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**Physiographic region:** The end product of south Asian structural and erosion history is summarized in the map of physiographic region which leaves in Spate's work and accompanying key table. These regions provide a frame of reference for subsequent discussions.

**1. Baluchistan:** The arid basins and hills of Baluchistan from the eastern portion of the great Iranian Plateaus sharply marked off from the Indus plain by the Kirthar and Sulaman ramparts. In the north of the Gomal River may be taken as a rational limit beyond this the strongly trellised. Drainage patterns of Baluchistan are replaced by transverse direct to Indus, giving a distinctly different human astrologic emphasis.

**1.1. Intermountain Basin and ranges:** This plateau is uneven. Average height from sea level is 1000f to 3000f. In the central area the Quetta and Kalat hills are situated. This average height is 5000f. In the other side some hills in the direction of North West to south west. These are called Chaghi and Tobakakar hills. Hills are border line between Pakistan and Afghanistan. Prabvi and Makran hills are in the central part of the plateau. In North West the famous desert Dusht is small tributaries flows towards Hamune Mashkel. Its saltiest waters due to heavy evaporation many interior basins of the rivers Kuchi plain, Lasbela and Dushat plain. This plateau is out of range from monsoon. Makran coast ranges is here and its average height 2000f. Sialkot range average height 1878ft. flow of water is underground average rainfall 8" annually due to cyclone. Important rivers Hub, Urali, Hengol and Dushat. Coal, Iron ore, gypsum, chromites are request. May out joint hotter month.

**1.2. Sulaman ranges:** South from the Gomal rivers the great series known collectively as the Sulaman range which rise to over 11000ft in Tekh-i-Suliman 11440ft from the Gomal but have summits general at 6000, 7000ft. at about 30N the Sulaman begin to swing westward, until finally their continuation in the Bugti Hills are providing towards the Quetta node looped between the Tobakakar and Sulaman ranges lie the trellis-pattern basin of the Zhob and the Beji vested fold of Cretaceous and Eocene live stores and sand stones producing in Loralai and extra ordinary landscape of innumerable scarp and hogs backs small plateaus steep craggy out crops with the talus slopes littered with boulders half the size of the field and set in the arid hills, gray, dunes and orchard, few greener patches in small alluvial or detrital basins.

**1.3. Kirthar ranges:** There is marked contrast between ranges of either side of 66 E to the east massive lime stones, Cretaceous Oligocene with some intrusion of Deccan Lava age from great anticline bulges. Erosion has opened up anticlines but this arid climate and thirsty rock it has not progressed stage of inversion of relief. The most striking feature on the Kirthar Wall rising from 4000ft in the south to nearly 8000 in the north and broken only by a few gorges such as those of the ( Mula and Gaj ) Mula remained in used Alexander's army with drawing. The capping of the Kirthar is the massive spitting limestone which also forms the Kalat plateau at 7000ft 8000ft. in the south ranges break down into the little scarps behind Karachi, and the triangular alluvial low lands the Purali occupied by Las Bela state.

**2. North West frontier hill and sub mountain Indus:** in a broad sense the hills of the old “North west Frontier” are but the ragged fringe of Afghanistan. The clear trends of and massive structure of Baluchistan are absent north of the Gomal some extant there is corresponding human fragmentation. The majority of the people of north western frontier hills are of one ethnic stock, one language and one faith, pathan, Pashto, Sunni islam respectively.

The western boundary of the regions is of course arbitrary the Duarand line the political boundary between Pakistan and Afghanistan, the eastern boundary from the Vale of Peshawar south ward is taken as Daman where the sinks under the basin along Indus. In the north spurs sunning down from the Hindukush/ Pamir/ Karakorum node.

The change of direction between the Karakorum and the Hindukush is presumably controlled at a direction, by the hidden out lines of the peninsular blocks. The long tongue of Afghanistan territory in the Oxus valley Wuhan the buffer strip between Russia and Iran Empire.

Here the north boundary lies at 16000-24000ft on hindukush watershed between yarkhune and Chitral River and Gilgit. South from this watershed as far as Kabul river (220 miles) the general trend is north east-south west of Tirich Mir in the north of chitral to 5000 to 6000ft. in the Mahmand hills and Malakand ridge which separates the swat valley from vale of Peshawar. The far north is geologically Himalaya’s territory.

This mountain atea is gashed by deep nattow valleys the town of chitral itself only 30 miles from Tirich Mir is less than 5000ft. the striking parallelism of the yarkhune, chitral- kunat, punjkura, and Swat Rivers to the middle Indus and their relation to the Kabul River.

