily and properly require of himself some measure of continuity and direction in his teaching and research which may give coherence to the whole."

Geography cannot be an exception. It is oldest of all the sciences and contains the largest single body of factual information. It is claimed to be 'mother of sciences' and indeed geographers make use of materials and methods of almost all other physical and social sciences. No other science provides a more graphic record of man's quest for knowledge and his attempts to gain control of his environment than geography. The history of geography as a matter of fact forms an integral part of the history of human race and its civilization. Thus the study of the subject in its historical retrospect, and a knowledge of its methodological and conceptual development acquire a special significance.

This is all the more important in our country when we realize that here geography still remains relatively less understood and less developed. For us it is more than necessary that we keep constantly looking backward and forward. Looking backward will help us determine the degree and rate of our progress and the correctness of our direction. Loking forward will enable us to visualize the possible trends in the development of geographical knowledge.

I have, therefore, taken upon myself to present in this address a picture of the historical development of the geograhpic thought and also show as to how from the very beginning of human history, geography has played a significant role in revealing the world of nature

Presidential address delivered at the First All Pakistan Geography Conference Karachi, January, 1964.

and extending the bounds of knowledge in various phases of human society and the way it has served as a background for determining the policies for national planning and government.

In an attempt to provide a meaningful perspective, the entire course of history has been divided into ages and periods. Each division implies some distinctive character and development of geographical thought.

ANCIENT GEOGRAPHY

Man's curiosity about things around him is inborn. He must, therefore, have begun gathering facts about places from the very beginning of civilization. Each of the most ancient civilizations which grew up on the plains of the Euphrates and Tigris, the Nile, the Indus, the Ganges and the Hwang formed a centre whence the neighbouring lands were explored to a certain extent. However, these civilizations were local in character and comrcial relations, the precursors of geographical knowledge were practically unknown.

The shores of the Mediterranean with the main cradles of mankind in and around it to which we can trace the beginnings of commerce, are the natural starting point in our enquiry.

The people who are considered to be the first depositories of geographical knowledge were the Phoenicians who lived in Syria, on the high-way between Babylonia and Egypt. They had a remarkable aptitude for maritme enterprise and were great leaders in geographical exploration. They were great traders, navigators and colonisers. They founded many trading stations beginning at about 1200 B. C. Their greatest colony was Carthage. They, however, kept all the geographical information obtained by them as secret and almost the whole of it is lost to us.

It is in the Greeks that we find the first geographers whose works have been handed down to us providing a bedrock foundation of geographical knowledge. The Romans followed them.

The Greek Period : *Speculation and Measurement*

The Greeks, who succeeded the Phoenicians, made a material contribution to the growth of geographical knowledge and are thus considered to be the pioneers of geography. Theirs was a golden age of geography as that of philosophy. The foundations of geography were well and truly laid by them. Unlike the Phoenicians, the Greeks allowed the observations made during the military campaigns and the knowledge gained through the spread of trade and colonies freely to disseminate. The Homeric poems give some idea of the chorographical knowledge of the lands bordering the Aegaen sea and beyond it. The

Greeks excelled in speculations and measurements. The early Greeks viewed the world as a flat circular disc divided by the Mediterranean into two parts, Asia and Europe. A great ocean river ran around the circumference connecting the sea.

The term 'Geography' itself was used for the first time by the Greeks (Aristotle or Eratosthenes), meaning all aspects dealing with the description of the earth. The first geographical theories to affect the western world were those evolved or at least first expressed by the Greeks, and most of the main branches of geography were established by them.

In this early period Miletus in Greece became the chief centre of geographical enquiry; and the philosophers of the Ionian School, of which that city was the head-quarters, availed themselves of the knowledge thus obtained to aid their speculations on the shape, size and nature of the earth.

Thales of Miletus (640—540 B.C.) is regarded as the founder of Greek physical science and philosophy. He is claimed by some as the first exponent of the idea of a spherical earth; but by others it is said that he regarded the earth as floating on water, the movement of which was the cause of earthquakes. He also knew how to forecast eclipses.

His disciple, Anaximander (580 B.C.) of Miletus, put forward the theory that the earth had the figure of a solid body hanging freely in the midst of the universe. He thought that the world was round and not flat. He also introduced a primitive kind of sun-dial. He was the author of one of the most important steps in geographical science by being the first person to publish a map of the earths surface with the boundaries of the countries and the leading features upon it.

Pythagoras (b. 582 B.C.) and his immediate followers were the first to introduce a cosmical philosophy somewhat more approaching the truth. According to the Pythagorean system as explained by Aristotle (ascribed by some to Philolous b. 480 B. C. and follower of Pythagoras), the earth was a sphere which was not situated in the centre of the universe, but in common with the sun, moon and planets and the fixed stars, it revolved around a central fire which occupied the middle point of the whole system. According to another version, Pythagoras believed that the earth was round and fixed at the centre of the universe with the sun, stars and planets moving round it. The Pythagoreans were also the originators of the idea of the rotation of the earth.

Hecataeous of Miletus who lived about 500 B. C. is considered by Tozer as the father of geography. His book entitled *Periodos* is the earliest known work on geography. It is a general survey of the inhabited world known at that time on a regional basis. In it we have the beginnings of regional geography.

Parmenides (b. 450 B. C.) suggested the division of the sphere into parallel zones of climate, a torrid zone uninhabitable for heat, two frigid zones uninhabitable for cold and two intermediate temperate zones fit for human occupation.

Herodotus (484—425 B. C.), the father of history, was the greatest of the travellers of ancient times. Although he was primarily a historian, he had a full sense of the value of geographical setting, and in his writings of history was able to add considerable knowledge based on personal observation and enquiry to the geography of lands

Plato (427—347 B. C.), the Athenian Philosopher, laid the foundations of human geography when he blamed the sea for its influence upon men, making them unfriendly and faithless toward fellow citizens and neighbouring states. Ponticus, an associate of Plato, taught the rotation of the earth on its axis, though still regarding it as the centre of the Universe.

Aristotle (384—322 B. C.), a pupil of Plato, had the distinction of founding scientific geography. He proved that the earth was a sphere by (*i*) the circular shadow thrown on the moon during an eclipse, (*ii*) the shifting of the horizon as one travelled and the appearance of new constellations or the disappearance of familiar stars as one travelled from north to south and (*iii*) the tendency of matter to fall together towards a common centre. He was also the first person to define the Torrid Zone by the Tropics and the North Temperate Zone by the Arctic Circle. He believed both the zones to be habitable. He gave great impetus to mathematical geography.

Aristotle was conversant with many facts of physical geography such as the formation of deltas, coastal erosion, earthquakes and volcanoes and to a certain extent the dependence of plants on physical surroundings. He formed a comprehensive theory on the variations of climate with latitude and season and was convinced of the necessity of the circulation of waters between the seas, oceans and rivers. Most of his opinions on mathematical and physical geography are contained in his *Meteorologica*. Aristotle speculated on the differences in the character of races of mankind living in different climates and correlated the political forms of communities with their situation on a sea-shore or in the neighbourhood of steep slopes serving as strongholds, the former favouring democracy and the latter oligarchy or monarchy. He thus introduced some basic concepts in human and political geography. In his *Politics* there are general reflections on the influence of strongly marked natural features and geographical position on the history of nations and of the world at large, thus laying the foundation of historical geophraphy.

Alexander (356—323 B.C.), the greatest conqueror of all times, was also a great explorer. There was an extraordinary expansion in geographical knowledge as a result of his campaigns and expeditions. A large part of south, central, south-west Asia and Egypt was explored. These expeditions were of the greatest importance both in general and regional geography.

Theophrastus (372—287 B.C.), a pupil of Aristotle, carried on the master's work on meteorology, studied rocks and soils and wrote the 'History of Plants' dealing with the habitat of the different trees and shrubs. He examined the relation of plants to climates which marked the beginnings of Plant Geography.

Eratosthenes (276—194 B.C.) determined the figure and dimensions of the earth, the extent of the inhabited world or Oikoumene and the positions of chief parallels and meridians that intersected it. He paid special attention to reforming the map of the world as it had existed down to his time and to its reconstruction upon more scientific principles. For this great work he is justly called the father of systematic geography. Mathematical geography developed by Thales, Anaximander and Aristotle reached its zenith with Eratosthenes, and therefore he is sometimes called the founder of mathematical geography. He was the first who had attempted scientifically to determine the circumference of the earth. His geographical treatise has been divided into three books which deal with (*i*) the progress of the study of the subject to his age (*ii*) mathematical and physical geography and (*iii*) projection of his world map and descriptive geography, the last including topography and natural production of the countries and the races that inhabited them.

The Roman Period : *Encyclopaedic and Chorographic Tradition*

The Greeks actually established all the important branches of geography and were quite scientific in their work. The Greek period of natural philosophy was followed by the Roman period when the geographical thought was more dominated by the utilitarian spirit of the Romans than the philosophical spirit of the Greeks. The Romans were primarily concerned with commercial and administrative problems and plans for military conquest. The two most notable of them are Strabo and Ptolemy. Strabo (64 B. C.—20 A. D.) is a great figure in the history of geography. His *Geography*, comprising seventeen books, is a summary of the knowledge then existing, an encyclopaedia of information concerning the various countries of the inhabited world as known at the beginning of the Christian era. It is a historical geography, and it is a philosophy of geography. Everywhere in his work he introduced the history of a country side by side with its geography. He illustrates the one by the other and tries to point out the intimate connection between the two. Besides this he is fond of tracing the influence of land on its inhabitants. The work also includes a fairly good treatment of mathematical, physical and some aspects of political geography. It will not be improper to quote his famous statement regarding geography, "Geography, in addition to its vast importance to social life and the art of government .... acquaints us with the occupants of the land and ocean and the vegetation, fruits, and peculiarities of the various quarters of the earth, a knowledge of which marks him who cultivates it as a man earnest in the great problem of life and happiness".

Ptolemy (Claudius Ptolemaeus, 150—160 A. D.), the great geographer, astronomer, mathematician and cartographer of the Roman Empire lived about the middle of the 2nd century. As a geographer he was primarily concerned with mathematical geography and cartography. He wrote a book which is now known as the Almagest containing everything that was known about astronomy and trignometry. He constructed 26 maps and a general map of the known world, which was one of the most important maps ever constructed. The 26 maps are in sections and are the first to be drawn with lines of latitude and longitude. The use of these terms appears first in his work.

His maps of Asia and Africa and his notes on latitude were collected in his *Guide to Geography*. These maps led Columbus to believe that he could reach India by sailing west across the Atlanic. The Guide exercised as great an influence on geographical progress as did his Almagest on astronomical. It was the most laudable attempt of the ancient world to place the study of geography on a scientific basis.

The general views of Ptolemy had much in common with those of Eratosthenes and Strabo. The ptolemic system of the universe was based on the spherical form of the earth. But he believed that it was fixed in the centre of the universe with the sun, moon and planets circling round it in great hollow spheres called the heavens. This doctrine was paramount for more than fourteen centuries. In cartography he made a great advance on the work of his predecessors in his system of projections, which in many respects approximate to that of the present day.

As regards his concept of the world, he believed that there were lands to the south and east of Africa and to the north of Europe, all stretching far away beyond his ken. Perhaps, the most remarkable part of Ptolemy's geography is that which tells of the lands beyond the Ganges including the Malay Peninsula and China.

Ptolemy used the word (1) cosmography, to signify the description of the universe (2) geography, the description of the earth as a whole (3) chorography, the fuller description of a small region and (4) topography, the very detailed description of a smaller locality.

The work of Ptolemy was constantly referred to by Muslim geographers.

The Dark Ages : *A Setback :*

With Prolemy the story of ancient geography comes to an end, for long after Ptolemy's time there was no addition to geographical knowledge. There gradually followed the period of time commonly called the 'Dark Ages', which was characterized by a negation of the spirit of enquiry, a dominating feature of the early centuries of the Christian era. After the dismemberment of the Roman Empire during the 4th century, knowledge seemed to remain stationary and exact reasoning based on patient investigation was at a discount. Geography now by degrees passed into the hands of the theologians, and any view involving the least departure from the literal wording of the scriptures was regarded as heresy and punished with utmost severity. Early Christian teaching deliberately avoided pre-Christian geographical theory. The church dignitaries discouraged all scientific and philosophical enquiry. The theory of the sphericity of the earth, which was supposed to be in conflict with scriptures, was denounced as heretical. Greek science gave place to primitive ignorance as shown in the monk's wheel maps. The missionary replaced the traveller and the explorer, but he was indifferent to scientific investigation.

Although Christian pilgrimages to the Holy City of Jerusalem, where Christ had lived, gave rise to a considerable literature down to the 10th century, it is not of much geographical significance. The pilgrims and missionaries being absorbed in their visits to shrines brought back little information of any value,

GEOGRAPHY IN THE MIDDLE AGES

The 'Middle Ages' is defined here as that section of the history of geographic thought in which the Greek tradition of geographical knowledge was revived, tested and furthered to the frontiers of modern geography. The furtherence of knowledge did not take place only by extensive travels and exploration but also by systematic organization of geographical information. This 'age' began sometime in the 9th century A.D., when the muslims rekindled the light of scientific work which had given way to ignorance and bigotry during the Dark Ages, and extends upto the first half of the 18th century, when Kant showed his concern about the status of geography and advocated the inclusion of geography in the overall framework of scientific knowledge.

During these almost ten centuries of the expanse of the middle ages there appears to be three distinct types of works, each specifying a period of its own dominant characteristics. These periods may be termed as The Muslim Period, the European Renaissance and the period of Medieval-Modern Transition.

The Muslim Period : *Travel Accounts and Gazetteer Writing* :

Though geographical knowledge almost died out in Christendom, it was kept alive by the Arabs and other Muslim geographers. The geographical knowledge of the Greeks and the Romans passed to the Arabs who not only preserved it but also improved upon it in certain fields, adding new knowledge and new concepts of their own. In the words of Beazley, "No race has ever shown a greater keeness for the acquisition of knowledge or more favour to the growth of science". Muslim interest in geography was stimulated for a variety of reasons. The chief was the universality of the Muslim empire which extended from the Atlantic ocean to the borders of the Pacific and for a considerable distance down the east coast of Africa. An excellent system of roads and desert routes, the yearly pilgrimage to the Holy City of Mecca, the great development of trade based on the diversity of regions within the empire, the high level of honesty of the Muslim traders and administrative needs of the empire, all contributed to the spread of geographical knowledge.

Apart from the pilgrimage, the zeal for the propagation of the religion of peace (Islam) and unswerving obedience to the teachings of the prophet, the behests of the Caliphs and the military campaigns undertaken, contributed to the growth of geography and other sciences. The Muslims recollected the tradition that "the ink of science was of more value than the blood of the martyrs" and obeyed the command of the prophet "to seek knowledge even in China". So it was that men such as Albiruni or Idrisi had a better knowledge and more adequate conception of the world in general than was possessed by a Christian before the 13th century. The works in historical geography of Albiruni, Albaladhuri and especially of Ibni-i-Khaldun reached new standards in accuracy of observation and in interpretation of the relation of the people to the land. Muslim geographers had started to formulate ideas concerning the uplift of mountains by folding and the erosion of slopes by running water and the great amount of time which these processes require.

It is significant to note that muslim geography did not develop until after the founding of the Abbasid dynasty (A.D. 766) when the caliphate was transferred from Damascus to Baghdad and Persian culture with its strong Greek imprint triumphed over Arabia. It was under the Caliph Almansur (753—775 A. D.) that geographical science began to take shape among the Arabs. Under the Caliph Almamun (died 833 A.D.), the successor of the Caliph Harun Al-Rashid in the earlier part of the 9th century, Arabian science reached its zenith. He created the first true school of geographical science which had been seen since the days of Antonines. The Almagest and Geography of Ptolemy and other works were translated into Arabic. An observatory was founded at Baghdad in 820 A. D., and attempts were made to determine the obliquity of the ecliptic. The circumference of the earth was recalculated, and the degrees were measured. Muhammad bin Musa-al-Khwarizimi compiled a system of the earth after the Ptolemaic pattern, a sort of index of place names, accompanied by its latitudes and longitudes. His works *Shape of the Earth* is of great importance.

In the earlier period the muslim geographers were mainly concerned with astronomical and mathematical geography. Their desert environment brilliantly lit stars and in clear nights helped in the guidance of their movements and the determination of their position. Their religion made accurate determination of latitude and longitude necessary for the construction of sun-dials to indicate the afternoon prayer time and to secure the geographical co-ordinates of Mecca, towards which the face was turned in prayer.

The Muslims perfected the planispheric astrolabe which was used for reading heights of mountains and calculating latitudes and time, and from it was adapted in the 15th century the navigation astrolable as used by Columbus.

The construction of maps and globes reached considerable efficiency during this period. But general cartography does not appear to have reached the same standard as geographical writing.

Works of the gazetteer type and desciption of travels were quite numerous. Travel by land or sea was a pleasant hobby of the Mussalmans, and this was partly due to the central position of Arabia in respect of the three known continents.

Excellent regional description and accounts were published of East, South, South-East, Central and South-West Asia, North and East Africa, Southern Europe and European Russia by various travellers, who are mostly crowded in the 9th and 10th centuries. Two of the leading Muslim travellers Ibn-i-Haukal and Ibn-i-Batuta travelled for about 30 years, and it is estimated that each covered an approximate distance of 75,000 miles.

One of the earliest works of this early muslim period is that of Ibn-i-Khurdadbih, the famous book on routes and Kingdoms (about 850 A. D.). It gives a summary of the main trade routes of Asia and a description of such distant areas as China, Korea and Japan. The beginning of his treatise gives a summary of his scientific views, which are those of a well educated disciple of Ptolemy. The earth, according to him, is round like a sphere and is placed in the midst of the celestical area like the yellow in an egg.

Another geographer of outstanding fame of the same period, Yaqubi (died 897 A.D.) sometimes called the father of Arab Geography, wrote a book resembling a modern gazetteer called *Kitab-al-Buldan* (book of countries) in 891 A.D. It gives details of numerous places and explains the physical and human geography of many areas. He was particularly interested in the statistical and topographical aspects. Al-Istakhri, Ibn-i-Haukal and Al-Masudi are three contemporary notable geographers of the 10th century. Istakhri wrote *Book of Climates* (about 977 A.D.) illustrated with maps. It forms the foundation of the "*Book of Ways and Provinces*" (988 A.D.) by Ibn-i-Haukal which gives a geographical description of the muslim countries, illustrating every region by a map. Al-Masudi, who had travelled over the Muslim World from Spain to China, is famous both as a historian and a geographer. He is one of the most versatile writers of the 10th century and is called the encyclopaedist of oriental geography of his age. His *Meadows of Gold* includes much geographical information. He has given his own map of the world. The size, shape, motion and main divisions of the earth are expounded in a way that even the modern science must recognize as not wholly inadequate.

Albiruni and Al-Idrisi are the two most eminent geographers of the 11th and 12th centuries. They are famous for their wide travels and descriptions. Both tried to make a fusion of ancient traditions and modern knowledge.

Albiruni (972—1050 A.D.) one of the greatest scientists and intellectuals of all times, holds a unique position amongst muslim scholars. He was a geographer, a historian, a geologist, an astronomer and a mathematician. He wrote numerous books and dissertations, of which a large number dealt with geographical matters, including measurement and determination of latitudes and longitudes, and finding distances and co-ordinates of many places, stereographic projection, roundity of the earth and its movements, natural springs, phenomena of tides, precious stones, geology, meteorology and climate. He gives a better idea of the inhabitable world than many of his predecessors and tries to establish interrelations between geographical factors and human affairs.

Al-Idrisi is perhaps the best known Muslim geographer in the west. He travelled widely in Europe, Africa and the Middle East. At the instance of King Roger II of Sicily he wrote a treatise 'Amusement for him who desires to travel round the world', also known as the Book of Roger. He also made a celestial sphere and presented the known world in the form of a disc.

