

# CLIMATIC CHANGES IN SINDH

BY  
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## (During Geological, Pleistocene, pre-historical and historical)

1. **Cretaceous period (137-67 m (million) years ago):** It had warm moist climate and it helped in spreading of Gileyaequator, to high altitudes. The Indian peninsula not yet hitting Himalayas, Asia and causing disc of was separated by more than 700-800 km wide sea. This reduced temperatures in the tropics by 3°C and correspondence increase in high altitudes temperatures was also 3°C.
2. **Paleogene or Paleocene period (67-60m. years ago):** It marked the beginning of gradual cooling of earth's surface. Humid forests extend to 47 degree N, against 20°N of the present.  
  
Cold resistant tropical forests now extend to 32°N, where as during this period they occupied most of the Europe.  
  
Savannas which now are situated 8 o to 18°N, existed between 35o and 52°N. The coal field in Raulkot series belong to this period.
3. **Eocene period (60-37 m years ago):** During this period climate was still warm and wet. Savannas with spare tree growth developed in Saharan, Arabian, Irani Baloachi and Rajasthan deserts, Sindh was part of these Savannas as and Sahran and Rajasthan deserts joined together in Sindh.
4. **Oligocene (37-26 m. years ago):** During this period there was progressive fall in temperature. Savannas stretched across whole of Sahara, and Rajasthan desert and also to Eastern Deccan.
5. **Neogene i.e Oligocene to Pliocene:** during this period, earth surface temperatures further dropped by 8°C.
6. **Miocene (26-12 m. years ago):** During this period anthropoid apes (pongids), orang-out-dangs, gorillas, chimpanzees and hominies appeared in ever-green forest remains of 15 apes have been found from Siwaliks.

7. **Pliocene (12-4 m. years ago):** High pressure developed at 30° North and South altitudes. Monsoon circulation developed. Permanent deserts developed in the tropical and subtropical zones. To the north of these were steppes and to the south Savannas.
8. **Eopleistocene (4-1 m. years ago):** In the upper Eopleistocene (4-1.5 m. years ago), ancestors of hominids left forests in search of food in Savannas and tried to walk erect. Man also appeared then. Australopithecus who had separated from other hominids then, became extinct some time probably in second part of Eopleistocene (2-1.5 m. years ago).

Ramapithecus, having brain of 600 cms could not be classified as man, because of a low skull volume, (700-800 cms) being dividing line between man and ape and also because he did not use any weapons but used his hands and teeth.

Ramapithecus disappeared prior to ground 1.0 million years ago. Man is not more than 1 million year old.

9. **Pleistocene (1.0.8 m. years ago to 10,000 [ya]:** The lower Pleistocene (1 - 0.4 m. years ago) is characterized by further drop in temperature and reduction in aridity in the tropics and during 800-600 thousand years ago man developed shell or Abberivillian culture of Archanthropus i.e the following:

- |                                |                    |
|--------------------------------|--------------------|
| - Pithecanthropus.             | In Java.           |
| - Sinanthropus.                | In China.          |
| - Atlanthropus.                | Mauritania.        |
| - Zeidielburg Pithecanthropus. | In Western Europe. |
| - Old wan Pithecanthropus.     | In East Africa.    |

The volume of their brain was over 2000 cm<sup>2</sup> being twice that of Ramapithecus, Australopithecus and Pre-sinjuncthropus.

10. **600-400 thousand years ago:** There was further drop in temperature. The average temperature in the plains of Northern Europe was 5-6°C lower than it is today and glaciation started. In the tropics and subtropics it was wet.
11. **End of (Likhvin) glaciations:** At this time developed the paleoanthropus or Neanderthal man using improved tools, hunting and food gathering. His brain cavity was 1450 cm<sup>3</sup>.

12. **Middle Pleistocene (400-120) thousand years ago:** Fire and clothing from skin were protected man against cold.
13. **220-120 thousands years ago or danieper Glaciations (Rise, Illinois):** Existence of a 100 m thick glacier on Khirthar range between Dad and Gaj river is possible.
14. **Upper Pleistocene or late Paleolithic, 120-100 thousand years ago:** Inter glacial period lasted from 120-70 thousand years.