South of Kabul river northeast/south west trend is intruded by the strong west east line of safed koh ranges which reaches 15620ft, hills in the angle between the Kabul or Landai River and the Indus. This trend is perhaps a continuation of an outer Himalayas ls from neighborhood of Jhelum gorge by the Kala chita Dhar south of attack.

The whole area between the safed koh and the Tochi river is a triangle of arid hills up to Eocene limestone’s and siwaliks sand storm and up to Kuram valley.in between Bannu and jandola these seems to be an accurate arrangement to meet the spur of the norh western hills of the salt ranges nearly meet in the Pezu Gap between Bannu and D.I Khan. In the extreme south Waziristan north/ south trends of sulaman.

**Sub mountain region Indus:** this area describe as the sub – mountain Indus rage as

- a. Three plains of Peshawar, Kohat and Bannu
- b. Potwar plateau east of Indus
- c. Salt ranges
- I. The Vale of Peshawar forms a semi circle of low land of some 2200 sq miles hill-girt except in the east where only a low sand stone ridge separates it from the Indus.  
The basin floor consist Attack slates, Vidhyan in age, but mainly buried deep in gravelly or clayey alluvium.

Perennial water from the two main rivers Kabul and Swat has long provided irrigation. The central basin is watered by upper and lower swat canals. The Peshawar areas are supplied by the Kabul canal and by the multipurpose Warsak Dam on the Kabul River which will ensure perennial.

The vale with its irrigated fields and famous orchards, its groves of willow mulberry and tamarisk is a great oasis in the generally arid and northwest.

- II. The Kohat valley lies higher than Peshawar and Bannu around 1500ft and is much broken by west/east limestone ridges. The filling of the uneven lime stone floor varies from lacustrine clays to gravel and boulder fans. There are many springs in the limestone, and the water table is generally high. The Tanda Dam on Kohat started in 1952 will allow perennial irrigation and supplement the small tanks formed by bounding the river heat watered by the relatively high rainfall 16" dominated in the past summer crop will be possible with extended irrigation.
- III. The Bannu lowland (500ft) covers some 1700 sq miles and entirely enclosed by hill except for the Kurram gorge through the section of the salt ranges west of the Indus and Pezu gap in the south into this basin converge the Kurram. The Tochi and any hill streams, all much braided and with broad boulder strewn channels.

Perennial irrigation is almost confined to the Tochi/Kurram doab an Oasis kuje the vale of Peshawar and supplied by a dam on Kurram above Bannu which was finished in 1962.

In the unirrigated parts of Bannu, flat tailed sheep, camels and donkeys are reared, and wool is perhaps the most important commercial crop, where mills have been established to provide a local market for the wool- groves and yarn for the important cottage industry.

3. **Himalaya - Karakorum:** This vast complex of mountain ranges with its numerous peaks reaching 6000ft and more sweeps in a 2500km arc from the gorge of the Indus cuts through flats of the Naga Parbat(8127) in western Kashmir to the hairpin bend the Tsangpo (Brahmaputra) as it enters north eastern India.

- 3.1. **Karakorum:** The Karakorum crowned by K-2 the highest of 33 peaks ascending (7315) lies apart from the Himalaya proper north of the Indus furrows. The whole trench at around (3680)-(4270) m marking the edge of the Tibetan plateau which rise to its north. The name Karakorum is a Turkish word which means "Black Gravel".

Geomorphologic the region is intensely interesting its human geography is scanty, but what there is may firstly be called haioic. Karakorum is much older than the Himalaya e.g. by the absence of tertiary sediments between Ladakh and the northern flank of the Kun Lunge. Its actual relation with the other range of the great orogeny remain obscure; to the North West the Karakorum ranges arch over on to the Pamir/Hindu Kush in a country of confused topography, which then continuation to the south east is still debatable, but probably via the Pang Gong range into Kailas. The divergence of Himalaya and Karakorum trench is most clearly seen north of the Shyok River.

- 3.2. **Kashmir Himalaya:** In the Kashmir Himalay the fairly regular progression of steps upwards from the siwaliks to the great Himalaya is interrupted by the vale of Kashmir 30-40 km wide and more than 130km along its axis parallel to the Pir Panjal. The vale is synclinal basin grooved

with a variety of alluvial deposit (lustrous fluvial and fluvial-glacial) through which the rivers Jhelum meanders at 1600 m above sea level before entering its deep gorge the Pir Panjal.

**3.3. Central Himalaya:** In the central Himalaya from Himachal Pradesh through to eastern Nepal the parallel elements are more compact. Some major river rise on the southern steppes of the great Himalaya the chandab, Beas and the Ganga while the Sutlej and Gogra rivers in the high plateau of Tibet and converge across the mountain belt.