The last of the celebrated Muslim geographers was Yakut (1179—1229), who compiled the famous dicitionary of countries *Mujam-al-Buldan*, which describes in alphabetical order every town and place of which the author could obtain any information.

To the fourteenth century belong two famous Muslim travellers, Ibn-i-Batuta of Tangier (1304—1378) and Ibn-i-Khaldun of Tunis (1332—1406). Ibn-i-Batuta is the greatest of all Muslim explorers. He is known to have visited the lands of every Muslim ruler, apart from other countries such as Russia, Ceylon and China. He gives an able and accurate account of these countries. His work is mainly in social geography. Ibn-i-Khaldun is said to be the greatest historical thinker of Islam. His Universal History with its famous introduction (prolegomena) is a monumental work both in respect of history and geography. His remarkable correlation of environment and human activity in introduction has earned for him a very important place in human and social geography. He traces the effects of both climatic condition and local environment on the physical and mental qualities of different peoples. He studies the distinction between the arid country with nomadic life and cultivable country with settled life. Sprenger rightly said that Ibn-i-Khaldun not only wrote history with sound criticism and imgination but also combined ethnography and geography with it.

Before we close the Muslim period, it seems proper to make a brief mention of the activities of the Vikings or the Norsemen for from about the middle of the 8th century to the 10th century at the same time when the Muslims were expanding the geographical knowledge in the east, they were attacking, exploring and settling in Western, Northern and Eastern Europe and Greenland. Stormy seas off Norway and Denmark favoured the development of ships more sea-worthy than those of the Mediterranean and their mode of life based on the fisheries of the sea rather than on agricultural resources, developed a great spirit of adventure. They were great traders and born explorers. They are credited with the discovery of North America which was accomplished without the aid of the compass. Late in the 9th century Iceland was colonized from Norway; and in 985 A.D. Eric the Red, sailing westward, discovered Greenland; and soon afterwards his son Leif Ericsson voyaged to America, the first European to reach there.

The European Renaissance : *Discoveries and the Revival of Geography*

As the rise of the Muslim culture overlapped the dark age of Christianity so did its decline overlap the beginning of the Renaissance in European geography.

While the Renaissance had started in the 8th century with the renewed study of Greek, the Crusades in the eleventh century marked a turning point in the revival of geographical knowledge in Christian Europe. In the words of Beazley. "They were successful in kindling a spirit of patriotism, of practical religious fervour and of boundless enterprise, where-by our western world finally attained to the discovery, conquest, colonization or trade dominion of portions of the world. It was no less due to the new spirit breathed by the vigorous Norsemen into every Christian nation by their association".

The power of the church was also enhanced along with the growth of the crusading spirit. Learning was therefore still inspired in and from the church almost exclusively.

Mainly on account of the crusades in Europe of the twelfth century, something approaching a revolution took place not only in political and material life, but also in intellectual persuits. In particular its geographical outlook, its knowledge of the world, both practical and scientific had been widened and deepened. Amongst the branches of science none made greater progress than geography. Translations and adaptations of Arabic texts were made for the use of Latin Christians. Descriptive geography shows a remarkable improvement.

In the thirteenth and fourteenth centuries a number of Europeans, many of them Christian missionaries and diplomats, journeyed to the east. These travellers were not only explorers of a high order but did excellent service also to anthropo-geography by careful observations of the manners and customs and by scientific classification of the chief races of Eastern Europe and Northern Asia. They are considered to be first Christian writers to give a truly literary character to geographical writings.

Some of the enlightened Christian scholars of the time, including Roger Bacon (1214—1294 A.D.), accepted the sphericity of the earth but still believed in the doctrine of the earth as the centre of the Universe. Bacon obtained an estimate of the circumference of the earth only one-fourteenth less than the truth. He assumed the inhabited world of the Northern Hemisphere to be probably balanced by corresponding southern land masses and he took the northern lands to extend much more than half way round the globe. The Christian missions continued to provide important sources for the descriptive geography of Eastern Europe, Central Asia, China, Malay coast, India, Ceylon, Persia, South-West Asia and North-East Africa.

Marco Polo (1250—1324 A. D.) was incomparably the greatest traveller and the most significant observer of the whole of the Middle Ages. He was the first to trace a route across the entire longitudinal extent of Asia. He has gives a very good account of China and most of the countries of Asia and North-East Africa that he visited and has produced the most fascinating work of travel ever written. His travels had been under taken partly for commercial reasons and partly to take some answers from the Pope to the Grand Khan of China.

With the rise of the Turks in the 14th and 15th centuries, trade with the east became increasingly difficult by land. But under the influence of the Renaissance on the European mind, there also developed an urge of adventure and enterprise to discover new lands to plant colonies of their own people in them and to find a new independent route to India. Thus the 15th century ushered in an era of discoveries in the history of European people.

By the beginning of this century the independence of Portugal had been finally established. On account of its favourable geographical location, it took the lead in maritime enterprise. The Portuguese hoped to perhaps find a route to the Indies by the south of Africa or by going west across the Atlantic. Toscanelli, as early as 1474, had pointed out from Ptolemy's maps that the east cost of Asia might be reached more easily by sailing west than by going south then east and north.

Prince Henry of Portugal (1394—1460), known in history as Henry the Navigator, devoted his life to scientific exploration and the extension of Portuguese Empire and commerce. For over forty years Henry closely studied the maps and sent forth numerous expeditions to explore the coast of Africa. In 1486 Bartholomew Diaz rounded the Cape of Good Hope. In 1498 Vasco da Gama reached Calicut (India) and realised the Portuguese ambition of finding a sea-route to India.

Under the patronage of another Atlantic power (Spain), Christopner Columbu (1451—1508) crossed the Atlantic in 1492 to West Indies and rediscovered the New World. By this discovery the old geographical views concerning the earth and its size were shattered.

In 1497 an Italian mariner in the employment of England named John Cabot sailed across the Atlantic to arrive off the northern coast of North America and thus laid the foundation for England's claim to the whole continent.

The geographical conception upto this century had made little advance on the philosophical speculation of Greeks. Though the view of the roundity of the earth thus came to be established in the 15th century, the Ptolemic tradition continued to be generally accepted till it was replaced by the Copernicus system.

The discovery of America opened a new chapter in the history of exploration. The keenness of the rivalry of Portugal on the eastward passage and of Spain on the westward led to the rapid exploration of new areas and an almost desperate search for some way round America by the north or by the south. This culminated in the most splendid feat of Magellan, a Portuguese navigator in the service of Spain. His expedition circum-navigated the world through the strait in the south of South America named after him via the Philippines (where Magellan was killed) and round the Cape of Good Hope between 1519—1522, and thus it was finally proved that the earth was round.

Throughout the 16th and 17th centuries the merchant adventurers established their trading posts and colonies and planted the flags of their countries on almost every shores. In 1500 a Portuguese Commander named Cabral thus acquired Brazil for Portugal. In 1519 the Spaniard Cortez (1485—1547) led an expedition to Mexico, and in 1533 Pizarro (1470—1541) conquerred Peru. The Spanish exploration won for Spain the southern portion of North America, all Central America and the greater part of South America. The Portuguese and Spaniards between them thus completed the rough map of Africa and the two Americas.

The other nations of Europe, the French, the English and the Dutch did not sit idle. They had their own plans for new discoveries. While also challenging the monopoly of the Portuguese and the Spaniards for eastern and western routes, they concentrated their activities on finding a new route to the east by a North-Easterly or North-Westerly passage. Great exploration was thus done in the northern latitudes during the 16th and 17th centuries by the French, the English and the Dutch.

In 1534 the French navigator Jacques Cartier's (1491—1557) expedition in an attempt to find the north-west passage reached the mouth of the St. Lawrence and discovered the lower fertile valley of the river. In 1553 the English expedition of Willoughby and Chancellor, in search of North East passage, reached the White Sea leading to the discovery of Russia. In 1576 Sir Martin Frobisher undertook three voyages (1576—1578) westward to find the north-westward passage and in the last attempt discovered the Hudson strait in the north of Labrador. Others followed him.

Francis Drake (1541—1596), the great English Navigator, an and enbodiment of Elizabethan enterprise, circum-navigated the world via the strait of Magellan and round the cape of Good Hope between 1577 and 1588. Barents (d. 1597) was the most important Dutch navigator to search for a North East passage to Asia. In his three voyages (between 1595—1597) he went as far as Novaya Zemlya.

The English thought of another plan to reach Japan across the North Pole. Hudson undertook two voyages for the purpose, in 1607 and 1623, when he was cast adrift in the Hudson Bay.

Early in the 17th century Australia was discovered by Dutch enterprise when Janszoon of Amsterdam in 1605 struck the east of the gulf of Carpentaria in the north of Australia. In November 1642 Abel Tasman discovered Tasmania and in December sighted the west coast of the South Island of Newzealand. He also sailed round Australia.

During the two centuries side by side with the great increase in knowledge of the world through extensive exploration, great progress was made in astronomical and mathematical geography and cartography.

Early in the 16th century, a Polish astronomer N. Copernicus (1473—1543), in opposition to the geocentric system of Ptolemy, introduced the Solar system and put forward the theory that the earth rotates on its axis every 24 hours and revolves round the sun. He explained the alternation of day and night by the rotation of the earth.

Copernicus, theory with some alterations is the one that we use today. The alterations were brought about mainly by the combined work of Brahe (1546—1601), a Danish nobleman, and Kepler (1571—1630) a German. Brahe made more accurate observations of the movements of the planets than had ever been made before. From these observations Kepler worked out a new scheme which contained the three laws known after him about the movement of the planets. Kepler also found out that the moon causes the tides.

Galileo (1564—1642) invented the thermometer in 1607 and a telescope in 1609. In 1613 he published *Letters on the Solar Spots*, and in it he supported the Copernicus theory that the earth goes round the sun. Torricelli invented the barometer in 1643.

In the first half of the 16th century, Germany became the principal centre of development of both mathematical and descriptive geography. Purbach and his pupil Regiomontanus founded a school of cartography and collected many of the astronomical observations Tables of latitude and longitude, maps and globes were prepared.

Peter Apian (b. 1495) and Sebastian Munster (1489—1552) are the two chief representatives of theoretical geography, the former in astronomical and mathematical geography and the latter in descriptive geography. Their writings held the field for a hundred years. Deriving inspiration from Ptolemy, Apian, in addition to making maps and globes, published two standard works: *Astronomicon Caesarem*, an astronomical treatise, and *Cosmographicus Liber*, which deals with those aspects of geometry and astronomy which are essential to geography. He distinguished between the chorology of the Greeks as the description of a particular place and the geography of his time as the general description of the whole earth. The earth is divided into five zones as we do it today. Very short notes are given on each continent.

Munster's Cosmographia (p. 1544), following Strabo's method and tradition, was a standard work of reference, which dealt mainly with human and political geography on a regional basis. It is a descriptive book that followed the example of Strabo. He also made improvements in the art of Cartography. For the first time he made use of a small compass, the forerunner of the prismatic compass, in a triangulation survey. For about a century the chief centres of cartography and geography were in the Netherlands.

Mercator (1512—94), Ortelius and Blaeu were the great cartographers of Flanders and the Netherlands who developed and improved the art of cartography very much. Mercator, a student of Apian, found new devices and instruments for the drawing of maps. He established a geographical institute at Louvain where he worked out his famous cyclindrical orthomorphic projection named after him. On it the famous planisphere map of the world for navigation was published in 1568.

Ortelius produced the famous world Atlas known as the *Theatre of the World* in 1570. However, as James has put it "not until the Philip Cluverius (1580—1623) and Bernhardus Varenius (Bernahard Varen 1622—50) wrote their monumental geographical treatises was the revival of geographic learning well started.

Introduction to Universal Geography by Cluverius, consisting of six books published posthumously in about 1626, was highly commended particularly in its regional description of the whole earth as it was known upto that time. It is distinguished from cosmography by dealing with the earth alone, not with the universe, and from chorography and topography by dealing with the whole earth, not with a country or a place. He is considered to be the founder of historical geography.

An even more important work in the development of geographic thought was the great treatise *Geographia Generalis* of Varenius published in 1650. Greatly impressed by the mathematical work of Copernicus, Kepler and Galileo, he defined geography "as that part of mixed mathematics which explains the state of the earth and of its parts, depending on quantity, *viz.*, its figure, place, magnitude and motion, with the celestial appearances, etc." By some it is taken in too limited a sense for a bare description of the several countries and by others too extensively, who along with such a description would have their political constitution. He divided the subject in two major divisions (*i*) General or Universal geography dealing with the earth as a whole and (*ii*) Special or particular geography dealing with each country in turn from the chorographical or topographical point of view. To Human Geography he reluctantly conceded a place in special geography as a concession to custom. While Cluverius set the standard for regional geography, Varenius did it for general geography. Nathaniel Carpenter, a fellow of the Exeter College, Oxford, was the first Englishman to write a scientific geography. In 1725 he published *Geography Delineated* in two books in which he regards cosmography, geography, chorography and topography as parts of a whole. He divides geography into two parts: spherical, or that for the study of which mathematics alone is required, and topical, or the description of the physical relations of parts of the earth's surface. He showed a remarkable degree of objectivity in his interpretation of observed phenomena.

In 1686 Edmund Halley produced the first wind chart and presented his theory of trade winds which related them to the distribution of heat on the earth.

Medieval—Modern Transition : *Quest for Reforms and Independent Status*

This period extends roughly from the middle of the eighteenth century to the early nineteenth century. The geographers during this period believed that the type of geography which developed during the preceding centuries could be anything but scientific in its objective. The inevitable outcome of this dissatisfaction was an attempt on the part of a small but active group of writers at reforming geography and thus raising it from the subordinate status to an independent science. The geographers now looked for a 'pure geography' (*reine-geographie*) and thereby laid emphasis on physical geography. The dominant idea was that the world should be studied in terms of natural divisions, which were regarded more real as compared to the political divisions used by former geographers.

Some of the important works summarizing a great deal of observed data concerning physical geography were presented by Philip Buache (1756), Torben Bergman (1766) and J. R. Foster (1783) in their various publications. Buache was the first person to make use of the contour lines. At the same time Jedidia Morse of U.S.A. published his compendium of geography (1789) and John Pinkertin, a British, wrote his *Modern Geography* in 1802. On the continent Conard Malte-Brun began the publication of the *Geographie Universelle* in 1810. Other scientific writers in geography were J. B. de Lamark, P. S. de Laplace, A. G. Verner, James Hutton, Charles Lyell, Georges Cuvier, William Smith and J.B. Blumenbach, to mention a few.

Gatterers publications in 1773—75 marked the beginning of a continuous effort toward reforming the subject. He was the first to present the idea of natural divisions, which was further clarified by him in 1805. H's works had great influence on his contemporaries and on later students including Humboldt and Ritter.

The importance of Imunannual Kant's lectures on physical geography at the University of Konigsberg cannot be exaggerated. He taught at this university for about 40 years (1756—1796). A great many students came in personal contact with him and got the benefit of his ideas, which were thus widely circulated. He paid great attention to collection and organization of materials from various sources and also dealt with a number of specific problems such as deflection of winds caused by the earth's rotation. In organizing his course Kant followed the outline of 'general geography' as laid down by Varenius a century ago. He considered physical geography as a summary of nature and a basis for history and all other geographies of which he enumerates five, (1) mathematical geography (concerned with the measurement of shape, size and movement of the earth and its place in the solar system), (2) moral geography (in the sense of mores, *i.e.*, an account of different customs and characteristics of mankind), (3) political geography (the study of areas according to their governmental organization), (4) commercial geography (dealing with trade in surplus products of countries) and (5) theological geography (the study of the distribution of religions).

Kant is also credited to be the first to advocate for the status of geography as an independent science. He argued that all knowledge gained by observation can be classified in two ways:

(1) systematic classification, *i.e.*, classification in terms of species and genera regardless of their place of occurence and

(2) physical classification, *i.e.*, things perceived in terms of time and space.

Classification of things in terms of space provided geographical perspective, and thus he asserted that geography was an integral part of the overall framework of scientific knowledge. According to James, it is this concept of the place of geography among sciences that has guided the main stream of geographic thought since Kant.

The geography of this period included both systematic as well as regional geography. The inclusion of these two forms of study within a single field has evoked much controversy in the methodology of geography. But it is important here to note that this concept of geography introduced later in modern geography by Humboldt and Ritter emanates from Kant. It may, however, be of interest to know that the systematic studies during these years had gained major importance, which led geography to its scientific status. Physical geography, as treated by nearly all the writers of this period including Kant, Foster and later Humboldt, included not only the study of natural phenomena but also that of man. Hartshorne observes that Kant's physical geography, both in purpose and in content might be considered as "anthropocentric," a point of view which Ritter inherited from Kant. For most geographers in this and the following period the concept of nature did not exclude man.

Hommeyer in 1810 may perhaps be considered to have introduced a definite trend toward a pure physical geography excluding the human aspect. He interpreted '*reine geographie*' as limited to the conditions of the terrain, concerned with climate and minerals. The organic life was left to '*Naturekunde*' '*Naturebeshreibung*' and '*Landerkunde*'.

Other concepts which were expressed during this period may be summarized as follows.

(1) That the character of different groups of people was related to the particular character of their environment. This concept was first expressed by Kant who considered Physical Geography to be a basis for social geography. He thought that the two were causally related. This concept gained so much support that later in the beginning of the 19th century the idea of the earth as an organism became quite acceptable, which included on the physical side inanimate and on the psychic side animate objects including man. However, as Hartshorne observes, 'it did not occur to any of the students of this period to consider these relationships as in themselves the direct object of geographic study'.

(2) As stated above, some of the writers of this period led by Gatterer, dissatisfied with the political divisions of the world, attempted to divide land in terms of natural conditions. But the increased knowledge of the earth's surface made this approach untenable. The impracticability of establishing natural regions was first shown by Ruhle von Lilienstern. Later Wilhelmi, Selten and Bucher showed that it was difficult to draw boundaries to establish natural divisions.

(3) Hommeyer introduced the concept of aesthetic geography and Lender expressed the idea that geography was concerned with 'where of things'.

With regard to the method of geographic study at the close of this period the emphasis was on two things, (*i*) inductive studies and (*ii*) mention of specific sources.

However, in spite of these developments in the methodology of geographic studies most of the writers of the period continued to set up *a priori* system of facts without testing them. What this period actually contributed was to prepare a stage for the development of modern geography. The science of pure geography of this period, in fact, contributed little toward accomplishing anything.

MODERN GEOGRAPHY

The third and the most significant turning point in the history of geography was whence the ideas and demands as presented by the geographers in the 18th and early 19th century began to take concerete shape. This marks the beginning of the modern age in geography. For this we are greatly indebted to Alexander von Humboldt and Carl Ritter whose works which contributed so much to the development of academic geography are considered to be most standard 'classical'. The concepts advanced by them became the main stream of the geographic thought which has since governed the subsequent developments in the subject. Their works reformed geographical thought not only in Germany but their impact was also felt in other parts of the world especially through Reclus in France and later through Hartshorne and Sauer in America.

The development during this age has been so rapid and widespread that for a clearer understanding we must distinguish three periods—the classical period of Humboldt and Ritter, the post-classical half-century and the current period beginning from the first world war.

Classical Period : *Geograhy Reformed*

The period during which Hamboldt (1769—1859) and Ritter (1779—1859), the two founders of modern geography, worked is termed as the classical period in the history of geography. It is interesting to note that these two scholars worked at the same time for thirty years in the same city, Berlin. Geography all over the world owes so much to them. They were the first scholars to make effective use of the results of the works in systematic sciences. However both differred in their training, background and approach.