Neanderthals developed division of work according to sex, age and domestication of animals. Permanently wet warm climate produced rich flora and fauna and the evolution of material culture was slow.

15. **70-10 thousands years ago or Wisconsin glaciations:** The man reached maximum stage of development 15,000 years ago. He developed tribal system.

The cultural changes in man were as under:

Neanderthal man and Aurignacian	70,000-40,000 years ago.
OR	
Cro-Magnon man	40,000-25,000 years ago.
Solutrean man	25,000-15,000 years ago.
Development and presence of modern man	42,000 years ago in Southern Africa.

- 39, 000 years ago in Kalimantan Island.
- 38,000 years ago in Poland.
- 35,000 years ago in France.
- 36,000 years ago in Australia.
- 15,000 years ago is South America.

Average span of life of man was not more than 40 years. Pal-eolith is characterized by mud huts, surface dwelling of animal-bone and wood and cloths sewn from animal skins.

Ice cap receded and melted by 10,000 years age.

16. **Holocene 10,000 years ago to present day:** An early Holocene or Mesolithic (12,000-7,000 years ago) is characterized by:

- Primitive community system ended.
  - Material family (material chate) ceased.
  - Parental family started.
  - Slave owning society began to take shape.
  - Pottery production arose.
  - Cooking of food became systematic.
  - Cattle herding developed.
  - Agricultural production introduced and developed.
  - First cultivators were women, who used simple stick to make furrows to cultivate cereals.
  - \* Men did hunting and tending cattle.
  - a) Neolithic (7,000 – 4,500 years ago).
  - b) Bronze Age 6,000 – 4,000 years ago.
  - c) Woven fabric 4,000 BC in summer in Mesopotamia.
17. **Climate changes in Middles Holocene:** Tundras were limited to North Siberia etc.
18. **Middle Ages; 500 to 1600 AD:** This is characterized by:
- Simple machines using power of
  - Man.
  - Animal.
  - Water.
  - Wind.
19. **Modern times: 1600 – to-date in Sindh and 1380-1850 in Europe:** It is characterized by:
- Harnessing of power from fuels.
  - Capitalistic power rise and colonization.
20. **1200-1300 AD:** About 2o or 3°C displacement of latitude due to physio-geographical process from earth’s mean, also caused climatic changes.
21. **Little Ice Age 1500-1700 AD:** in 17<sup>th</sup> century a drop of 1 to 2°C in average temperature brought about “Little Ice Age”.
22. **Climatic patterns of past 500 years and causes of it:** Taking climate of 45 years average from 1900 to 1945 and again climate of past 500 years, it was cooler before 1900 AD and also cooler from 1945 to 1990, the results are:

Between 1800 AD and 1940 difference is 0.6°C rise and between 1945 to 1990 it is a fall of 0.3°C.

23. **Causes of climatic change:** Mean global temperature 18,000 years ago was 6°C cooler and British Isles were under ice. It was the height of last glaciations.

In deserts and poles, earth receives less radiation than it returns, but at equator it receives more than it returns.

No part of weather system, can be dissociated from the other. Orbit of the earth around sun varies between 90,000 – 100,000 years. It is some times almost circular and at other time elliptical.

When it is elliptical, solar radiation varies 30% during the course of the year.

Today it is at 23.5° tilt on its oscillation around the sun.

Greater the tilt more is difference between summer and winter temperatures. Last maximum was 10,000 years ago.

Earth wobbles around its axis, cycle takes 21,000 years.

Sun also rotates and cycle varies from 90 to 27 years.

Sun spot cycle of 11 to more accurately 22 years is most famous.

Sun spots having 22 years cycle vary and cause variation in the solar radiation there by climate on the earth. Between 1645–1715 AD, radiation could have been 1.4% lower than at present and there by there was difference of 1 to 2°C. Radiation increased around 1916 AD. Differences between rotations of planets including earth, has disturbances on sun, at a rhythm of about 1700 years. Pull of earth and sun creates tides. Exceptional high tides occur at 1800 year interval patterns, and set a process in train, which takes long time to correct. The Little Ice Age may have been triggered by tidal maximum altitudes in 1433, which caused south ward drift in the polar ice and it on-set “The Little Ice Age”.