Average height of these mountain ranges is 20000ft. always remained under snow. Some highest peaks of the world are here. Near the branch of this range is called Zaskar mountain range. Vale of Kashmir and Gilgit is the central Pir Panjal. Southern Tibet is area which touches the range is about 10000ft.

Nepal, Bhutan and Indian area of Sikkim is there, Dargiling is here. The range is 100 miles wide. Prominent peak of Kanchenjunga and Everest are here height 26000 and 29028 respectively are in the border of Nepal. Naga peak is here its old name is divine the "home of the ferries" before 1953 they were notoriously named as the "home of death" due to killing of many mountaineers. Rocka Pothi is also here 25550ft. 8<sup>th</sup> of the world. In 25<sup>th</sup> June 1958 Britain's and soldier of Pak army topped this peak. Important passes are given below:

- I. Murtagh pass 19030 ft Gilgit to China's province Sinkiang
- II. Karakorum pass 18990ft lie with Yarkund
- III. Babosar pass 14431 Bultistan with Gilgit
- IV. Shandar pass 12205 Chitral- Gilgit
- V. Dobela pass 11580 Srinagar with Yarkund

**3.4. Eastern Himalaya:** extend from the Arun- kosi basin in eastern Nepal through Sikkim and Bhutan 782000 and into Arunachal Pradesh. The Siwaliks belt is lacking here or at least a very minor feature. Transverse rivers such as Arun draining the Everest (8840) m and the Tista breach the lesser Himalaya belt into numerous spurs projecting from the main chain of mountain and consequently present the structural strike from dominating the land form. East of Kanchenjunga (8579)m higher peaks become fainter the Tsangpo (Brahmaputra) is last of the great summit west of the river, beyond which the crest line falls progressively along the water parting between tributaries of the Brahmaputra and the Salween in Burma. Charapunji is here.

#### 4.0 Hills and Plateaus of North

**5. The plain:** A nearly flat sometimes gently undulating stretch of land, generally at low elevation. Representing the present surface of the more or less deep alluvial fill of the trough that makes the contact zone between the stable peninsula shield and the Himalaya fold system the plains may be treated as a single physiographic unit despite the variation in detail that exist within them. In the main plains is the product of the larger rivers raising the Himalaya the Indus its Punjab tributaries, the Ganges and its tributaries and the Brahmaputra.

**Indus plain:** Indus plain is subdivided as:

- I. Indus upper plain and eastern Punjab
- II. Lower Indus plain
- III. Indus Delta plain

- I. **Punjab:** The whole area forms an immense plain some 350 miles north west/south by 450 north east/south west (565 by 725 km). all of it is under 1200ft most of it under 600, while in extreme south east, along the Indus, it falls to under 250ft. the fall is naturally steepest (about 15ft.miles, rather under 1m/km) in the sub mountain stip. Over most of the area 1ft and in the extreme south only 6inches. The region is a great mass of alluvium brought down by the Indus and the five rivers from west east Jhelum. Chenab, Ravi, Beas and Sutlej which gives the province its name and unite in the south west to form the Punjab.

The interfluvial-doab or two water are gives names compounded from those of their confining streams in the same order Chaj, Rachna, Bari, Bist.

**Chaj:** Gujarat, Jhang and Sargodha.

**Rachna:** Gujranwal, Shilohpur, Sialkot and Faisalabad

**Bist:**

**Sind Sagar:** Muzafar Ghar, Mianwali, Khushab.

The old unreclaimed Punjab still persist in the intractable and unirrigated steppes for Sind sager doab between Jhelum and Sind/Indus and especially in the wind blows sands of its central section, the Thal, the heart of which at least approaches true desert condition. Once past the Jhelum/Chenab but there is an abrupt cessation of cultivation along the scalloped edge of the Thal, which from the acuties of sand with a remarkably even stipple of bushes and low acuties. In year of good rain there is thin grass cover and there are scattered patches of precarious cultivation in the lows. Small inundation canal have very important and more especially in the area Multan and Bahawalpur. In the south west May inundation canals is constructed by Diwan Sawn Mal the governor of Multan Khadir.

The first canal of any size to reach upland as distinct few was contrived from the Yamuna in AD 1351.

Parts of Rachna and Chaj doab were irrigated in the early and later 1890. By 1900 old course of the Bias was only partly irrigated by inundation canals while Ganji Bar was dry. Multan was irrigated by sidhnai. Most of the area of Sind sager doab is now irrigated by the Thal canal project under the Thal development authority TDA. The area of Thal is now prosperous and thickly population due to TDA by the establishment of industries, colonies and forest of every kind.