By training Humboldt was not to become a geographer. In fact he started his education to be a diplomat and thus studied technology, economics, history and philology. However, he developed a passion for the study of nature. As a mine inspector he made some study of subterranean vegetation, and later his connection with George Foster played an additional role in stimulating his interest in geography. His trips to Rhineland, England, Switzerland, Italy, South and Central Americal and Central Asia provided him with a large amount of accurate data. He utilized them to produce his outstanding work entitled, *Kosmos*. This book contains travel accounts and description of the physical geography of the earth. However, it will be hardly true to say that his geographical works were entirely based on field observations. He did make use of other works including that of Ritter.

Humboldt's contributions to the methodological problems in geography are of great importance. He laid a tradition of the systematic classification and comparative description of the observed phenomena. This he was able to achieve with the help of his knowledge of physical and biological processes.

He developed methods of measuring and recording the phenomena he observed. He was the first to introduce 'isotherms' to show temperature differences on a map by measuring the temperature of different levels of the tropical mountains in America. He made use of the Census data as well. Thus Humboldt showed a way to quantitative-systematic description which was a major advance over the qualitative-encyclopaedic description in geography.

Ritter possessed a different background. He was ten years junior to Humboldt and benifitted a great deal from his works. In the words of James "perhaps no man had broader background of preparation for geographic study than did Ritter". Before going to university he was educated in a school at Schnepfenthal where education was organized in accordance with the ideas of Rousseau and Pestalozzi, which insisted on acquiring knowledge of the world by direct observation of nature. Another contributary factor to the excellence of his training was the fact that during his school days he was under the personal care of J.C.F. Guts-Muth whose major interests were nature study and geography. Thus he developed a passion for geography right from the very school days. At university level he received training in natural sciences, history and theology. Unlike Humboldt he did not make long journeys and confined his observations to Europe only. Thus Ritter was well equipped with the observational method of nature study on the one hand and had interest in human problems (History) on the other. This helped him to do original geographical work. His meeting with Humboldt in 1807 provided him further stimulus. He was impressed with Humboldt's idea that the earth's condition had an important relationship with man's life. Consequently he decided to stick to geography rather than switch over to history which he was contemplating. However, his deep involvement with history and religion is reflected in many of his writings. After his death he was much criticised and accused that he made geography a handmaiden of history.

Ritter was strongly in favour of comparative studies of different parts of the world and was fully conscious of the weakness of the generalizations formulated on the basis of the knowledge of one area alone. In his works he was concerned with showing how things occuring in an area existed together in mutual relationship. His publications between 1804—1807 regarding the geography of Europe were the first to bring Ritter into the lime light. They created quite an impression on the geographers in Germany as well as France. Later he made a plan to study the world by regions in a four-volume *Erdkunde*. He completed two volumes, the first on Africa and the other on Asia. They earned him a great name in the academic world and Ritter received recognition, in Marthe's words, "without question as the reformer of geography, as the master who first made that field into science". He was appointed as a professor of history and geography at the gymansium in Frankfurt. After a year he was given a double position in the Military College and in the University. Later in 1820 Ritter went to Berlin as the first university professor of Geography. Here he continued with his geographical work, *Erdkunde*, but in its latter volumes his historical bias became more and more pronounced.

Ritter gives us two important ideas concerning geographic method, which he had clearly stated from 1804 onward. The first thing which he emphasized was that geography should be an empirical science. In his *Erdkunde* he wrote "The fundamental truth which should assure truth to the whole work is to proceed from observation to observation not from opinion or hypothesis to observation". He was first to point out that Buache's idea of continuous mountain system and the assumed correspondence between the crest lines of mountains and the divide of drainage basins was contrary to the observed facts. He was also the first to subdivide the continents on the criteria of surface features and thus to provide a framework to regional description. Secondly, his emphasis was mainly on particular places and the mutual relationship of the variety of phenomena occuring there. Thus his approach was regional rather than systematic. However, his regional method should not be confused and taken as dichotomous to systematic geography.

From the works of both Humboldt and Ritter there emerged a new and unified concept of the nature of geography. Both were concerned with the significance of likeness and differences from place to place on the earth and both attempted to understand the meaning of association and interconnection among phenomena occuring at a particular place. They set a tradition of working out of door in geography and armchair geography was no longer acceptable.

Post-classical Half-Century : *Shifting Viewpoints*

While it is true that from the writings of Humboldt and Ritter there emerged a clear and unified concept of the nature of geography, it is interesting to note that their followers over-emphasized certain views. Thus during this period, extending roughly upto the first world war, we notice frequent shifts of emphasis from one view to another. The students of Ritter, especially Earnst Kaap, Arnold Guyor (the French-Swiss who was appointed to the first chair of geography in the United States of America at Princeton University) and Elesee Reclus of France, who earned the title of the "Ritter of France", laid exaggerated stress over the historical-regional approach. Systematic Studies were neglected. Consequently ambiguity over-lapped the geographic thinking. The academic status of geography fell in Germany and for several years after the death of Ritter there was no professor of geography in any German University.

However, the general scientific atmosphere of this period did not allow this confusion to continue longer. Under the leadership of Peschel the revival of systematic geography took place, which emphasized on the study of physical, non-human aspects. Peschel published a number of papers from 1866 onward. His emphasis was on the study of landforms, but he also attempted to study the influence of land-form on human history. He was followed by Richthofen and Penck in Germany and by William Morris Davis in

America. These men were trained in geology and provided a better foundation to Peschel's geomorphological studies. Thus we see a new trend in geography. It began heading toward natural sciences. Human geography came to be considered in relation to geomorphology and thus was confined to regional studies. This resulted in another type of confusion. Two forms of dualism in geography arose. Not only the systematic and regional geographies were considered to be two separate things but also the physical and human geographies were regarded to be of two separate kinds.

The leadership for providing a scientific and independent status to human geography goes to Friedrich Ratzel. He published *Anthropo-geographie* in two volumes. The first appeared in 1882 in which his main concern was to study the natural conditions of the earth in relation to human culture. But in the second volume, published in 1891, he changed his approach and argued against the concept of environmental determinism. He says "I could perhaps understand early New England without knowing the land, but never without knowing the Puritan immigrants". His followers not only overemphasized human geography, but some of them also mistrepresented his views. Particularly his American pupil, Miss Ellen C. Semple interpreted and circulated his ideas in terms of environmental determinism which influenced the thinking of American and British geographers.

The chorological concept of geography was restored in Germany mainly due to the efforts of two scholars of this period: Marthe and Richthofen. Marthe (1877) defined geography "as the science of distribution" and advocated the recognition of casual relationships in small localities, which he considered to be a basis for the recognition of casual relationships in larger regions or over the world as a whole.

Richthofen in his inaugural address of Leipzing (1883) restored the chorological concept and stressed that this concept was indispensable to geography. He also attempted to clarify the relation between systematic and regional geography. He remarked that the difference between systematic and regional geography did not lie in the contents but in the method of study. Systematic geography leads to the understanding of causal relation of phenomena in area and provides principles that may be applied in the study of individual areas. This point of view conformed with that of Humboldt.

Alfred Hettner looked for a still better and fuller exposition of the nature of geography. He made a thorough study of all the previous works including that of Humboldt and Ritter and even went back to their predecessors in the pre-classical period. Hence his methodological statements came to be regarded as 'classics'. Never in the history of German geography has there been so much unity in the fundamental concepts as we find in the first part of the twentieth century. This was all due to Hettner. He maintained that the geographic researches should be conducted from the points of view of both systematic as well as regional. He did not recognize any fundamental difference in human and physical geography as well.

The impact of Hettner's methodological works was also felt on geographic thinking in other countries outside Germany. Among the geographers who were particularly influenced by Hettner's views may be included Berg in Russia, and his student Marcus in Estonia, Grano in Finland, Arstal in Norway, Helge Nelson in Sweden, Michotte in Belgium, Giannitrapani, Marinelli and Almagia in Itaiy, Chisholm and Herbertson in Great Britian, Inouye, Komaki and Watanuki in Japan. However, in general, geographers outside Germany have shown little interest in methodological problems.

In France although the first chair of geography was opened in 1809 at Sorbonne University and the Geographical Society at Paris was founded as early as 1821, yet during most of the nineteenth century the geographic writing followed the encyclopaedia tradition. At universities geography was afforded a subsidiary status particularly for the students of history. The 19-volume series (1875—94) published by Elesee Reclus, under the title of *Geographie Universelle*, was, no doubt, the most scholarly type of descriptive writing of that time. But it does not show any conceptual advance over the work of Ritter.

It was due to the works of Vidal de la Balche (1845—1918) that geography in France was raised to higher standard. He was in fact the founder of modern scientific geography in France. He succeeded Himly to the chair of geography at Sorbonne in 1898 and in February 1899 he presented his epoch-making address outlining his programme. He advanced the concept of possibilism and discredited environmental determinism. According to his thesis the physical environment offered both possibilities and obstacles to man. What is more significant to note here is that Vidal introduced the chorological concept in French geography by emphasizing the regional method. He was fully conscious of the usefulness of comparative studies which led him to plan a series of *Geographie Universelle*.

Human geography was given excellent treatment by him and was raised to new level of achievements. His book *Pronciples of Human Geography* is regarded to be a masterpiece. His works made a profound impact on his followers. Jean Brunhes was his most zealous disciple. His book *Human Geography* is well known to French and English readers. It may be observed here that because of the dominating influence of Vidal on his followers a remarkable degree of agreement on the basic concepts and contents is found among the French geographers.

Although the American Geographical Society was founded in 1851, yet geography did not achieve any academic status until Arnold Guyot, a student of Ritter, was appointed to the chair of geography at Princeton University in 1854. He did not have any successor, however. The teaching and research in geography were greatly advanced by R. D. Salisbury, W. M. Davis and Miss Ellen C. Semple, who may be regarded as the chief American figures of this period. Salisbury was a geologist and started as a Professor of Geographic Geology at the University of Chicago. Later in 1903 at the same University he organized the first independent Department of Geography in America and remained the head of it for sixteen years. Davis, a follower of Peschel, was Professor of Geology at Harvard University. His interest in geographical work was so great that he organized the Association of American Geographers in 1904 and was elected its president thrice. Both Salisbury and Davis were mainly interested in the evolutionary processes of landforms. Both tried to develop geography in the words of Platt "into an explanatory evolutionary science of life in relation to physical environment".

Meanwhile Miss Semple, a student of Ratzel introduced the idea of human geography in America, which was based on the first volume of Ratzel's *Anthropogeographie.* She laid a tradition of explaining human activities in terms of Physical environment. Thus the concept of environmental determinism finds its most eloquent support in America as well. Although Semple also lived during the current period, yet her important works were published before the world war began.

Here again, because of the works of Davis and Semple which differed in approach and emphasis, we see the same form of dualism in physical and human geography as was developed in Germany. Semple's concept of environmental relationship gained more popularity and dominated the thought of a large number of geographers not only in America but also in other English speaking countries. This concept was, however, opposed by Fenenman in 1919 but was restated, more carefully though, 'as human ecology' by Barrows in 1923.

In Britain, as Buchanan observes "the revival of acdemic interest came relatively late". Royal Geographical Society was founded in 1831. The University teaching started in 1887 when Mackinder was appointed at Oxford. At Cambridge Yule Oldham was appointed in 1893. Later Alfred Herbertson joined as assistant to Mackinder at Oxford. However, except Mackinder and Herbertson, British geographers have shown little concern with the methodology of the subject. They have been greatly influenced by Semple's concept of environmental relationship and have derived very little from Germany. Nevertheless, a very important statement defining geography was made by H. R. Mill in 1903. He says "Geography is the exact and organized knowledge of the distribution of phenomena on the surface of the earth, culminating in the explanation of the interaction of man with his terrestrial environment". This is similar to the ideas of Marthe and indicates that the concept ,of 'areal differentiation' was not completely lost sight of in England.

Thus we see that toward the close of this period geography had attained independent status as a university subject in many countries. Its chorological concept had found firm anchorage in Hettner's methodological statements.

Current Geography : *Specialisation*

After the World War I the development of the concept of geopolitics, as initiated by Karl Haushofer, marks another drift away from the main stream of geography which was set by Hettner. This concept was based on the ideas of a Swedish Political Scientist, Rudolf Kjellan, as expressed in his book *The Great Powers of the World.* Ideas of Mahan's supermacy of sea power and Mackinder's ' heartland ' were also utilized by Haushofer. Together with Obst and Lantensach he founded *Zeitschrifte for geopolitik* in 1924 at Munich. His main objective was to justify the Nazi policy of expansion. Thus geopolitics became a cabalistic catch-word for the Nazis and to quote Morgenthau " degenerated into the political metaphysics couched in a pscudo-scientific jargon ".

In the meantime scientific geography in Germany continued but under great financial handicap. Hettner himself was still active. Sapper, Otto Maull, Fritz Klute, Otto Schluter, Karl Dove, Heinrich Schmitthenner, Walther Penck, Alfred Wagner, Philipson, Carl Troll and others continued the scientific tradition of geography and maintained the concept of ' areal differentiation '. The German geography today is following the same line of thought.

Geography in France follows the views of Vidal de la Blache. The works of Brunhes, Albert Demangeon, Emmanual de Martonne, Henry Bauling, Pierre Deffontaines, Jean Gottman and others which concentrated on regional studies of some area or the other are regarded of high quality, especially on methodological grounds. They maintain the basic chorological concept of geography. However, as Sauer suggests, it is the works in themselves that provided the development in regional method rather than studies in the nature of geography.

American Geographers have been more concerned in recent years with methodological problems than geographers anywhere else except in Germany. Isaiah Bowman, Derwent Whittlesey and Carl Sauer made the pioneering efforts in providing a fuller understanding of the nature of geography. Sauer's publications; entitled "Survey methods in Geography and its objectives " (1924), *The morphology of Landscape* (1925), "Recent Developments in Cultural Geography" (1927), "Cultural geography" (1931); set the tradition of the unified concept of geography which aimed at areal differentiation He was particularly influenced by Schluter.

Richard Hartshorne's *Nature of Geography* (1937) came to be regarded as a 'bible' for the geographers in the English speaking countries. In this remarkable book he made a critical examination of the development of geographic thought, drawing mainly upon the German works. He has been particularly influenced by Hettner. More recently Preston E. James and Clarence F. Jones have edited *American Geography : Inventory and Prospects.* It was prepared under the auspices of the Association of American Geographers in which more than hundred geographers participated. There are twenty six chapters in it, each has been written by a specialist in that field. Thus this book as James puts it " brought together the experience of half a century in the formation of the concept of geography and in the developments of acceptable procedures in geographic research."

The American Geographers today are developing highly sophisticated conceptual models of research. In recent years "Quantitative Techniques in Geography " is gaining importance. Almost all the principal universities have made 'Quantitative Techniques' as a required course for their post-graduate students. However, some universities, like Iowa State University, are over emphasizing it. This is a dangerous trend indeed, lest we should lose 'geo' and be left with 'graphy' only.

As noted earlier, British geographers have been little interested in the methodological discussions. The concept of environmental relationship as presented by Semple became the traditional line of geographic thought in Britain and in other countries with which Britain was associated as Imperial power. It is only recently that geographers have developed interests in understanding the nature of geography. Roxby's presidential address of 1930 was probably the first attempt amongest the British geographers to examine the concept of earlier German and French geographers. Later in 1933 R. E. Dickinson and O. J. R. Howarth published *The Making of Geography.* This was probably the first book which examined the nature of geography through ages. More recently S. W. Wooldridge, Gordon East, Dudley Stamp, Henry C. Darby including some other younger geographers have shown deeper interest in the methodological aspects of the subject. Under the directorship of Dudley Stamp, the British Land Utilization Survey was started in 1930 with almost similar objective as that of the Michigan Land Economic Survey (1920—30). In this survey, methods of detailed field study have been applied of which his monumental book ' *The Land of Britain : Its Use and Misuse* (1937—41) is the result. Wooldridge and East published ' *The spirit and Purpose of Geography in* 1950, and Wooldrige published his essays on the scope and nature of geography in *The Geographer as Scientidst* in 1956. Darby has been interested in developing the methods for the study of historical geography.

Geography in the U.S.S.R. also has a long history. The Geographical Society of the U.S.S.R. was founded in 1845 under which from time to time various sections were organized to deal with different phenomena geographically. In the beginning the emphasis was on ethnology and cartography. It was after the 1917 Revolution that geographical work was greatly advanced. The first Soviet Geographical Congress was held in

1933 at which N.N. Baranskiy made a case for the preparation of the 'Geography of U.S.S.R. region-by-region. In 1937 the project was taken over by the Institute of Geography of the Academy of Sciences of the U.S.S.R., but this plan could not make any headway until after the second world war when the work was resumed in 1946. Till 1957 eleven monographs had been published and works on other regions were in progress.

On methodological questions there appears to be some disagreement among geographers, but that does not dislodge the concept of areal variation as essential to any geographical work in the U.S.S.R. The Soviet geographers have done work of considerable importance in the fields of physical geography, economic geography, population and soil geography. On the basis of these studies, an adequate amount of factual material 'Characterizing similarities or differences in various phenomena has developed. As I.P. Gerasimov observes "on the basis of these facts and their explanation, comparison and generalization, the theory of geography has developed.

The university status of geography in this sub-continent of Indo-Pakistan is a post-World—War I development. Muslim University at Aligarh took the lead and established the department of Geography in 1924, offering courses to graduate and post-graduate students. It was followed by Madras and Calcutta and later by other universities in undivided India.

The University of the Punjab was the first to start the post-graduate classes at Lahore in 1944 in our part of the sub-continent. After independence outside Lahore geography departments for post-graduate teaching were established in all the other universities in Pakistan, *viz.*, the Universities of Karachi, Sindh, Peshawar, Dacca and Rajshahi.

The Geography in this sub-continent has been greatly influenced by British geographers as most of us were trained at British universities specially London. There has been no serious attempt at rethinking about the scope and the content of the subject ever since it was introdued at Aligarh. However, we did make some efforts from time to time to promote its teaching and research at various universities in this country. The Pakistan Geographical Association was organized in 1948 and the East Pakistan Geographical Society was formed in 1956. The former has been publishing *Pakistan Geographical Review* since 1949 which began as *Punjab Geographical Review in* 1942. The latter started *Oriental Geography* since 1957. Both of these journals are widely circulated and are appreciated in and outside this country.

Recently Pakistan Institute of Geography which was founded in 1957 has been re-organized and has started publishing *Geografia*. The Karachi Geographical Society founded in 1947 has ceased to function and the publication of its Bulletin has also stopped. Karachi Geographers Association came into existance in 1958 in collaboration with which the Pakistan Geographical Association held the first all Pakistan Geography Conference in January 1964.

A trend toward modernizing the concept of geography is seen among the younger geographers of this country as well. The geographers have begun to emphasize field studies. Land Use survey of a small area forms an essential part of our post-graduate courses first introduced at the Punjab University and later at Dacca. Due consideration is being given to urban and cultural geographies and cartographic presentation. We have also started teaching "Quantitative Techniques" at the Punjab and Peshawar Universities. A National Atlas Board has recently been established to prepare a comprehensive Atlas dealing with Physical, Economic and Social aspects of the geography of the country.

The most striking feature of the current geography all over the world is its emphasis on specilization. Various phenomena of the earth's surface have been studied more deeply than others. Thus various branches of systematic geography have emerged some of which are more developed. Some of the more important are physical geography, cultural geography, economic geography, political geography, settlement geography, geography of transportation, urban geography, agriculture geography etc. Each of these branches has well developed objectives and concepts.

In an attempt to co-ordinate the works of geographers in various parts of the world, the International Geographical Union was organized in 1922 which meets every fourth year. Geographers from different counitres of the world participate in its meetings and the proceedings are published. This is, however, not the first attempt. International meetings of geographers date back to 1871 when the geographers met at Antwarp (Belgium) for the first time under the auspices of *Congres International pour les Progres de Sciences Geographiques.* Subsequent meetings were held at London (1895), Geneva (108) and Rome (1913). As the dates show these meetings were not held regularly until the I.G.U. was founded.