- II. **Lower Indus:** The area treated here 48000sq miles corresponds nearly the West Pakistan division of Khairpur and Hyder Abad, with Karachi district by includes the Sibi low lands or sewistan.

The region may be divided following:

The history of Indus is extremely complex and there have been many changes in historic time. In common with many great rivers of the Northern hemisphere, the Indus shows a strong tendency to work into its right bank, but from Sehwar, east of Manchar lake, to below Hyder Abad its movement is to some extent limited by its impingement on to the more or less solid territories of Kohistan and in the north of the channel as it were down by Sukkar/Rohi lime stone outlines. North of the limestone outcrop at Rohri-Sukkar a similar area of past and present. Indus flood plain watered by inundation canals and flanked by the desert edge of the Thar from a transition to the perennially irrigated Bahawalpur plain and the beginning of the Punjab.

From the point east of Sukkar the east Nara parallels the Indus at a distance of 60-75 miles now fed mainly by a cut of the now dry Hakera or Ghargra. It divides the desert from the sown, the bulk of Sind cultivated land lying on the Indus/Nara doab.

Western valley section informed mainly of older alluvium soils are finer towards the south, with many small lakes, fertile in itself this is one of the worst area of damage the Bolan and Nara rivers and the west Nara, probably and old Indus course is canalized for irrigation.

The eastern valley is in a sense the older delta a great doab of recent alluvial sands and clay, falling from 250ft to 50ft. along the eastern Nara small alkaline lakes (dhands) is especially numerous. Karachi the set of the Arabian sea currents is to the east; Karachi lies just off the eastern extremity of the delta, sheltered from the Makran longshore drift by Ras Moai. It occupies a peninsular site between the Kohistan rivers Lyari and Malir the harbour is formed by the Lyari mouths, sheltered by the long Monora spit and the little island of Kimiari; which is connected by mainland by the 5 miles long Napier Mole with its Railway line.

**III. The delta plains:** The present delta of the Indus is typically triangular in shape and extends from Thatta up to sea. It covers an area of 2600km<sup>2</sup>. Accordingly to Pascoe's 1964 before the construction of canal irrigation system the delta was advancing about 113ft/year towards sea. Indus was transporting 300 million tons or 30000 acre foot of silt to the delta.

Since the construction of canals and barrages across the Indus and tributaries the annual mean discharge reduced and active delta has shrunk to a small 260km. The Indus is one of the largest in the world. It ranks in area, one step ahead of Mississippi 12<sup>th</sup> largest in its drainage area 7<sup>th</sup> largest in river discharge 10<sup>th</sup> largest in the length of its shoreline. It receives the highest av. Water energy of any major delta in the world at a water depth of 10m bordering the deltaic flood plains is an accurate zone of older tidal delta has been cut off from the alluvial process and had assumed the form of tidal mud flat. Small coastal sand dunes are frequent.

The deltaic deposit mainly comprises inter layered deposit of very fine sand, silt clay. Pits shallow wells dug on the deltaic flood plain shows the remoulded nature of the sediment.

The Indus plain from the western part of Pakistan it is from mountain ranges to the N and S by the Arabian Sea to the S and the Thar Desert to the east. It is almost about 1200km in its southern and lower part.

## **5.2 Thar Desert:**

Between the irrigated land of the Indus and Sutlej riverine and that eastern edge of the Aravali stretch the desert and the semi desert wastes of the Thar, covering approximately 100,000 sq miles. Most of the



thar lies in the former large Rajasthan state of Bikaner, Jodhpur and Jaisalmer but it also include large portion of Bahawalpur, Khairpur and Thar parker in west portion.

Most of the thar is preassembly a sanded over pedi planes .The strike of the great sand ridges is generally transverse to the south west wind, But in the south where the winds are stronger, They are longitudinal to the wind flow and up to 500 ft high. In Jodhpur are bare rocky hills of granite rhyolites extrusions on the old Aravallis surface of the recent deposit, the calcareous conglomerates found along the larger wadis such as Luni .In the pat desert, adjoining khan pur, impervious clays beneath the sand hold up ground water, dhand are numerous?

The presence of large stretches of sifting sand, bare wind –swept rock and gravel plauiies suggest extreme aridity which is perhaps of region .The great Kingdom in this region would not have been established about 1500 years ago. It is said that desert started spreading near about 600 AD. Desiccation of this arid region is due to the following reason

The causes of gradual development of the arid condition are attributed to

1. The westward drift of the rivers of this region due to the slow uplift of the Himalaya and the plain adjoining it.
2. Reduction in the volume of water in the Ghaggra owing to the capture of its head by the yammna.
3. Over grazing.
4. Clearance of the forest occurring over most of the area even as late as the early Mughal period.