CONCLUSIONS

Geography has grown from a s mple speculative-descriptive field to a highly spohisticated-analytical science. Mathematical tradition of Ptolemy and Kant has been changed into cartographic techniques. The astronomical aspects of this fields have almost lapsed into insignificance. The descriptive tradition regarding various countries and regions as provided by Strabo and Munster is no longer considered to be acceptable. Modern regional geography begins with a central theme or problem around which all information is built up.

From time to time there have emerged various deviations in the concept of geography like 'Geography as a science of distribution', 'geography as a science of relationships, 'geography as a subject dealing with visible features of landscape', 'geography as geopolitics, and some others which were less important.

The essential nature of geography which has come to be recognized today is that it offers a point of view. Geography is concerned with those things which are unevenly distributed. It is concerned with the association of things that distinguish one area from the other. There is no dichotomy whatsoever in geography. As a research discipline geography can make more realistic contributions than others, particularly as a social science, because it is the only science which studies phenomena in the context of their place of occurance.

In short, geography is no longer defined as a mere description of the earh or a study of the influence which the land exercises on its people. But as Hartshorne puts it "geography is concerned to provide accurate, orderly, and rational description and interpretation of the variabls character of the earth's surface".

Thus geography is well entrenched in the idea of areal variation and presents a unified concept. The various branches of the subject that have developed are naturally the results of specialization.

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THE UPPER KURRAM REGION*

ASRARULLAH

Geological Survey of Pakistan, Quetta

The Upper Kurram region is the northern half of Kurram Agency. It is in the north-western part of west Pakistan and lies between 33° 44′ and 34° 2′ N. lat. The plain of Parachinar is its most important physiographic unit, which lies between 4500 and 6700 feet above sealevel and covers about 100 sqr. miles. The plain has been formed by the coalition of a number of gravel fans. The region enjoys a Sub-Tropical Continental High land type of climate with an average annual rainfall of over 29 inches.

The paper describes the physiographic and climatic conditions of the region. A comparative study of the climates of Parachinar, with those of Quetta and Murree—two important hill stations, has been made. An Attempt has been made to study the surface and sub-surface water conditions of the area. There are a number of waterfalls in the region. Possibility of developing hydro-electricity has also been discussed.

As the region enjoys a more equable climate than the Murree or Quetta area and has sufficient land and water resources, study has been made with a view to its development with Parachinar as its nucleus, as a prospective hill station.

Previously the area has been visited by Cotter, Heron and M.I. Ahmad. Cotter of Geological Survey of India visited the Agency in February, 1926 in connection with the water supply of Parachinar. Heron of Geological Survey of Pakistan, examined a few mineral deposits of the region in 1950. M.I. Ahmad spent a long time in the Agency in connection with geological mapping of the area in 1954. Unpublished reports of these officers are available in the Geological Survey of Pakistan.

Location : Kurram Agency is situated west-north west of the Kohat District (Fig. 1). It covers a few miles on either side of the Kurram river. The river enters the territory from Afghanistan about one mile south-west of Kharlachi, and after traversing the entire length of the Agency and parts of the Districts of Kohat and Bannu, joins the Indus west of Isakhel. The Agency extends from that in the east to the Peiwar Pass to the North west, a distance of about 70 miles. For about 45 miles from Thal the valley is narrow and is

*The paper is a comparative study of Parachinar Quetta, and Murree describing the physiographic and climatic conditions of the study area.

hedged in by low hills. After that, it widens considerably into the extensive Plain of Parachinar. This wide and sloping plain and its surrounding mountains constitute the Upper Kurram; while the lower and narrower part of the Agency is known as the Lower Kurram.

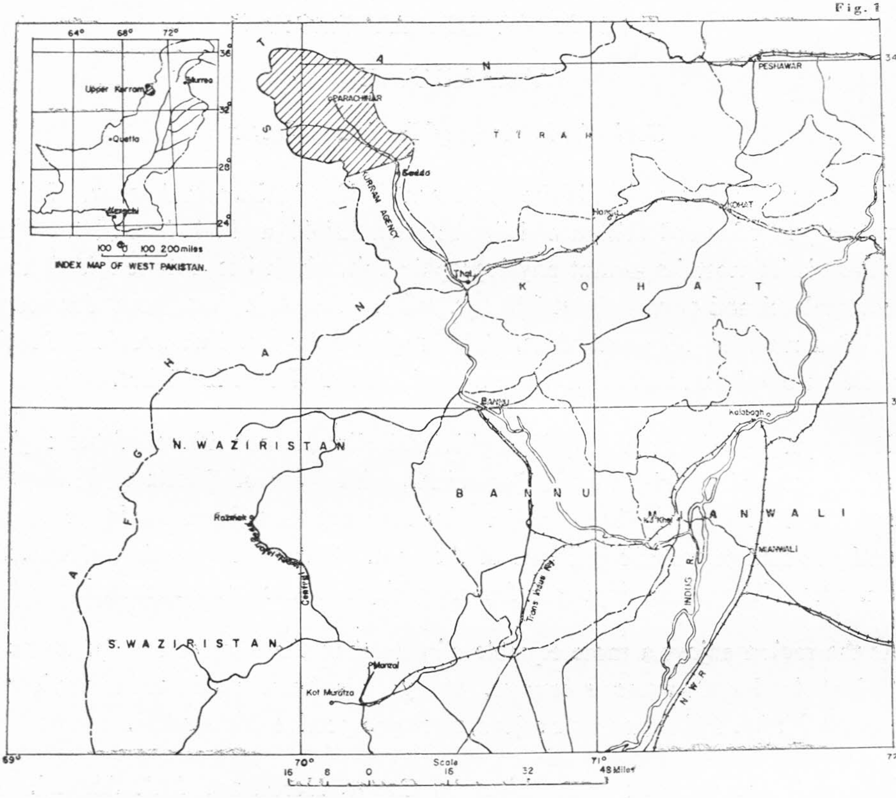


Fig. 1

Upper Kurram, though a remote part of the Agency, is fairly well connected with the settled districts of Kohat and Bannu on the border. Parachinar is connected via Thal with Kohat by an all weather metalled road and is 118 miles towards west north-west. In addition to the road link, a narrow guage railway line joins Kohat with Thal, a distance of about 62 miles. Kohat itself is the terminus of a broad-guage railway connecting Rawalpindi. That is connected in the South-west by road with Miranshah, the headquarters of North-Waziristan Agency.

Physiography

The most striking physiographic features of the Upper Kurram are the wide expanse of Parachinar plain in the centre and the towering Safed Koh forming its boundary in the north. The southern boundary of the plain is formed by the Muqbil andCharmu hills.

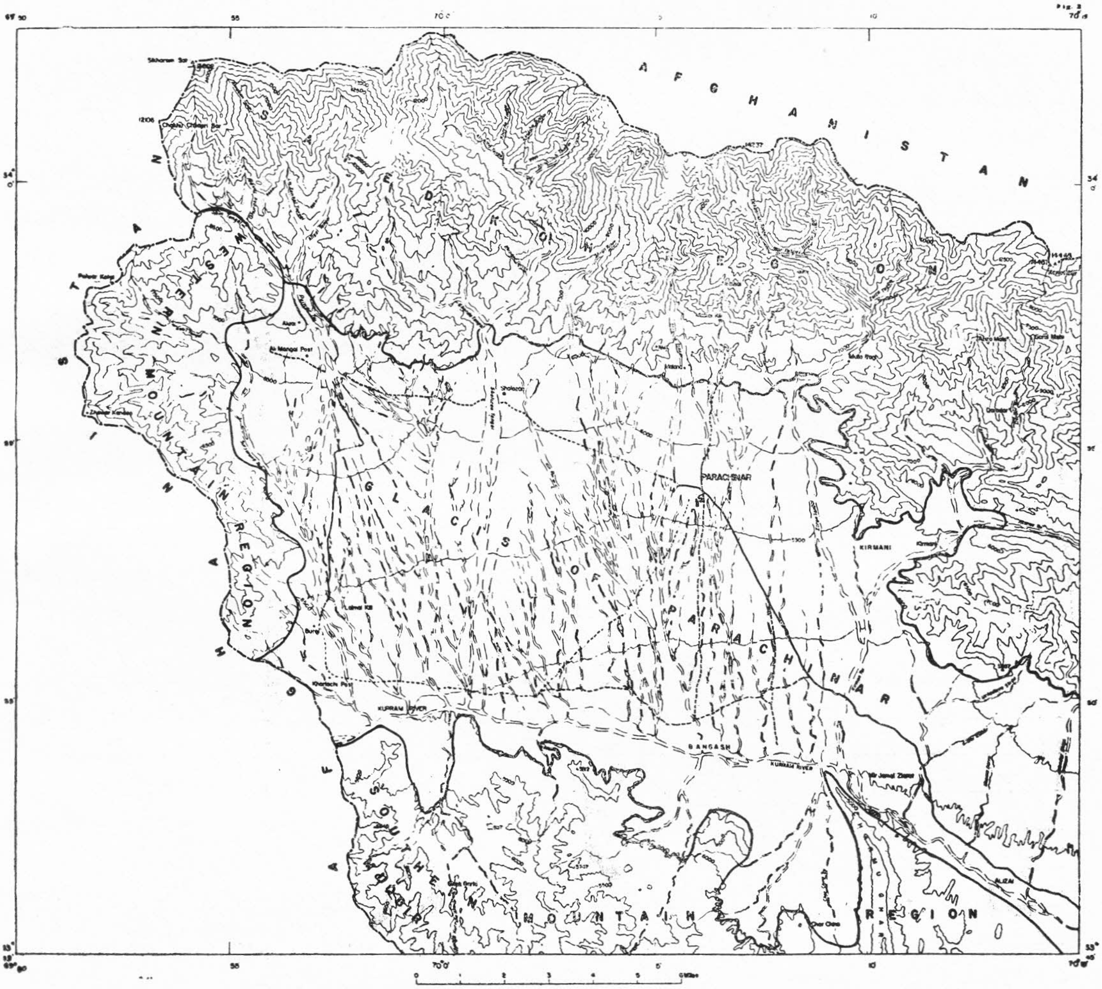
Its western side is bounded by the Mangal hills that extend from the north of the Peiwar Kotal to Kharlachi. Physiographically the Upper Kurram readily falls into the following four sub-divisions : (Fig. 2).

Safed Koh (Spin Ghar) Region.

Glacis of Parachinar.

Southern Mountain Region.

Western Mountain Region.



PHYSIOGRAPHIC DIVISIONS OF UPPER KURRAM AGENCY.

Fig. 2

From the point of view of utilization of water resources of the Upper Kurram, only the Safed Koh and the glacis of Parachinar require closer study as there is very little scope of development in the southern and western mountain regions due to scarcity of cultivable land and paucity of rainfall.

Safed Koh region : The most outstanding feature of the Upper Kurram is the Safed Koh whose several ranges are as high as 14,000 feet above sea level. Sikaram Sar, the highest peak, is 15,602 feet above sea level. This range besides being the boundary line, also constitutes a water-divide between Afghanistan and the Agency. Its southern slope, is about 8 miles wide and covers a total area of about 114 sqr. miles. Its east-west extension covers the entire length of the Parachinar plain. A number of streams, that drain the southern slope of the mountains, have carved narrow valleys across the slope of the ridge. These transverse valleys provide avenues of approach to the interior of the range. Peiwar Toi, Shalozan Tangai, Shian Tangai, Malana Tangai, Zeran Tangai and Daradar Tangai are some of the important transverse valleys. Connected with some of these valleys are passes that cross the range into the Nagrar region of Afghanistan. The passes lie between the height of 11,000 and 13,000 feet above sea level.

In the Safed Koh region are exposed rock formations of limestone, clay, shale and subordinate sandstone, and there are exposures of granite, gneisses and schists. Its slopes are fairly steep as is evident from the fall of altitude from 14,500 to 6,000 feet within a distance of about six miles, with a number of intervening ridges. Its intermont valleys are narrow and the flanking slopes are steep. As a result of the general steepness of the slopes of the mountain, its consequent streams, draining the slopes, bring down considerable quantities of rock debris with high proportions of boulders and pebbles. All these streams form extensive gravel fans where they emerge from the mountain confine. The plain of Parachinar is formed by the coalition of these gravel cones.

The Safed Koh or Spin Ghar is drained by a number of consequent streams. The direction of these stream is from north to south. The important transverse consequent streams from west to east are : Peiwar, Shalozan, Shian, Malana, Zeran and Daradar. The Kirmani Toi enters the Agency from the east near Kirmani village after draining a vast tract of the Tribal territory. Practically every one of these streams have a perennial flow. The flow decreases during winter when the greater part of the higher reaches of the Spin Ghar is snowbound. During summer, the discharge of these streams increases to flood dimensions of which most goes to waste. Unfortunately, no data of the seasonal discharge of these streams are available, as such the proportion of run-off, percolation etc. is very difficult to assess.

The catchment areas of the streams lie mostly along the southern slopes of the Spin Ghar. Only the Kirmani river has its catchment area outside the Agency. But this also commands the southern slopes of the extension of Safed Koh eastwards in the Tribal territory. The catchment areas of individual streams are given below :—

Peiwar	18 square miles.
Shalozan	28 ,, ,,
Shian	6.5 ,, ,,
Malana	7·0 ,, ,,
Zeran	23.0 ,, ,,
Daradar	14.5 ,, ,,
Total	97 ,, ,,
Kirmani	73 ,, ,,

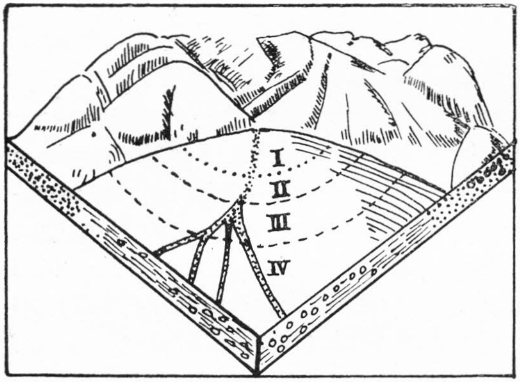
The total catchment area commanded by the bigger streams draining the southern slopes of the Spin Ghar is 97 square miles. Out of 114 square miles of mountain catchment area the remaining 17 square miles are drained by smaller streams that have not formed any sizeable valleys and are too small to merit attention. The Kirmani Toi alone commands 73 sqr. miles, by far the biggest catchment area of these streams. With 30 inches of annual rainfall in the catchment area, the stream brings down huge volumes of water during both the flood and normal seasons.

Glacis of Parachinar : Due to its equable climate and good agriculatural potentialities Parachinar Plain may be considered the most important part of the Agency It is a wide sloping plain of gravels, silt and clays brought by the streams draining the southern slope of the Safed Koh. The plain covers an area of about 100 sqr. miles. The gravel fans formed by the streams have pushed the Kurram River to the southern most limit of the valley, reaching close to the border of the southern mountains. The coalition of these gravel cones has formed a continuous belt of piedmont alluvial deposits forming the great glacis of Parachinar. Its gneral slope is from north to south and it extends for about 12 miles from east to west. Its north-south extension is 8 miles.

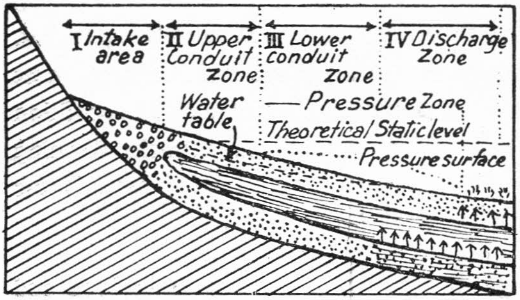
The plain is formed of rock debris brought down by the streams during flood and other seasons. It is composed of boulders, pebbles, sand, silt and clays. It is an excellent aquifer and must contain huge quantities of water that percolate through the stream beds and also from the falling rains.

An alluvial cone is formed of spreading layers of cobbles, boulders, sands and clays. Often impervious layers of silt and clay are also spread during subsiding floods in the lower portions of the cone. These impervious layers often seal the intervening tongues of gravels and sands and thus create conditions suitable for confined water and artesian aquifers in the lower half of the cone.

In general the hydrologic structure of an alluvial (gravel) cone is comprised of four functional divisions. (1)—the upper part of the Intake Area, where the stream debouches from the mountains. (2)—the Upper conduit zone or the zone from where the confining clay starts. (3)—the Lower conduit zone or the zone of pressure or artesian condition and (4)—the Discharge Area, where the sub-surface water emerges in the form springs (Fig. 3). (Tolman 1937, p. 372).



HYDROLOGICAL STRUCTURE OF AN ALLUVIAL CONE
I, Intake area ; II, Upper conduit Zone
III, Artesian or pressure zone, IV, Discharge Zone



CROSS SECTION OF AN ALLUVIAL CONE SHOWING HYDROLOGIC STRUCTURE AFTER TOLMAN

Fig. 3

The Parachinar plain slopes from north to south toward the Kurram river. It is steeper in the upper half but flattens toward the south. The slope varies between 1 in 12.5 to 1 in 31.5 across a line passing through Parachinar. The water, percolating through the stream beds from the intake area, flows southwards and creates a sloping water table towards the south. A number of springs emerge along the bed of the Kurram river where it is in contact with the apron of the gravel fan. The line of spring indicates the preseuce of the discharge zone of the gravel cones (Fig 4.). The position of the permanent watertable of the plain will be shown by the line joining the level of emergence of springs along the Kurram river and the depth of the water table in the stream beds debouching from the Safed Koh. In between the intake and discharge zones may be a pressure or artesian zone if the confining clay layers are present in the make up of the fans. If such a layer is present, which can only be proved by boring, a zone of artesian aquifer is likely to occur between two and three miles south of Parachinar.

Southern mountain region : The mountains that form the southern limit of Upper Kurram are lower in elevation and drier in aspect. Their maximum height is about 8,300 feet. The amount of rainfall received is little and as a result, these mountains are barrne and devoid of forest cover that is seen on the slopes of the Safed Koh.

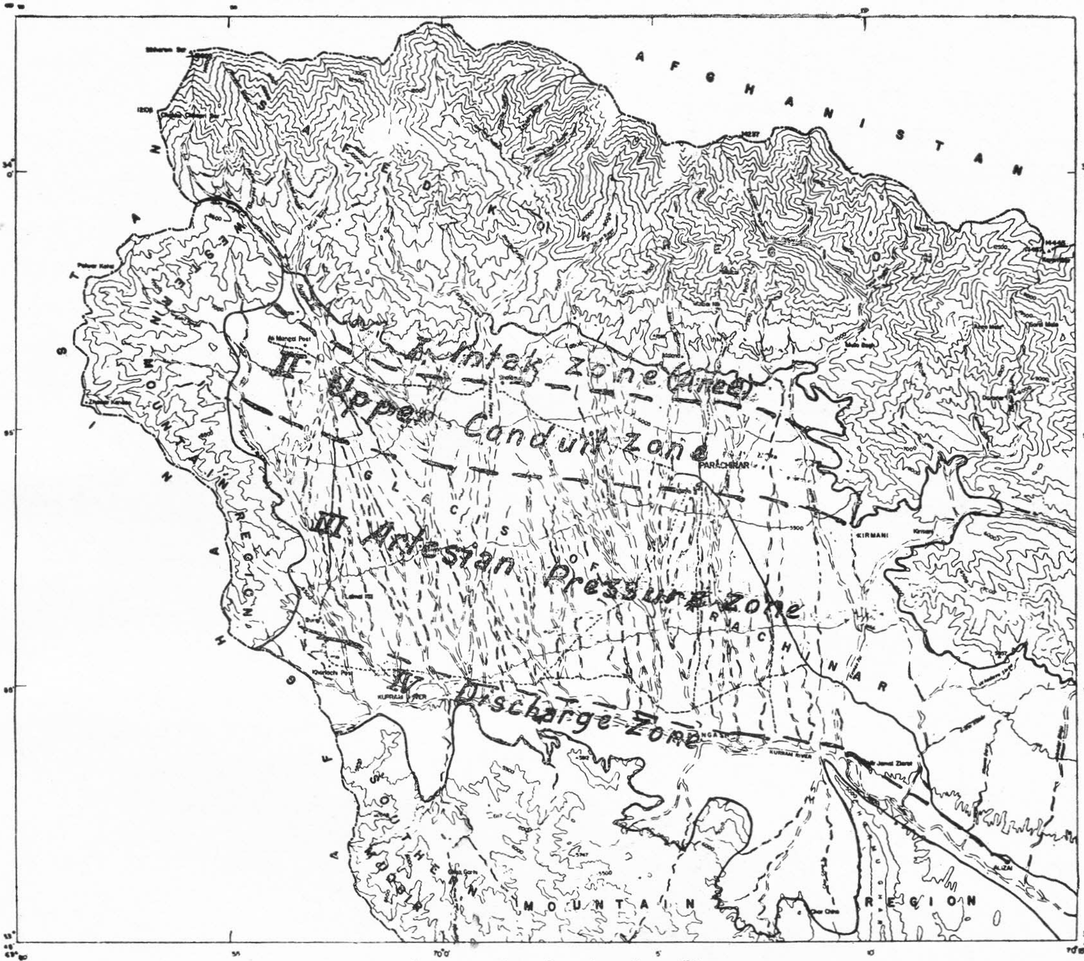


Fig. 4

Western mountain region: The Mangal range which is low in elevation, constitutes the western boundary of the Agency. Its highest point is 9,667 feet above the sea level at Zhawar Kandao, about three miles south of the Peiwar Kotal (pass). This range lies between the Peiwar Kotal and Kharlachi. At Kharlachi, the range drops rapidly in elevation and the Kurram river enters the valley. Peiwar Kotal is another very famous pass through the Mangal range in the north-western part of the Agency. It lies at an elevation of 8,533 feet.

Geology

Geologically, the area lying within the Agency is fairly complicated. Considerable thrusting with intense folding and faulting have affected the region. The Safed Koh and its eastward extensions represent a great line of overfolded and thrusted rock formations. It represents the westerly extension of the folded and over thrust sequence of Hazara. The over-thrust has brought a zone of Mesozoic and probably older limestones and shales, with wedges of Tertiary rocks, to rest with tectonic discordance on the Tertiary and Cretaceous rocks to the south. (Auden 1956, p. 3). According to M. I. Ahmad "Safed Koh has been formed by the thrusting of inverted beds of Mesozoic limestones and shales over the Murree and the Cretaceous shales. The latter had been faulted against the Murree before the thrust commenced. Ghazij shales and Kirthar Limestones, mostly brecciated, occur at places along the faulted contact of the Murree and Cretaceous Shales."

On the eastern extremity of the Spin Ghar in the region of the Darader Tangai and around Kirmani rocks, ranging from Jurassic to Palaeocene, crop out folded into isoclines. Excellent sections of thrusting and folding can be seen on the slopes between Karpachi Kalai and Maikai Rest House (Fig. 5).

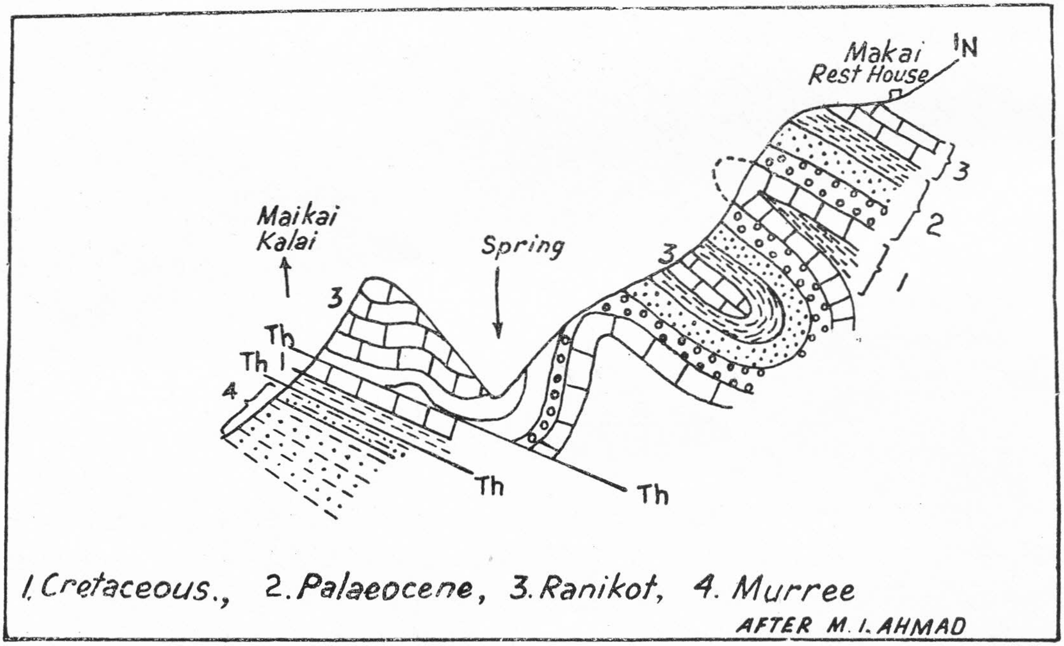


Fig. 5

Regarding the geology of the hills forming the southern boundary of the valley, no definite information exists about their structure and the age of rocks forming them.

The lower slopes and valleys are mostly formed of shales, looking somewhat similar to Cretaceous formations. Tahirkheli of Geological Survey of Pakistan reports to have found Belemnites in some of their exposures. The higher parts are mostly formed of limes-stones which he thinks are comparable with the Lithographic Limestones of the Samna Range. There are occasional bands of flaggy sandstones associated with the shale. Along the higher parts of these hills toward the south are a number of large intrusions of ultra-basic rocks.

The Spin Ghar range also shows evidence of igneous activity with accompayning metamorphism of the associated rock formations. The higher ranges appear to be formed of granite, gneisse and schists of various kinds and marble, slate and crystalline limestone.

A number of sills and dykes of basic and ultrabasic rocks intrude parts of the mountains. Besides these predominantly basic and ultrabasic intrusions, there are a few acid pegmatites with crystals of quartz, felspar, mica and tourmaline.

The general stratigraphic sequence of the area, as worked out by M. I. Ahmad, is as follows (Ahmad 1957) :—

Red and Maroon shales with conglomerates. ..	Murree
Dark grey shales ..	Ranikot
Dark grey limestone (brecciated) ..	
Sandstones with arenaceous limestones containing shell fragments of Gastropods at the top Conglomerate ..	Palaeocene
Greyish limestones with iron nodules ..	Cretaceous
Greyish arenaceous shales with Belemnites ..	Cretaceous
Massive grey limestones ..	Jurassic
Basic intrusions.	
Granite of the Safed Koh and metamorphic rocks.	

Structurally, the whole area is fairly complicated and, except for the major thrust structure of the Safed Koh with its associated isoclines, nothing is known about the nature of the Kurram valley. Its structure is completely obscured by the thick mantle of river borne deposits. It is a case of a valley fill formed by the coalition of a series of gravel cones.

Climate

Temperature : The Upper Kurram enjoys a sub-tropical continental highlands type of climate. It is characterised by cold snowy winters with the general winter and spring rains and also a little rain during the summer months. (Ahmad 1950, p. 25). On the whole the annual range of temperature is great. At Parachinar the mean minimum temperature in each of the winter months, from December to February, is below freezing point, while the mean maximum temperature lies between 50° F and 55°F. In June and July, the hottest months of the year, the mean maximum temperature is about 87°F.

Comparision of the mean monthly maximum and minimum temperatures of Parachinar with that of Murree and Quetta, the two important hill stations of West Pakistan, brings out some very interesting and enlightening facts to light Throughout the year, the mean monthly maximum temperatures of these three stations run nearly parallel to each other; and the position of Parachinar remains consistently in between Quetta and Murree.

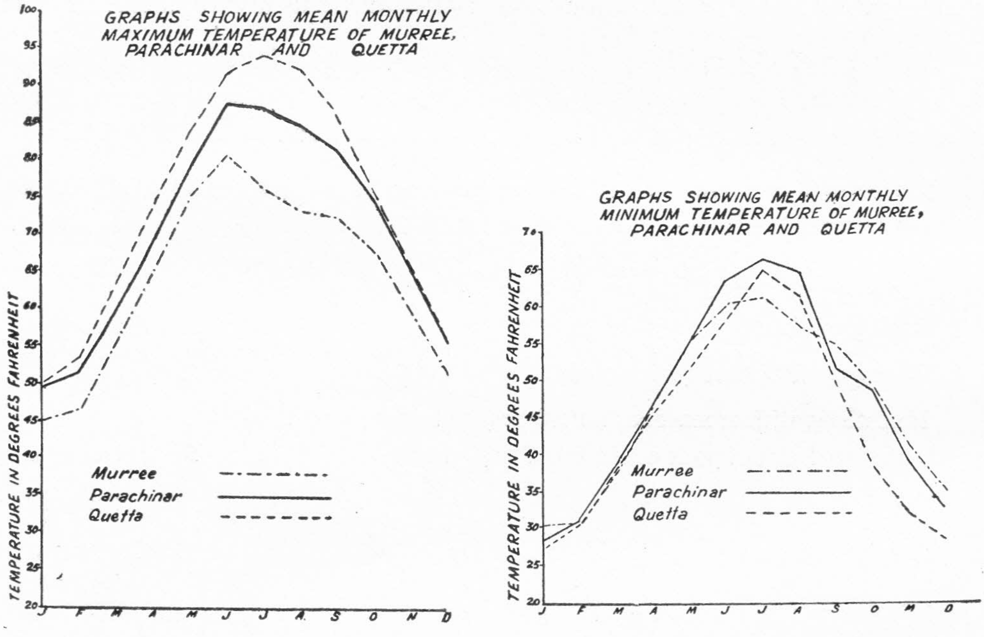


Fig. 6 and 7

(Figs. 6 and 7). Quetta records a summer maximum of 94°F, while the mean maximum summer temperature of Murree hardly reaches 80°F on the other hand Parachinar, during summer months, records a comfortable maximum of 87°F, a real mean of the two stations. The position of Parachinar with regard to the mean monthly minimum temperatures of Quetta and Murree is also note worthy. During winter, the mean monthly minimum temperature at Murree, Parachinar and Quetta are 30.7°F, 28.6°F and 27.6°F respectively. Here too, Parachinar occupies a middle position. So far as the mean minimum monthly temperatures of summer months is concerned, Parachinar records the highest of the three. It is 66.4°F in comparision to 58.9°F and 65°F of Murree and Quetta respectively. The mean monthly maximum and minimum temperature of Murree, Quetta and Parachinar are given below for comparison. (Ahmed 1950).

TABLE 1

MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURE

Station		Jan.	Feb.	Mar.	Apr.	June,	May	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Murree	..	M45.2	46.7	55.6	65.3	75.1	80.7	76.2	73.2	72.3	67.6	59.5	50.7	64.0
		N30.7	31.1	37.8	46.9	55.6	60.5	58.9	57.4	54.8	49.3	41.0	34.9	46.6
Quetta	..	M50.2	53.6	63.6	74.0	83.8	91.6	94.0	92.2	86.2	75.7	65.4	55.5	73.8
		N27.6	30.8	38.3	45.8	51.9	58.7	65.0	61.6	49.7	38.9	32.1	28.5	44.1
Parachinar	..	M49.8	51.8	59.8	68.7	79.5	87.7	87.1	84.7	81.2	74.2	64.7	54.8	70.3
		N28.6	31.3	38.6	46.9	55.6	63.7	66.4	64.8	51.6	48.7	39.3	32.5	47.9

M = Maximum. N = Minimum.

The above comparison clearly places the climate of Parachinar, or that of Upper Kurram, between that of Murree and Quetta. It lacks the extremes of the two stations and enjoys a more genial and equable climate.

Rainfall : The rainfall in the Agency is fairly good as compared with other parts of West Pakistan south of the Himalayas. It falls mainly during two seasons. The summer rain is received during the months of July and August; while the winter-spring rain falls during the months of March and April. The mean annual rainfall of Parachinar is 29.25 inches, March and April being the wettest months have more than 4 inches each; while July and August also receive more than 3.5 inches. The winter rain in the Agency is received from the western disturbances associated with the Mediterranean region; and the summer rain is due to the south-westerly monsoons prevailing throughout the greater part of the Indo-Pakistan sub-continent.

The mean monthly and annual rainfall of Murree, Parachinar and Quetta are given below.

TABLE 2

MEAN MONTHLY AND ANNUAL RAINFALL IN INCHES

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Murree	..	3.79	4.31	4.81	4.13	2.62	3.98	12.40	13.81	5.42	1.56	0.73	1.80	59.36
Parachinar	..	2.03	2.63	4.34	4.03	2.31	2.00	3.52	3.70	2.11	1.95	0.40	1.23	29.25
Quetta	..	1.94	1.98	1.74	0.98	0.39	0.17	0.46	0.33	0.04	0.12	0.28	1.01	9.44

The general trend of the graphs of mean monthly rainfall of these stations is nearly similar (Fig. 8). The two maxima of the summer and winter rains are quite marked in all the three cases. Interestingly enough, like the comparative temperature conditions of these places, Parachinar maintains an intermediate position even in the case of mean monthly and annual rainfalls. The amounts of mean annual rainfall for Murree, Parachinar and Quetta are 59.36, 29.25 and 9.44 inches respectively. (Fig. 9). The great difference between the annual rainfall of Murree and Parachinar is due to more pronounced activity of the summer monsoons in the Outer Hamalayas.

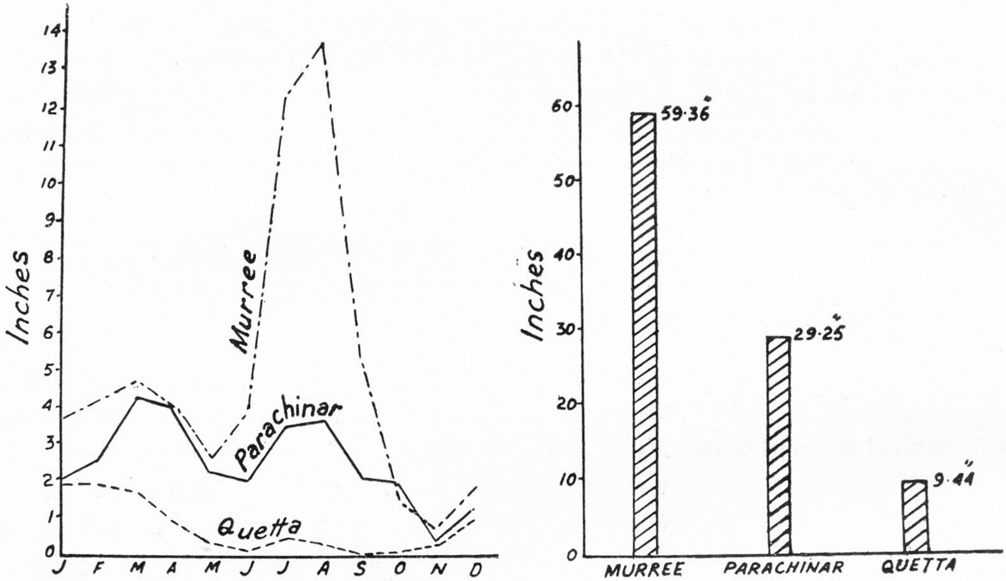


Fig. 8 and 9

The rainfall diminshes in amount and varies both from west to east, and from north to south. Among the recording stations Parachinar receives the highest amount in the Agency. Here, the mean annual rainfall exceeds 29 inches, while Sadda and Aravali record 22 and 14 inches of rain, respectively. These figures clearly indicate an increase of rainfall from east to west. Consistent with this trend, it will not be wrong to assume even higher rainfall in the region lying west of Parachinar. Ali Mangal and its surrounding areas are reported to receive a higher rainfall than Parachinar. The southern mountains receive lesser rain than the northern region. This part, as a result, is comparatively barren and dry. Unfortunately, no meteorological data are recorded at any place in the southern mountains region, consequently the conclusions arrived at regarding this region, are mostly based on apparent conditions.

Of the total amount of rainfall received during the winter months, a small percentage comes as snowfall. On the mountains this is, of course, much higher. No meteorological station exists on the mountains or even in their valleys to record the fall of snow in this area. As a result, no definite information is available regarding the amount of snow or rain that falls in the mountains. Occasional hailstorms in the mountains, and also sometimes on the plains, are the dreaded features of the region. Considerable damage is done by these hailstorm to fruit trees, crops and livestock.

During winter months the higher mountains remain snow-bound. A fair percentage of the winter precipitation is in form of snow that remains accumulated on the mountains. As a result, the supply of water in the mountain streams dwindles considerably. Some of them are reduced to a mere trickle. The volume of water coming from springs also decreases. The summer months herald the melting of snow on the mountains, along with the on set of summer rains. As a result, the streams draining the slopes of Spin Ghar come down in spate. By far the greater part of this flood water goes out of the region, as there is no provisions for the storage of flood waters in the Agency.

Water Resources

Before suggesting ways and means of utilisation of the rain that falls over the area, it is worth while making an assessment of actual quantities of water available in the region. A proper inventory of water resource of the area is very difficult to make as no record of any kind is available. The total amount of annual rainfall is reduced by evaporation, percolation and the run-off. A precise understanding of the relation between the total precipitation and run-off and also between evaporation and percolation becomes very important in the quantitative assessment of total water available in any question relating to water supply. An idea as to the percentage of total precipitation which ocours as run-off can be formed by stream guaging in the area. However, the relation between percolation and evaporation is not very easy to determine. No stream guaging has ever been attempted in any part of the Agency.

Considering the climatic conditions and the nature of the terrian, a very rough basis of calculation of the total quantity of water available is given below after assuming 25% of total rainfall as run-off and percolation factors. It should, however, be emphasised that this percentage figure is largely conjectural and is liable to correction when data are available.

Run-off : Assuming 25% as the run-off factor, 7½ inches of 30 inches annual rainfall will go as run-off from the mountain and the plain area.

From the Safed Koh region with a catchment area of 114 sqr. miles the total run-off will be : $114 \times 7.5 \times 2.3 = 1966.5$ million cu. feet. This is equal to 59 cusecs of water all the year round. The entire volume of this water does not flow off in the channels, but a certain percentage percolates into the sub-surface water flow in the plain of Parachinar.

The amount of run-off from individual streams draining the slopes of the Safed Koh or Spin Ghar is given below :—

Stream	Catchment area	Run-off	Cusecs
Peiwar ..	18 sq. miles	310 million c. ft.	9.3
Shalozan ..	28 ,,	438 ,, ,,	14.5
Shian ..	6.5 ,,	112 ,, ,,	3.36
Malana ..	7 ,,	121 ,, ,,	3.63
Zeran ..	23 ,,	397 ,, ,,	11.91
Daradar ..	14.5 ,,	250 ,, ,,	7.5
Kirmani ..	73 ,,	1259 ,, ,,	37.77

The amount of total run-off from the entire plain area that goes to the Kurram river is about 1938.7 million cubic feet which is equivalent of 58 cusecs.

Percolation : If 25% of the total annual rainfall is assumed to be the percolation factor in Upper Kurram the Safed Koh region with an area of 114 sq. miles will record an annual percolation of 1967 million cubic feet of water. This collossal amount of water which is equivalent of 59 cusec, goes to replenish subterranean reservoirs of water and a part of it comes up again in the form of springs. As a result of faulting and the complicated structure of the mountain belt, it is very difficult to say which way all of this water goes. However, due to joints, cracks and faults in the rock formation, a certain proportion of percolation water issues again as springs in different parts of the mountain area. These springs augment the general run-off in the streams.