- **Climate**

It is the region of scanty rainfall. May and June are very hot month during which strong dust laden winds blow. The maximum temperature may rise to 49°C at many places.

- **Vegetation**

Only 1.3% of the total area of this region is covered with forest large stenchies of land covered with grass and bushes .These are short and scarted due to scanty rainfall. Jhand ,Pelo, khar, Phog, bin, larvum, lerip are the plant which are used as feed for camels, goat and sheep.

- **Agriculture**

Here aridity is the chief geographical control and adversely man and his food resources .Under such conditions agriculture is uncertain without irrigation. Wells are very deep in depth 30m to 120m. Their water is often bralinsh and insufficient for both man and animals .Rain water is stored carefully and is used for drinking purpose.

Perennid canal irrigation is available in the North West in Ganga –nagar district. The canal burrow as the Brkanercanal takes off from the head works on the Sutlaj near Ferozporein the Punjal and it's irrigate north – western Ganga nagar district. In the western district where annual rainfall is 25.4 cm and irrigated facilities are not available, very little land is under cultivated.

### **The Rajasthan Canal**

The large area in Brkaner Jaisal meer district are fit for cultivation but owing to extreme aridity .Most of the area is now under irrigation the canal name as “Indira Ghandi Nahar Project” completed in 1986. The area of Pakistan would lie irrigated by the canal Abbasia canal from Pagnad .It is now in initial stages and not started work.

- **Minerals**

Gypsum occur in the bed of dried up lakes .Fuller ,clay ,MultaniMitti is very important. Lignite is also mineral. Anthrasite in Pakistan recently been discovered on Tharparkar. Large deposits of Rocks salts are founded .Natural gas has been founded at a few sites in Jaisalmer.

**4. Potwar:** Potwar plateau covers an area of 4000-5000 miles at about 1200-1900ft. there are a few outlying spurs of salt range in the south and in the north the Khair-e-Murat and the Kala Chita dhar with a very open cover of wild olives and bushes. But in general it is open undulating country developed on the merrily sandstone siwaliks and mantled by varying thickness of loess silt most of hills and rivers are bordered by belts of intricately directed reverine land locally Khuddera. The stream is general deep owing to rejuvenation and of little or no use for irrigation; the agriculture is thus almost entirely depending on the rainfall of 15-25 inches. Soil of are often sandy or stony.

On the whole it is a hard land; symptomatic of gravel poverty is the fact that donkeys are often used for ploughing instead of bullocks. Irrigation is almost non-existent, but in many areas fields are carefully embanked to conserved soil moisture. The most favored are is the Chach a strip some 20 miles by 10 along the Indus northeast of Attack and really perhaps a continuation of Peshawar vale.

Here the soil is generally rich loamy and wells are numerous, wheat, maize, sugar cane and vegetation are grown and snuff tobacco is an extremely valuable cash crop. Prominent Pakistan oil, gas fields are here Khaur, Dhulian, Bilk sar, Mial, Tut are here. Rawalpsindi and lowranepur have and expanding textile industry. Main rivers, Kurang, son, Haro are here.

**The Salt Ranges:** The ramparts of the salt range, sinuous in outline the hills exceedingly complex in detail, sharply mark off the region from the cut of plains. They reach nearly 5000 ft at Sakesar, but in general are much over half that height. The southern face is remarkably steep and dissected into jagged spurs and crests separated by wild ravarine for the most part an inteusly arid and for budding country, even through rain fall are higher than in the surrounding plains. North wards the hills sink more gently beneath the Potwar loess.

There are few picturesque lakes in solution or Aeolian hollows often very saline, Kalar kahar, khabaki and uchali. The north is diversify by scattered olive and wild olives but in south vegetation is spar. The salt range is flanked by the most intensely gullied Khuddera Bad Lands; alternating with the overgrazed interfluves patches of torrent water Rabi crops in a zone transitional to the Thal. The main parts of salt mines are khewara, warchha, kalabagh etc are here; very prominent and famous for quality Katha, Dandot, and Maker wal are the chief producer of coal in Pakistan.

There is an ammonium sulphate factory at Daud Khel and emend plant. Some potash salts and large quantities of gypsum from the basin of the largest soda ash factories in sub continent silica sand, chromites, Dolomite and iron ore is frequent in the range.