Similarly, in the plain area about 1938 million cubic feet of water are annually added to the sub-surface supply of water by percolation. The annual replenishment of sub-surface water of the glacis of Parachinar amounts to not less than 58 cusecs.

Present Use of Water : Water flowing from the streams and springs is used for irrigation when and where possible in different parts of the Agency. Channels are made and the water is diverted to flow to the place where cultivable land is available. Wherever this water reaches, agriculture starts flourishing and occasionally fruit gardens also crop up. This state of affair is confined to a very limited fringe along the hills around big streams. Most of the irrigated land of the Upper Kurram lies in this belt. The next in importance comes the region lying on the bank of the river Kurram. The great plain of Parachinar, with the exception of Parachinar and a few places, lies barren and waste, and as a result is significantly called "Sahra".

Depending upon the physiographic location of the region the local administration has divided the whole region into the following assessment cricles. (1) Koh Damman (fring of mountain) (2) Rod Ghara (near lower river) (3) Sahra (wilderness).

Koh Damman is the region along the mountain river valleys near their debouchment along the fringe of the mountain. Here one finds the maximum use of water for irrigation. Of the total area under agriculture in this circle, 17000 acres are irrigated while only 1,416 acres are unirrigated. In Rod Ghara circle, the figures for irrigated and unirrigated acreage are above 7000 acres and 500 acres, respectively. In the case of Sahra, or the Parachinar plain circle, the figures are the least: 3500 and 1300 acres for irrigated and unirrigated land under agriculture. These are very insignificant figures compared with the great extent of culturable waste land that extends for miles and miles.

The figures quoted above in no way indicate the total extent of cultivable land available in the Upper Kurram. No regular survey of such a nature has so far been carried out, so no definite figures for culturable waste lands can be given. However, if the areas under the permanent and flood time channels of the mountain streams flowing across the plain be excluded as permanent waste land, considerable areas still remain in the Sahra region as culturable land. And these cultivable waste lands can be brought under the plough only if water can be supplied to them.

Solution of the Problem

Water storage : The main problem of the region is how to utilize the vast amount of water that goes to waste in the form of percolation and run-off. The run-off water can only be harnessed if some arrangement can be made for impounding it. The mountain streams have made narrow valleys, and there are a number of suitable places where a dam could be constructed to impound the water. In view of the very steep gradient of these valleys, the storage capacity of dams of moderate height will be very limited. Besides, these streams bring considerable quantities of boulders and pebbles during flood seasons, which will result in rapid silting of the reservoir.

The most promising stream in this respect appears to be the Peiwar Toi, but even in this case the gradient of its bed near the place of its debouchment on to the plain is about 1 in 10, which is fairly steep for any scheme for impounding of a stream.

The case of the Kirmani river seems to be little better. The gradient is less, but the valley is very narrow, and the storage capacity does not appear to be adequate for any big scheme. As the valley lies mostly in the Tribal belt no detailed examination could be attempted. However, in view of the vast amount of discharge of this stream and the unknown nature of the valley and its hinterland, it will be worth while at some future date to examine this valley more closely.

In view of the non-feasibility of satisfactory impounding schemes along the mountain valleys of the Upper Kurram, the only alternative is to look for sub-surface flow of the streams and to try to utilise it by having sub-surface weirs and infiltration galleries across these streams. Water from such schemes can be conveyed in lined channels or pipes to lower regions where it can be utilised for irrigation. There are suitable sites for sub-surface weirs in each valley either near its exit or some way up.

Hydro-electricity : As there are permanent flows of sub-surface water draining from the Safed Koh, a constant and assured source of supply can be tapped in each valley. If this is conveyed through pipes or lined channels a head can be developed in the lower regions where it is required to be utilised for irrigation. This head in the pipes at the point of their discharge can be utilised for generation of electricity.

A half-hearted attempt to harnesss the water of the Sbian Tangai in this way was made in pre-independence days. The surface flow of Shian stream is about 10—15 cusec: since this generally soaks into its bed after leaving the narrow rocky channel about two and half miles above Luqman Khel village, it was proposed to convey the flow in a lined channel to Luquram Khel for irrigation. The surplus water was also to be given to Parachinar to relieve its shortage.

The scheme was to be a multipurpose one, *viz.* irrigation-cum-hydroelectric. The slope in the valley down stream of the site where it was proposed to tap water for irrigation is generally 1 in 7. A drop of 700 feet could be obtained in a mile. With an average discharge of 8 cusec, about 400 K.W.T. of electric power was to be produced. This electricity was to be supplied to Parachinar where it was badly needed and where even to this day the existing installation can produce only 12 K.W.T. of electricity. The scheme never materialised, and only the broken channel remains in the Tangi to tell the story.

Similar schemes can be developed at every stream coming from the mountains, and a grid of hydroelectric stations along the lower part of the mountain region can be formed. The electrictity from such a system can best be utilised for running tube wells in the lower conduit or pressure zone of the Parachinar plain. Here, a couple of miles south of Parachinar, a series of tube wells along the lower part of the gravel fan can create a rich belt of agriculture and fruit gardening.

Water-falls: In addition to the possibilities of generation of hydro-electricity by waters brought down in pipes or lined channels from the sub-surface flow of streams, a large amount of hydro-electircity can also be developed from a number of water falls that lie along the course of streams coming from the Safed Koh. Notable falls occur along the Zeran and Daradar streams. Plate I. The Daradar water-fall is well up in the heart of the mountain

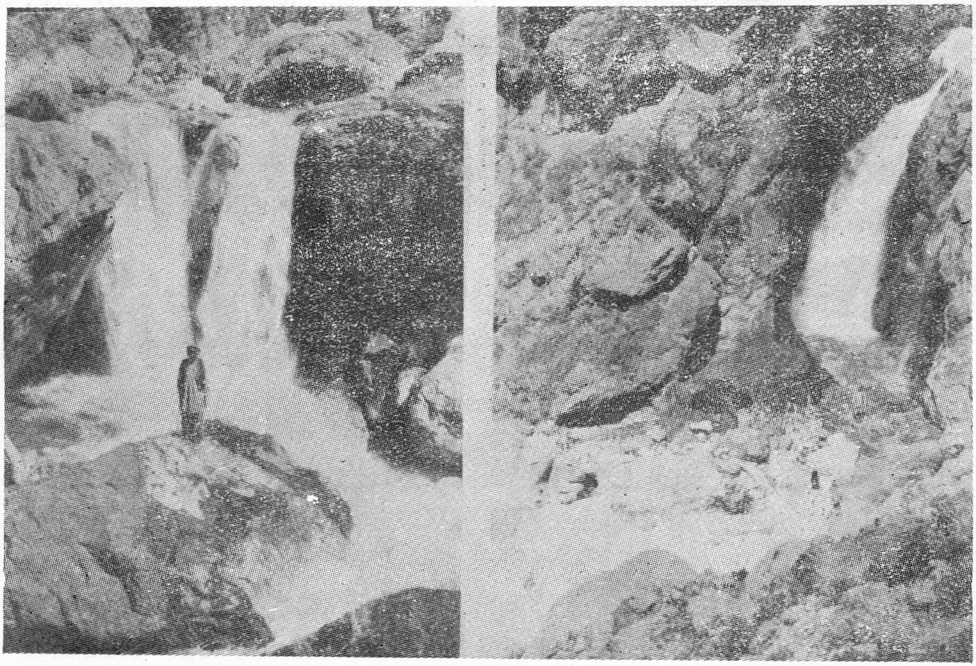


Plate 1

about 16 miles from Parachinar while the one occuring in Zeran Tangi is only half that distance. The latter occurs about half a mile downstream of the junction of the Star Tangai and the Zeran Tangai. There are a number of small cataracts in the vicinity. The biggest natural fall in the Tangai is about 50 feet. The discharge at the site on 19-6-55 was 90 cusec measured by the Agricultural Survey and Improvement staff. While the writer measured it as about 60 cusec on 15-6-56. It is thought that the winter discharge may be reduced to between 30 and 40 cusec. This fall can produce about 200 to 250 K.W.T. of electric power.

Plate 2

Other possibilities: Karezes are a very common sight in the Quetta and Kala Divisions. These Karezes tap the subsurface waters of the gravel fans of the region where rainfall in general is very scanty. There seems no reason why Karezes would not prove successful along the upper parts of the Parachinar plain where rain is plentiful. They would tap the subsurface flow from the mountain streams and irrigate parts of the plain lying in the lower regions. A number of Karez experts from Baluchistan could help in digging the channels. Although the digging of karezes appears to be feasible in this area, it would be quite expensive and would be beyond the means of the local inhabitants. A number of such Karezes could be dug under local development schemes.

Conclusion and Recommendations

The Upper Kurram, situated as it is between 4,500 and 14,500 feet above sea-level, has its extensive plain of Parachinar and the mountain valleys situated over an altitude of about 5,000 feet. The region has tremendous scope of development due to its extent, altitude and climate. The plain of Parachinar commands an area of over 100 square miles. It lies between the elevations of 4,500 and 6,700 feet above sea-level. Climatically it lacks the extremes of Quetta and Murree; and enjoys a cool and genial climate. As regards temperature and rainfall, the entire plain occupies an intermediate position between the two stations. It receives an annual rainfall of about 30 inches, which is considerably greater than that received in the environs of Quetta. Although climatically the Upper Kurram is placed in an enviable position, it is one of the least developed parts of West Pakistan. The greater part of the plain of Parachinar, despite its general climate and the amount of rainfall, lies barren and waste. Of the enormous amount of annual rain water rainfall, only a very insignificant part is utilised for irrigation along a narrow fringe near the places of debouchment of the streams from the mountain. The rest of the water goes to waste in the form of surface run-off or by percolating underground. If this water, by some means, can be harnessed for irrigation, the greater part of the plain can be brought under the plough; and the area can prove to be a potential source of the products of temperate climate. In addition, the region can also be developed into a good health resort. In view of the dearth of hill stations in West Pakistan, every effort should be made to develop the region and create nuclei for modern hill stations.

The main hurdle against the development of the region is the present lack of proper utilization of its water resources. The development of the region can be affected by harnessing the subsurface flows of the streams and by pumping it out from the lower parts of the gravel fans that form the plain of Parachinar. A number of subsurface weirs with infiltration galleries can be constructed across the stream beds in the mountain valleys. The water so collected can be sent in lined channels to the lower reaches on the plain to be utilised for irrigation and for drinking purposes. These schemes will irrigate the upper portions of the plain of Parachinar. In the lower portions of the plain, which constitutes the lower conduit or pressure, zone of the gravel fans, the underground water is likely to be under artesian or semi-artesian conditions; and here a number of tube wells, along a belt about two miles south of Parachinar, are likely to produce water in good quantities. If the water in tubewells does not happen to be under artesian conditions, which is not very unlikely, it can be pumped by using the electricity generated from the waterfalls of the mountain streams. Some electricity can also be generated from the lined channels bringing down water from the subsurface weirs constructed across the stream beds in the valleys. Due to the steep gradient along the upper reaches of the plain, a sufficient head can be created along these channels for the generation of electricity. A number of such small power stations can be constructed and grouped together with a grid system to given sufficient power for the development requirements of the Agency.

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AGE AND SEX COMPOSITION OF URBAN LOCALITIES, WEST PAKISTAN, 1961

BY

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Study of the age and sex composition of urban localities is revealing in several ways. It becomes all the more so in case the composition is correlated to the size class of the town under study, its sex ratio, rate of increase and immigration.

The profile of the age and sex distribution of a town (or a region) is the outcome of a number of forces that have been in operation over a long period of time. But, generally speaking, the proportion of the population in the several age groups will decline from the base of the pyramid towards its top in a population that has not undergone marked changes in the birth and death rates and which has been little influenced by migration to or from the place for which the pyramid is drawn. The decrease in the length of tiers is generally most pronounced between the age group 0—5 years and that of 5—10 years(1). Apart from the other factors, immigration is important in causing a buckling of the pyramid in the middle.

The age and sex pyramids were constructed on the 'comparable' method (as against the 'absolute' method) in which all age groups of male and female population are shown as percentages of total population (including male and female both). The method has the advantage of giving a "realistic view of sex and age variations(2)." The age and sex pyramids drawn in Fig. 1 are 'unorthomorphic,' that is, the width of each tier in the pyramid is uniform, and not proportional to its length. Since the purpose of the illustration was not to compare the heights of the pyramids, it was unnecessary to make the pyramids orthomorphic. The lengths of the pyramids showing per cent values of age and sex groups are on an arithmetical scale.

It pays to compare the age and sex composition of urban centres at the time of the latest census with those of earlier decades. The data of the nature available in the 1961 census is inadequate and related only to 22 urban centres of West Pakistan, belonging to the 50,000—under 100,000 and 100,000 and over population sizes. The earlier data is of a highly sporadic nature. However, comparisions have been set up wherever possible.

(1) T. L. Smith, *Population Analysis*, New York, 1948, pp. 91-92.

(2) E. J. Monkhouse and H. R. Wilkinson, *Maps and Diagrams*, London, 1952, p. 265.

The population size of the towns, illustrated in Fig 1, at the 1961 census, is given below :—

50,000—under 100,000	..	Mardan, Jhelum, Gujrat, Jhang, Kasur, Montgomery, Okara, Bahawalpur, Shikarpur and Mirpur Khas.
100,000 and over	..	Peshawar, Rawalpindi, Sargodha, Lyallpur, Lahore, Multan, Gujranwala, Sialkot, Sukkur, Hyderabad, Quetta and Karachi.

Of the 100,000 and over towns (cities), Rawalpindi (3,40,175), Lyallpur (4,25,248), Lahore (12,96,477), Multan (3,58,201), Hyderabad (4,34,537) and Karachi (19,12,598) are large size cities, with percentage increases over the past decade varying from 43 per cent in case of Rawalpindi to 137 per cent in case of Lyallpur.

The most salient features of the age and sex pyramids, illustrated in Fig. 1, are set out in the following paragraphs.

The pyramids are generally corrugated, signifying unstablised population trends, chiefly resulting from the rural-urban (and inter-town) migration. The factor of long-distance migration, as a consequence of the Partition, affecting the 1951 census figures, is practically non-existent now. The corrugations are more marked between :

(*i*) the 5—9 year and the higher age groups,

(*ii*) the age groups of 20—39 years and other tiers, and

(*iii*) the 60 and over year age group and the adjacent tier.

The last named corrugation is not very meaningful, since the highest tier includes all the age groups of 60 and over, and is, therefore, bound to be markedly longer than the adjacent lower tier. The retirement age group of 60 years and over in urban localities accounts for a slightly lesser percentage to the total as compared with the rural figures(3). The second corrugation signifies greater rural-urban migration of the economically productive age groups of 20—39 years. It has been a usual feature of the age and sex composition of towns over the past decades. The first noted corrugation seems to be most significant. Comparing Figs. 1 and 2, it can be seen that it is a new feature appearing in Fig. 1, and is highly suggestive of new trends in the natural rate of increase, resulting from a re-adjustment of birth and death rates, of lower age groups of urban population over the last 10 years.

The age and sex pyramids of the population of towns over the past decades, shown in Fig. 2, in general indicate a marked decrease in the length of the 5—9 (or 5—10) year tier

(3) Census of Pak, 1961, *Bulletin No.* 3, p. xii.

AGE AND SEX COMPOSITION

SELECTED URBAN LOCALITIES WEST PAKISTAN (1961)

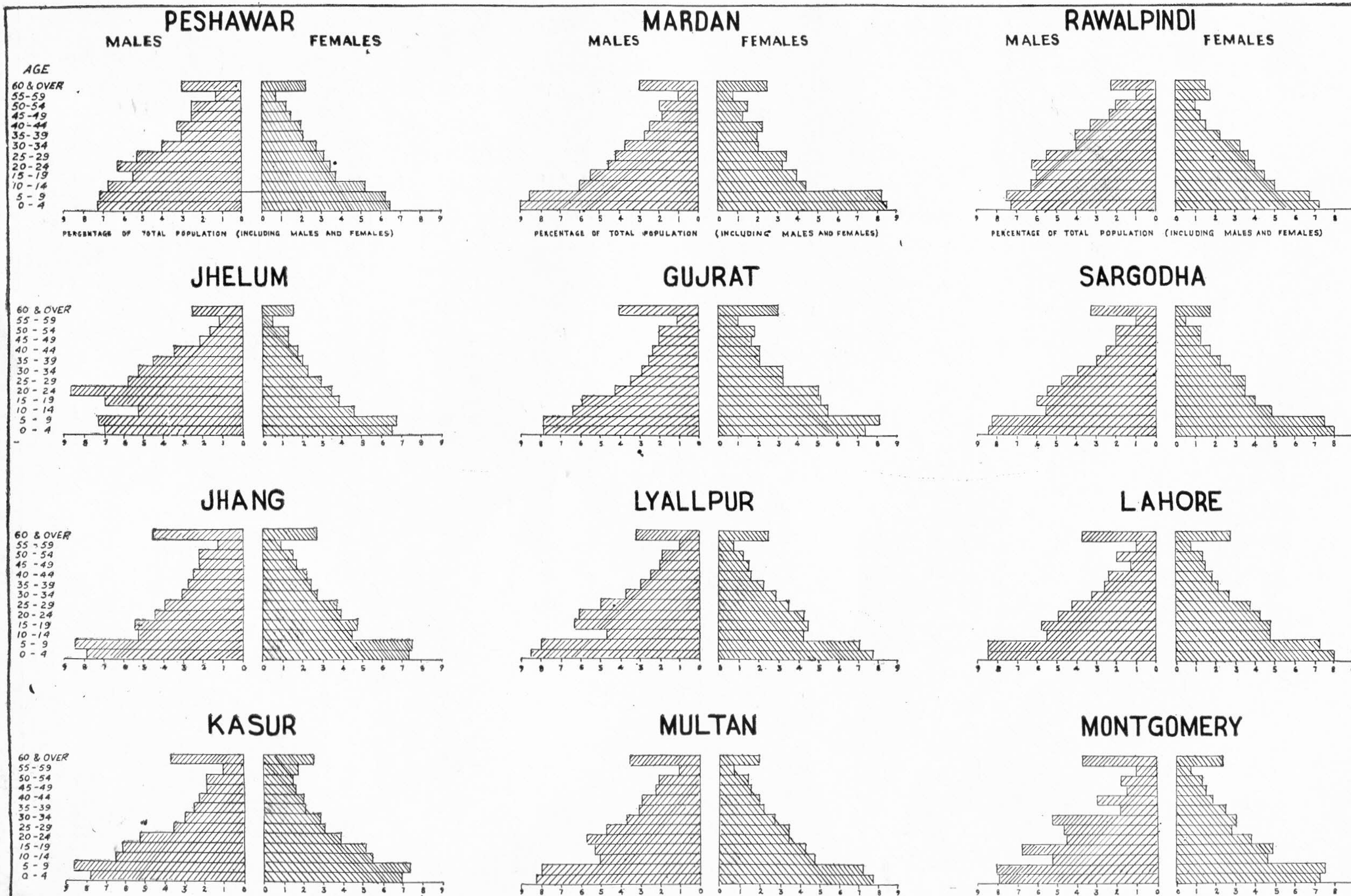


Fig. 1

AGE AND SEX COMPOSITION

SELECTED URBAN LOCALITIES WEST PAKISTAN (1961)

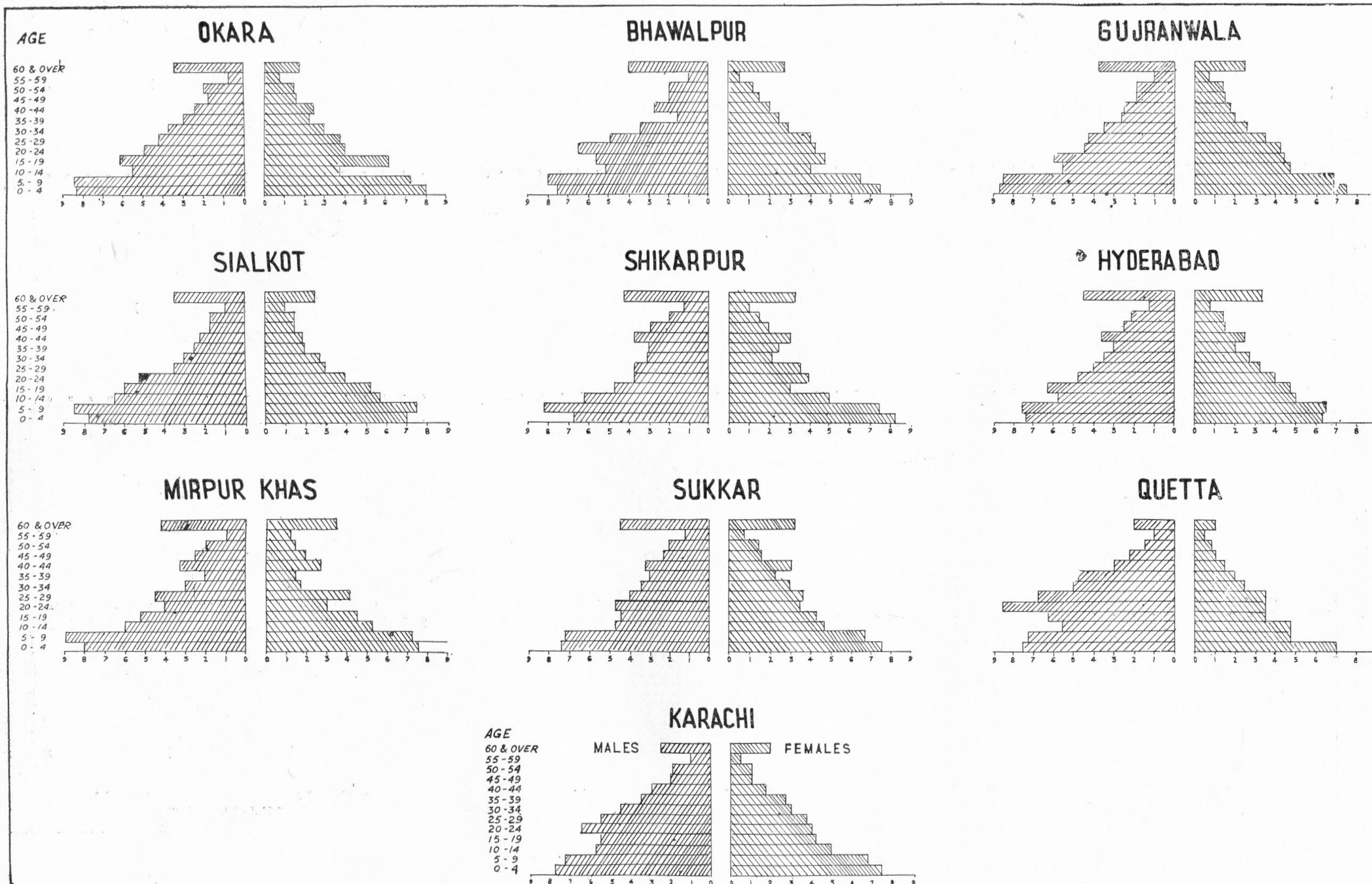
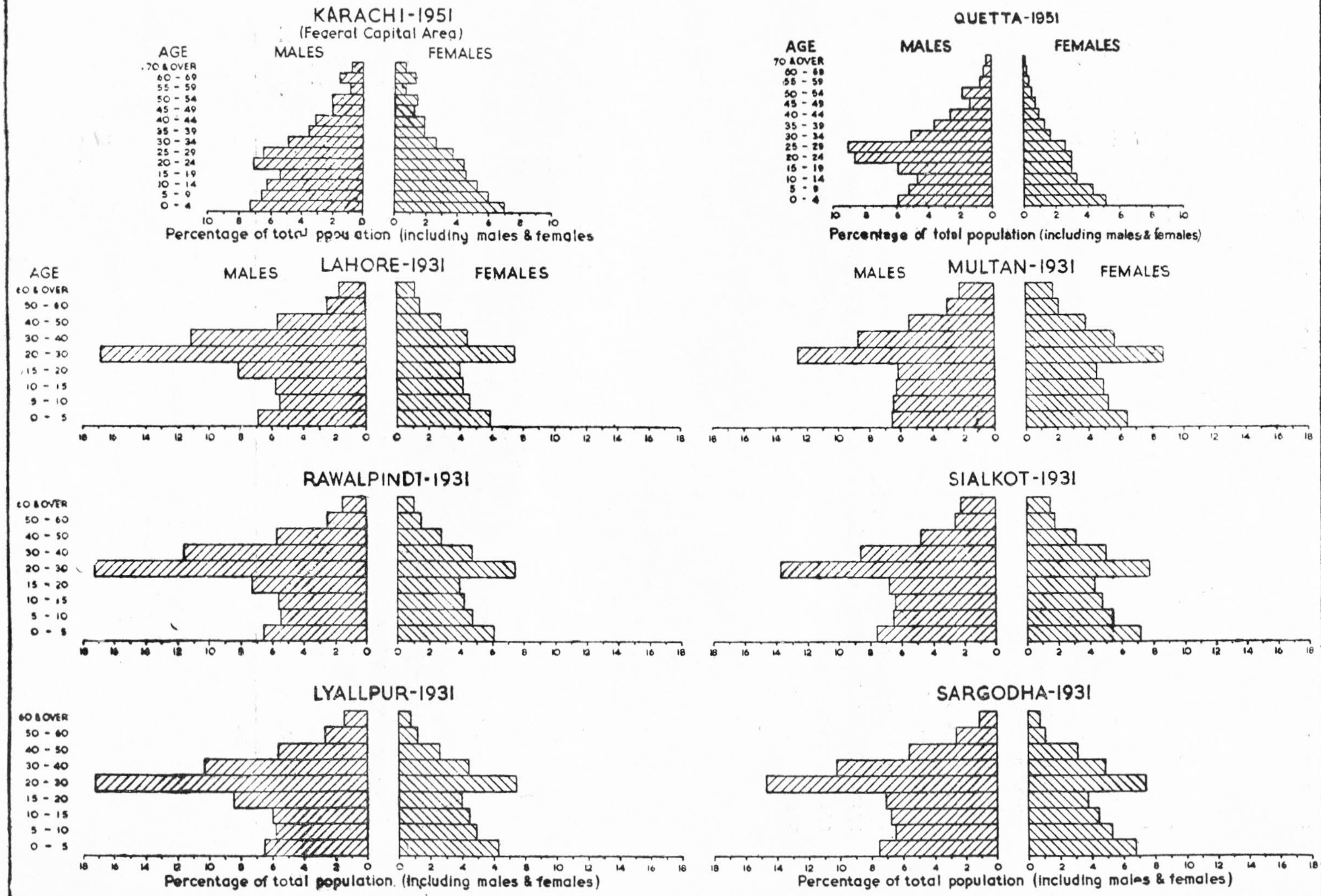


Fig. 1 (*Continued*)

AGE AND SEX COMPOSITION

OF THE POPULATION OF KARACHI (1951), QUETTA (1951), LAHORE, MULTAN RAWALPINDI, SIALKOT, LYALLPUR AND SARGODHA (1931)



N.B. Age and Sex Composition of Lahore, Multan, Rawalpindi, Sialkot, Lyallpur and Sargodha is shown for 1931, because later data were not available

Fig. 2

as compared with the lower one, signifying a commensurately high infant mortality. That is no more the case now. The substantial decrease over the decade, 1951—61, in the rate of infant mortality, manifest from a comparative study of the two bottom tiers of pyramids in Fig. 1, is in consonance with the general conditions prevailing in the country as a whole. In Pakistan in 1961 the percentage of children under 10 years of age to the total population was over 35 %. In 1951 it was only 28·4 %. The percentage of children under 10 years of age is large, increasing the number of dependents in the country(4). While over the decade, 1951—61, the rate of increase of total population was 2·3 % per annum that of child population of under 10 years returned an increase of about 5 %(5). It points to a greater pressure on educational institutions now and the availability of large labour force about 10 year hence. The substantial decrease in infant mortality seems to be the most important single factor counting towards the abnormal rate of increase of 2·3 % per annum of population of Pakistan over the dacade. The increase far belied the recorded estimates, given below. The United Nations estimate, assuming a constant fertility and moderately declining mortality, came nearest to the actual count. The difference of over 1,000,000 between the U. N. estimate and the actual count seems to be largely attributable to a greater declining mortality than assumed in the estimate.

Estimates of Population of Pakistan and the Actual Count(6).

		Million	
1.	Pakistan Planning Commission	88·9	(mid 1960).
2.	Mauldin and Hashmi	91·45	
3.	Rahman	90·41	(mid 1961)
4.	United Nations(7)	92·5	
5.	Pakistan Census Office	89·0	
6.	Actual Count	93·8	

Comparing the pyramids given in Fig. 1 with that for Pakistan for the same census, 1961,(8) the latter is found to be much less corrugated. It indicates that the causes affecting the age and sex composition of urban centres include the historical factors, applicable to the country as a whole, plus factors of short term application. The additional factors relate to the rural-urban migration, together with the fast changing economic and commercial aspect of urban centres. The pyramids representing urban centres and that of the country as a

(4) Census of Pak. 1961, *Bulletin No.* 3, p. vii.

(5) *Ibid*, p. x.

(6) Census of Pak, 1961, *Bulletin No.* 2, Statement 2-A, p. 4.

(7) *The Population of Asia and the Far East, U. N.*, 1959, quoted in *Ibid*, p. 4.

(8) Census of Pak, 1961, *Census Bulletin No.* 3, Fig. on title page.

whole are similar in the respect that the two lowest tiers in them are longest, and that the difference between these two tiers is, in general, not so marked as is found in the pyramids of earlier decades.

The lengths of the sections representing male population is greater in almost all the tiers than those representing female sections. A higher sex ratio (number of males per 100 females) in towns is largely the outcome of rural-urban migration, being comprised of larger proportion of males than females. The greater masculinity of the immigrant population to towns has its basis in the social bias of the people against allowing their womenfolk to seek remunerative employment in towns. Secondly, the employment that the towns provide at the present level of their commercial and industrial development is mostly of the nature which suits male labourers more than the female workers.

The disparity in the lengths of sections of tiers representing male and female population is more marked in case of the cities than in case of the towns of 50,000 to under 100,000 population size. The greatest difference occurs in the tiers representing the economically productive age groups of 20—39 years. It seems to explain the greater dynamism of these cities, resulting from rural-urban migration, selective of male than of female workers.

Although the sex ratio of the urban population of West Pakistan is greater than 100, it has been undergoing a slow but constant decrease over the last four decades. This decrease can be related to the increasing diversity of employment in urban centres or a greater 'freedom of the towns' with respect to the choice of professions, providing limited but increasing avenues of employment to females. It may be mentioned that the statement made earlier, regarding the more marked disparity in cities between the sections of tiers representing male and female population, does not go against the present assumption. Inspite of a more marked disparity, the total employment provided by a city to women workers may still be greater than that provided by a town of lower population size. An analysis of the 'civlian labour force' by size classes of towns and by sex in 1951 seems to favour the assumprion. The analysis reveals the following :

1. The proportion of the civilian labour force in the cities was higher than that of the urban population of West Pakistan as a whole.

2. The poportion of females in the civilian labour force was small in all the size classes of towns, but was not so small in cities.

The above two characteristics of the percentage distribution of civilian labour force, by size classes and sex, explain the greater rate of increase of population of cities as compared to the towns, and brings forth the greater freedom of the choice of professions in them, increasing the scope for the women workers to seek remunerative employment.

For assessing the volume of rural-urban migration the 'town-country ratio' of working age groups (15—60 years) is a useful index. In it an indication of volume of migration is provided by comparing the age structure of towns with that of the country as a whole. The town-country ratio is calculated as follows :

$$t/cr = \frac{a}{b} \times 100$$

Where t/cr is the town-country ratio,

a is the percentage of the economically active age groups to the total population of the town, and

b is the same percentage for the country(9).

The town-country ratio as an index of the volume of migration is decidedly better than the percentage increase of population. The percentage increase of population of a town over a specified period, say, a decade, is a function of both migration and natural increase, and not of migration alone.

In our towns the proportion of economically active female population is very small. It can, therefore, be safely assumed that the town-country ratio, as an index of rural-urban migration, will improve if the above formula is adapted as follows :

$$t/cr = \frac{a}{b} \times 100$$

Where t/cr is the town-country ratio,

$\acute{a}$ is the percentage of the economically active male age groups to the total male population of the town, and

b is the percentage of the economically active age groups of the country to the total population of the country.

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(9) (Editor) Jack P. Gibbs, *Urban Research Methods*, N. Y., 1961, pp. 138-9. In the formula given in the book the working age group is considered to be 15—65 years. The average age of our population is lower and the data of the age group 60—65 years are not available. In the present treatment, therefore, the working age group is considered to be 15—60 years.

The town-country ratios thus calculated for the 22 urban centres of West Pakistan are given in Table I.

TABLE I

Town-Country Ratio

Town	*Town-country Ratio*	*Town*	*Town-Country Ratio*
Mardan	104	Montgomery	111
Peshawar	103	Lyallpur	114
Rawalpindi	120	Jhang	105
Gujrat	102	Multan	112
Jhelum	130	Bahawalpur	114
Gujranwala	104	Sukkur	111
Sialkot	103	Shikarpur	106
Lahore	106	Hyderabad	111
Kasur	103	Mirpur Khas	101
Sargodha	111	Quetta	126
Okara	107	Karachi	119

The total range of town-country ratio of the above urban centres of West Pakistan is from 101 to 130, signifying considerable variations in the rate and volume of rural-urban migration to urban centres.

The following grouping of the towns in 3 ranges of town-country ratios throws further light on the subject.

Range of town-country ratio	*Towns grouped under the range*
(*a*) 101—110	Mirpur Khas, Gujrat, Peshawar, Kasur, Sialkot, Mardan, Gujranwala, Jhang, Shikarpur, Lahore and Okara.
(*b*) 111—120	Sargodha, Montgomery, Sukkur, Hyderabad, Multan, Lyallpur, Bahawalpur, Karachi and Rawalpindi.
(*c*) Over 120	Quetta and Jhelum.

The above grouping indicates that the bulk of the towns under review falls under the lowest range, signifying moderate rural-urban migration. Excepting Lahore, the urban centres grouped under this range are mostly towns and a few small cities. The small cities falling under the range have been indicating slow growth over the past few decades. The case of Lahore, being a large city with a high rate of growth over the past decades, is exceptional. The moderately low town-country ratio of Lahore might indicate one of the two following trends or both :

(*a*) The volume of rural-urban migration has been large in the past, but its rate is now declining.

(*b*) The turn over of labour in the commerce and industry of Lahore is decreasing. Possibly, there has been some improvement of late in the housing situation of labourers in Lahore, inducing them to live in the city with their families in increasing numbers.

The urban centres falling under the range 111—120 of the ratio are those which have been showing greater dynamism and are generally large size.

Only two centres, namely Jhelum and Quetta, come under the catagory of over 120 ratio. Jhelum town has returned a small decrease in its population over the last decade, but its cantonment has registered an appreciable increase. The cantonments generally have a large proportion of adult males. The high ratio of Jhelum is, therefore, only apparent, and has no significance. The high ratio of Quetta is difficult to explain, as the city over the past decades has not been registering a very fast growth. Possibly, the high ratio is related to the well known general migratory habit of the people of Baluchistan, also manifesting itself in the rural-urban migration.

NEWS & NOTES

COASTAL EMBANKMENT PROJECT

BY

KHAN MD. AZAM, CHAIRMAN,

East Pakistan Wapda

The most important problem facing East Pakistan is the problem of supply of food for the teeming millions inhabiting this Province. The population has been increasing very rapidly. The average density of population in this Province is over 1,000 person per sq. mile. The present population is nearly 55 million living in an area of 54,140 sq. miles only. It would thus be obvious that unless every effort is made to bring back maximum area under cultivation and ensure double or triple croppings, supply of sufficient quantity of food to the growing population cannot be ensured.

Every year large areas in the coastal districts of Khulna, Barisal, Noakhali and Chittagong are severely affected by saline inundation during high tides. If this vast area along the sea coast could be saved from inundation and allowed to be utilised for growing more crops., it would certainly be possible to boost up production considerably and help people to improve their economic condition.

Most of the lands in this area lie below the high tide level and would, therefore, be flooded if not protected by dykes or embankments. When the land is flooded by sea water, it leaves a layer of salt on the ground and makes the land unfit for cultivation until the salt is leached down by rain water. When any area is enclosed by dykes, it becomes necessary to provide arrangements to drain out accumulated rain water from within the embankment area. This drainage takes place during the ebbtides through automaticsluices whichprevent sea water from entering but allow drainage water to go out.

A few embankments were constructed earlier by Zamindars for a limited area but were of poor specifications and used to breach frequently and destroy crop. The drainage sluices were of timber requiring replacement almost every year and very often they were found to be inadequate. With the abolition of Zamindari system in 1951 no responsible agency was there to continue the repair and maintenance even. The condition of old dykes deteriorated with the passage of time. The ever increasing salinity of the soil caused by frequent inundation by high tides resulted in poorer yields which ultimately forced many farmers to abandon their lands and seek livelihood elsewhere.

The East Pakistan Water and Power Development Authority which actually started functioning in 1959 studied the problem at length and with the help of experts prepared the Coastal Embankment scheme. The scheme provides for properly designed embankments (along the entire sea front from our border with Indiato Burma) which are strong enough to withstand the pressure of sea water at high tides. These embankments will have pucca drainage sluices which will automatically drain out water from the embanked areas called 'polders'.

The Coastal Embankment Project is one of the most important under-takings of East Pakistan Water and Power Development Authority. It is spreads over the districts of Khulna, Bakerganj, Noakhali and Chittagong.

Estimated to cost Rs. 590 million, this project will reclaim a gross area of 3.4 million acres from inundation by saline sea water out of which 2.4 million acres will be suitable for growing paddy and other crops. The project provides for construction of about 3,000 miles of embankment along rivers and tidal estuaries to form protective enclosures for units of areas called '*Polders*'. The embankments containing over 185 million cubic yards of material will have 14 fit. top width; 5 ft. freeboard over the maximum high tide level side slopes of 10 to 1 ft. on the sea side and 3 to 1 ft. on inland side. About 5,200 large metal pipe sluices equipped with flap gates will be put in the embankments to allow excess water to drain during ebb tide and to prevent entry of saline water during high tide. About 1,000 miles of embankment have already been completed by Epwapda so far, protecting about 7,50,000 acres and giving an increased paddy yield of about 5.2 million maunds. The project is scheduled to be completed in 5 years time. A large number of sluices have been constructed and this year 500 sluices will be provided, and 294 miles of embankments will also be added. Last year the sluice work suffered due to shortage of cement. For this year 20,000tons of cementand 3,240 tons of steel has been been ordered.

It may be mentioned that in the cyclone of July 1963 the Coastal Embankments stood up to the fury of the sea waves admirably considering the fact that these embankments are not designed against cyclones and tidal bores. A great number of human lives and cattle and other property were saved wherever Embankments were completed. As an example, Hatia and Qutubdia Island were protected by Embankments and were thus completely saved while Sandwip Island had no Embankment protection and was thus heavily damar.d and many lives were lost. This has made the demand for embankments more imperative and there is wide spread clamour for them but due to physical limitations the scheme will take another 5 years to complete.

MULTAN POWER STATION

Multan one of the oldest cities of the subcontinent is known for its dust, heat, beggars and cemeteries. Now it has another distinction of being the centre of the largest power station in the country — a distinction which would solve many of its problems. This will eliminate ultimately, dust, heat and beggars from the city. Electric fans, air conditioners, refrigerators and other electric appliances, now in use in the city, are minimizing the effects of sultry weather during the summer. Mills, factories, warehouses and flourishing business centres that have sprung up with the abundance of cheap power will remove the curse of beggary. The growing industrialization has opened up new avenues of employment for thousands of people who had no means of livelihood. Schools, colleges, roads and multi-storeyed buildings are coming up. The telecommunications have improved considerably. Newspapers and news-agencies have opened their offices.

Six miles from the city stand the magnificent buildings of Pakistan's first gas power station at Piran Ghaib. The gas is flowed to the power house in huge pipes from Sui, 230 miles in the south. Attached to the power house is a big switchyard which carries the most powerful voltage line of 220 kv to Lyallpur as a part of what is known as the high tension or primary grid which pools the entire thermal and hydel energy in the northern region.

With the extension of power its generating capacity has almost been doubled to 265,000 kilowatts; this assures a continuous flow of power to all industry, irrigation tubewells and domestic consumers. The river flowers running low in the northern region of the province which decreases the production of hydel power will no longer affect the continuity of power supply conditions.

It took seven years to achieve this ultimate capacity. The work was started in 1956. Two units of 65,000 kilowatt steam sets and one 5000 kilowatt gas turbine were commissioned for commercial use in April 1960. In the same year the next phase was initiated and the extension programme next phase was intiated and the extension programme was taken in hand in April 1961. Under the extension programme two more steam geenrating units of 65,000 kilowatts each have been installed which went into full production on 25th December 1963.

At the time the first phase was taken up for exceution, the total generating capacity of the province connected to the national grid was a meagre 111,000 kilowatts pooled by small and mediumsized hydel, steam and diesel stations. It fell short of the demand by a large margin, but this shortage could not be assessed correctly since there were not basis to go by. General clamour for power, the demand of the industry for more energy and stringent curbs on new connections indicated the inadequacy of the power supply position in the province.

Lack of realisation that electrical power is the backbone of a country's economic development and the general deterioration of country's economy were among the factors which created such state of affairs. It was against this bleak background that a decision was taken to add a substantial amount of generating capacity tothe grid in the shortest possible time.

GEORGE B. CRESSEY (1896-1963)

George B. Cressey (1896-1963)

George Babcock Cressey was born December 15, 1896 and died October 21, 1963. He graduated from Dennison University in 1919 and received the Ph.D. in geology at the University of Chicago in 1923. He was on the faculty of the University of Shanghai from 1923 to 1929 before returning to Clark University to earn his second Ph.D., this time in geography, in 1931. He joined the faculty of Liberal Arts at Syracuse in 1931 as chairman of the Department of Geology, Geography, and Mineralogy. He was chairman of the separate Department of Geography from 1945 to 1951, in which year he was given the distinguished title of Maxwell Professor of Geography.

A man of tremendous energy and deep devotion to the study of the earth as a human habitat, he started early in life to follow the rule that to be a geographer one must travel. No other geographer has actually seen as much of the earth as he did. It is estimated that he traveled about half a million miles during his lifetime, visiting 75 countries and all the continents except Australia. There is no part of China in which he has not carried on field studies. He spent much of the time between 1955 and 1958 traveling to the most remote oases of Southwest Asia. His colleagues in other departments at Syracuse often greeted him on the campus with the query, "Are you just leaving for some place or did you just get back?"

His travels and field studies resulted in the publication of ten books, and some 200 shorter titles in professional periodicals. Some of his books have been through numerous editions, and have been translated into many languages. During his many months of illness he had started work on a new study of the resources of the ocean, in which field, had his life continued, he would have made a pioneer contribution.

Cressey was also active in professional organizations. He was president of the International Geographic Union from 1949 to 1962, and a member of the executive committee of the International Council of Scientific Unions from 1949 to 1956. He was honorary president of the Association of American Geographers in 1957, and president of the Association for Asian Studies in 1959-1960. He was also active in the Presbyterian Church, and was vice president of the Commission on Ecumenical Relations from 1953 to 1957.

But Cressey's devotion to geographical studies was expressed more fundamentally by his service as a teacher. It was not enough to see and understand the interconnections of man and the land throughout the world—he had to communicate his understandings. He did this with a rare vitality and enthusiasm which sent his students away with a new excitement about learning. Not only was he a brilliant lecturer, but in many way he was at his best in small seminars where his incisive questions and comments brought forth the best efforts of his students. He was always impatient with mediocrity and insisted on high standards of academic accomplishment. All over the world Cressey's former students occupy positions of leadership in the profession, and bow their heads in homage to the man who set them on their careers.

Cressey is survived by his wife, Marion Chatfield Cressey, by a son and three daughters, and five grandchildren.

PRESTON E. JAMES

BOOK REVIEWS

A GEOGRAPHY OF PAKISTAN : By Kazi S. Ahmad Oxford University Press, 1964, 12.5 × 19 cm. 216 pp. Limp edition Rs. 6/- boards Rs. 8.50.

Although Pakistan became a sovereign state in 1947, this is the first comprehensive geographical text book of Pakistan to be produced for use by College students. This book is therefore an excellent contribution to the geography of this sub-continent, and serious students in all parts of the world should find it of interest and value in assessing the development of Pakistan in the 16 years since Partition.

Dr. Kazi S. Ahmad has presented the geography of Pakistan from the systematic point of view, and has carefully traced the development in irrigation facilities, agricultural production, mining, the growth of industry etc. from the time of Partition. Thus the reader is in a position to assess for himself the progress made by this new nation. Each chapter contains fair and reliable information on Pakistan, there is no distortion of the facts, and one is pleased to note that the statement in chapter VIII "......but it is perhaps even more important that good use should be made of the land already under cultivation by increasing the yield per acre" is made clearer in the following chapter where yield per acre of the major crops is compared with yields in other parts of the world. Comparisons of this kind are too rare in the majority of text books.

As well as dealing so adequately in the textual sense with the geography of Pakistan, the book is also well supplied with clear maps and diagrams, an excellent statistical appendix and a number of well selected photographs.

This book, with its up to date information, concise style and detailed index will be indispensable in the teaching of Pakistan in Pakistan, and will be invaluable to students in ther countries who study this area. I have no hesitation in recommending it as an essential geographical text book to any subsequent study on Pakistan.

MARY P. COOPER,
Kinnaird College, Lahore.

ATLAS OF CENTRAL EUROPE John Murray, 1963. 42/- sterling.

This Atlas contains ten maps on a scale of 1 : 1,000,000, one map on a scale of 1:500,000 and two key maps on a scale of 1:5,000,000. It thus gives detailed relief maps of Germany (including all territory under the control of Germany in 1937), the Netherlands, Belgium, Luxembourg, Austria and Switzerland, thereby depicting most of the area covered by Miss Alice Mutton in her book on Central Europe, Readers of this book should therefore find this Atlas most useful. The scales of the maps are much larger than the normal scale of an Atlas map, and consequently more detail is shown which is a definite recommendation.

As this edition is only a section of an original German Atlas, most of the names are given their German form and this is not always the form familiar to those conversant with the English language, it is, therefore, not so easily used by the English speaking student, though an index of English equivalents of names is given. Unfortunately, map references are given by number and letter (*i.e.* D-6 etc.) and not by the exact latitude and longitude, thus decreasing the speed with which a place may be located.

Relief is shown by layer colouring and hill-shading, giving a three dimensional effect which is pleasing to the eye.

Such details as draingage channels in Western Schleswing, the lower Elbe, the Netherlands etc., a detailed map of the Ruhr industrial region and the inclusion of the most recent place name changes in areas administered by Poland or the U.S.S.R. are not available in other Atlases. Therefore, for the serious student of Central Europe, this Atlas is to be recommended.

M. P. C.

STATISTICAL SUPPLEMENT

1960 East Pakistan Census of Agriculture

The first Census of Agriculture in Pakistan was held in 1960, and it co-incided with the 1960 World Census of Agriculture programme sponsored by F. A. O. The Pakistan census was sponsered by the Central Government, and the implementation of the project was done by the Agriculture Census Organization in the Ministry of Food and Agriculture. The census was conducted in the two provinces with the help of the respective Provincial Revenue Departments.

The main objectives of the census were to develop basic information on the structure, resources and state of use of agriculture in the country and to provide benchmarks for the improvement of the current agricultural statistics.

In East Pakistan, the Census enumeration was done from 1st February to 21 March, 1960, on the basis of a ten per cent random sample of *Mouzas* (villages). In all, 5,773 sample *Mouzas* out of a total of 58,477 *mouzas* were covered by 1,900 enumerators working under the supervision of 400 supervisors. The information was collected by direct interviews with the farmers and live stock holders, of whom complete lists had already been prepared for each sample *Mouza*. The census questionnaire consisted of over one hundred questions regarding size and tenure of farms, utilization of land, means of irrigation, crops, manures, work animals, milch animals, other livestock, fish ponds, farm indebtedness,farming families and agricultural labour. A post enumeration survey was conducted in a sub-sample of 40 *mauzas*, soon after the completion of the census enumeration. Its objective was to obtain an estimate of the nature and content of errors in the enumeration.

Some of the census data on various subjects are being presented in the tables.

TABLE 1

LAND UTILIZATION, CLASSIFIED BY SIZE OF FARM

Size of Farm (acres	All Farms	Total Farm Area (acres)	Cultivated Area (acres)	UNCULTIVATED AREA							
				Total Uncultivated		*Forest (a)*		*Culturable Waste*		*Unculturable (b)*	
				Farms Re-porting	Unculti-vated Area (acres)	Farms Re-porting	Forest Area (acres)	Farms Re-porting	Cultu-rable Waste Area (acres)	Farms Re-porting	Uncul-turable Area (acres)
1	2	3	4	5	6	7	8	9	10	11	12
Total Farms ..	**61,39,480**	**2,17,25,827**	**1,91,38,139**	**60,19,590**	**25,87,688**	**13,50,370**	**5,04,037**	**9.14,180**	**4,70,518**	**59,46,360**	**16,13,133**
Under 0.5	8,02,630	2,04,496	1,38,382	7,82,070	66,114	97,750	5,358	53,520	3,609	7,76,070	57,147
0.5 to under 1.0	6,89,840	4,99,144	4,01,680	6,72,280	97,464	1,29,030	10,639	71,490	7,367	6,65,330	79,458
1.0 to under 2.5	16,77,410	28,26,355	24,68,590	16,35,810	3,57,765	3,08,420	49,311	1,89,810	38,466	16,07,470	2,69,988
2.5 to under 5.0	16,15,020	57,34,739	51,51,175	15,86,740	5,83,564	3,32,740	1,02,578	2,37,650	86,772	15,68,400	3,94,214
5.0 to under 7.5	6,98,450	41,92,948	37,80,245	6,90,660	4,12,703	2,07,820	80,004	1,49,870	78,046	6,83,260	2,54,653
7.5 to under 12.5	4,42,360	41,58,797	37,17,064	4,39,430	4,41,733	1,64,660	85,376	1,22,950	1,01,335	4,35,060	2,55,022
12.5 to under 25.0	1,87,790	30,66,199	26,88,922	1,86,750	3,77,277	96,450	70,529	76,220	1,04,350	1,85,190	2,02,398
25.0 to under 40.0	21,370	6,32,622	5,38,618	21,280	94,004	11,430	16,031	10,330	27,024	21,110	49,949
40.0 and over ..	4,610	4,10,527	2,53,463	4,570	1,57,064	2,070	83,211	2,340	23,549	4,470	50,304

(*a*) Covers forests on private farms only.

(*b*) Includes area not available for cultivation out of all area in private possession.

TABLE 2

INTENSITY OF LAND USE AND INTENSITY OF CROPPING FOR ALL FARMS, CLASSIFIED BY SIZE OF FARM

Size of Farm (acres)	CULTURABLE AREA (acres)					Cropped Area Area (acres)	INTENSITY (PERCENT)	
	Total	Culturable Waste	*Cultivated*				Land Use (*a*)	Cropping (*b*)
			Total	Net Sown	Current Fallow			
1	2	3	4	5	6	/	8	9
Total Farms	**1,96,08,657**	**4,70,518**	**1,91,38,139**	**1,88,47,649**	**2,90,490**	**2,78,81,320**	96	148
Under 0.5	1,41,991	3,609	1,38,382	1,37,688	694	2,28,391	97	166
0.5 to under 1.0	4,09,047	7,367	4,01,680	3,99,175	2,505	6,84,128	98	171
1.0 to under 2.5	25,07,056	38,466	24,68,590	24,49,766	18,824	40,67,276	98	166
2.5 to under 5.0	52,37,947	86,772	51,51,175	50,98,545	52,630	79,05,934	97	155
5.0 to under 7.5	38,58,291	78,046	37,80,245	37,26,310	53,935	54,71,215	97	147
7.5 to under 12.5	38,18,399	1,01,335	37,17,064	36,50,877	66,187	51,12,382	96	140
12.5 to under 25.0	27,93,272	1,04,350	26,88,922	26,22,922	66,000	34,68,860	94	132
25.0 to under 40.0	5,65,642	27,024	5,38,618	5,18,786	19,832	6,57,913	92	127
40.0 and over	2,77,012	23,549	2,53,463	2,43,580	9,883	2,85,221	88	117

(*a*) Land use intensity $= \dfrac{\text{Net sown area X 100}}{\text{Culturable area}}$

(*b*) Cropping Intensity$= \dfrac{\text{Total cropped area X 100}}{\text{Net Sown area}}$

TABLE 3

INTENSITY OF LAND USE AND INTENSITY OF CROPPING FOR OWNER FARMS, CLASSIFIED BY SIZE OF FARM

Size of Farm (acres)	CULTURABLE AREA (acres)					Cropped Area (acres)	INTENSITY PERCENT) (*a*)	
	Total	Culturable Waste	*Cultivated*				Land Use	Cropping
			Total	Net Sown	Current Fallow			
1	2	3	4	5	6	7	8	9
Total Farms ..	**1,02,92,567**	**3,00,183**	**99,92,384**	**98,21,042**	**1,71,342**	**1,45,72,131**	**95**	**148**
Under 0.5	1,23,862	3,416	1,20,446	1,19,814	632	1,97,462	97	165
0.5 to under 1.0	3,10,389	6,441	3,03,948	3,01,958	1,990	5,14,004	97	170
1.0 to under 2.5	14,47,477	27,255	14,20,222	14,08,484	11,738	23,24,361	97	165
2.5 to under 5.0	23,84,233	49,324	23,34,909	23,08,822	26,087	35,93,343	97	156
5.0 to under 7.5	17,99,301	44,089	17,55,212	17,28,250	26,962	25,62,664	96	148
7.5 to under 12.5	19,93,859	60,414	19,33,445	18,95,640	37,805	26,77,321	95	141
12.5 to under 25.0	16,51,887	67,245	15,84,642	15,41,411	43,231	20,60,269	93	134
25.0 to under 40.0	3,81,719	21,198	3,60,521	3,45,499	15,022	4,43,804	91	128
40.0 and over	1,99,840	20,801	1,79,039	1,71,164	7,875	1,96,903	86	115

(*a*) See foot-note table 13.

TABLE 4

INTENSITY OF LAND USE AND INTENSITY OF CROPPING FOR OWNER-cum-TENANT FARMS, CLASSIFIED BY SIZE OF FARM

Size of Farm (acres)	Culturable Area (acres)					Cropped Area (acres)	Intensity (Present) (*a*)	
	Total	Culturable Waste	Cultivated				Land Used	Cropping
			Total	Net Slown	Current Fallow			
1	2	3	4	5	6	7	8	9
Total Farms	**90,83,161**	**1,68,624**	**89,14,537**	**87,98,463**	**1,16,074**	**1,29,79,881**	**97**	**148**
Under 0.5	14,927	159	14,768	14,716	52	25,650	99	174
0.5 to under 1.0	90,271	878	89,393	88,954	439	1,56,196	99	176
1.0 to under 2.5	10,05,671	10,783	9,94,888	9,88,359	6,529	16,59,080	98	168
2.5 to under 5.0	27,59,915	36,914	27,23,001	26,97,709	25,292	41,77,404	98	155
5.0 to under 7.5	20,16,331	33,743	19,82,588	19,56,320	26,268	28,52,296	97	146
7.5 to under 12.5	18,03,029	40,634	17,62,395	17,34,260	28,135	24,08,578	96	139
12.5 to under 25.0	11,33,424	36,955	10,96,469	10,73,928	22,541	13,99,995	95	130
25.0 to under 40.0	1,82,421	5,810	1,76,611	1,71,801	4,810	2,12,364	94	124
40.0 and over	77,172	2,748	74,424	72,416	2,008	88,318	94	122

(*a*) See foot-note table 13.

TABLE 5

INTENSITY OF LAND USE AND INTENSITY OF CROPPING FOR TENANT FARMS, CLASSIFIED BY SIZE OF FARM

Size of Farm (acres)	Culturable Area (acres)					Cropped Area (acres)	Intensity (Percent) (*a*)	
	Total	Culturable Waste	Cultivated: Total	Cultivated: Net Sown	Cultivated: Current Fallow		Land Use	Cropping
1	2	3	4	5	6	7	8	9
Total Farms ..	**2,32,929**	**1,711**	**2,31,218**	**2,28,144**	**3,074**	**3,29,308**	**98**	**144**
Under 0.5	3,202	34	3,168	3,158	10	5,278	99	167
0.5 to under 1.0	8,387	48	8,339	8,263	76	13,930	99	169
1.0 to under 2.5	53,908	428	53,480	52,923	557	83,835	98	158
2.5 to under 5.0	93,799	534	93,265	92,014	1,251	1,33,186	98	145
5.0 to under 7.5	42,659	214	42,445	41,740	705	56,255	98	135
7.5 to under 12.5	21,511	287	21,224	20,977	247	26,483	97	126
12.5 to under 25.0	7,961	150	7,811	7,583	228	8,595	95	113
25.0 to under 40.0	1,502	16	1,486	1,486	..	1,746	99	117
40.0 and over	..	..	..	..	..	..	..	..

(*a*) See foot-note table 13.

(*ii*) **Shorter Contributions** of research and semi-research type which present a summary of work in progress and results achieved. General accounts of fieldtrips are also included in this category. They should not exceed 1,500 words.

(*iii*) **Correspondence** in which contributors may communicate their views and comments on papers appearing in the journal. A space limit of 1000 words should be observed.

(*iv*) **News and Notes** which contain brief accounts of new discoveries of resources, development projects and other news of geographical interest. They should not exceed 500 words.

3. The manuscripts should be typewritten, double spaced, typed on one side of the paper with wide margins. The diagrams and photographs should be clear. The tables should be consistent with the size of the Review. References should be listed at the end of the paper either in order of citation or alphabetically and indicated in the text by the corresponding number written in parenthesis.

4. The contributions are accepted with the understanding that they have not been published elsewhere.

5. Writers of Papers and Shorter Contributions are supplied with 15 complimentary reprints of their contributions. In case they require more copies they should indicate the number of copies desired at the time of receipt of intimation regarding the acceptance of their contributions.

6. Normally the proofs are seen by the writers but in order to preclude any possibility of delay and maintain the schedule strictly they are not sent to writers outside of Lahore. Additions at this stage should be avoided.

7. The publication of a paper should not be assumed as an approval by the Editors of the statements and opinions expressed by the writers. In fact, the former do not hold any responsibility to that effect. However, the Editors reserve the right of removing such material from the papers as they consider is unnecessary or is lacking in sound theoretical and empirical foundation.

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