24. **Climatic changes in the historical times. Four climatic Epochs since 12,000 to 10,000 BP:** These changes were world-wide and in Sindh they are represented by the following:

- i) Warm times 5000-3000 BC.
- ii) 2900-300 BC, colder.
- iii) 3090 BC – 1430 AD, warm.
- iv) 1430 – 1850 cold.
- v) 1850 – 1940 warm.

These are further explained as:

- a) Warmest times culminating 5,000 – 3,000 BC. Between 5,000 – 3,000 BC, sea level rose rapidly as former great ice sheet kept melting after ice age. Sea kept rising further up to 2000 BC, when it may have been 3 meters higher than to-day. Between 5,000,000 BC, temperatures were higher in Europe by 2-3°C than the present. The same was the case with Antarctic. Temperature in Sindh may have been higher by about 1 to 2°C.
- b) Colder climatic epoch of Iron Age culminating or reaching its maximum 900 BC. After 900 BC, colder period started and even upto 300 BC, it was cold.
- c) Rise of Indus civilization 2300 – 1700 BC, was quick and decline was caused by drought after 2000 BC.
- d) In the Southern Hemisphere 5000-3000 BC, was a cold period as per available data.
- e) Around 100 BC, Italy witnessed warmer times than centuries preceding it.
- f) Dust storms are recorded in the 8<sup>th</sup> century AD, which may have affected Brahman rule.
- g) Rangmahal culture occupied the Indus region in the 4<sup>th</sup> century AD, showing better rainfall. The construction of stupas from 5<sup>th</sup> to 7<sup>th</sup> century in Sindh also show prosperity due to climatic change.
- h) Warmest of Early Middle Age was 1000-1200 AD, Temperature started rising and optimum was reached around 1000-1200 AD. Some investigators are of the opinion, that temperatures were quite favorable in Sindh, even after 800 AD, in the northern America. The above optimum shows, the rise of Habaris and the Soomra of Sindh. The above optimum was also wetter period in America. 900-1120 AD, were a warm, though variable times. The deserts are

reported to have expanded around 1000 AD, but statement is not fully verified for Sindh.

- i) India witnessed a number of famine years in the 14<sup>th</sup> century.
- j) Little Ice Age 1430-1850 AD, in Europe and 1500-1700 AD, in Sindh and England in late 16<sup>th</sup> century. It had its maximum effect in Sindh from 1600-1700 AD. Cooling had probably began around 1130 AD, and 1380 AD, its impact was perceivable in Central Asia and India.
- k) Warming since 1850 in Europe brought new prosperity. In Sindh it caused rise Kalhoras around 1700 AD, and their decline due to high temperatures in Himalayas and their by hydrological changes in the course of the Indus from 1755-1758 AD.

25. **Little Ice Age (according to John Gribbin):** It started around 1430 AD, and ended in 1850 AD.

During the period Arctic pack ice expanded considerably and temperatures across North Atlantic above 5°C, but there were frequent low temperatures i.e., there was year to year variability of temperature. In Sudan, Ethiopia and Egypt the Nile fed from equatorial belt had low levels showing reduced rains. In the Southern Hemisphere this pattern is not reflected. Earlier epochs were in the whole globe, while the Little Ice Age, was an Equator-ward shift in northern Hemisphere and a synchronous (but smaller) pole-ward, shift in Southern Hemisphere. In the Little Ice Age temperatures on mountains in low latitudes were 1-2°C cooler than today. In the warm epochs they were 2 to 3°C higher than today.

The warming of 1800-1945 AD probably was presence a temporary fluctuation from Little Ice Age conditions, to which we may shortly return. Arctic expansion around 1900 BC, caused a retreat of northern forests from regions which had been suitable for them around 1900 BC. These changes may have adversely affected civilizations like the Indus in the South. Between 1500-1850 temperatures in the northern hemisphere fell to their lowest since ice age and glaciers advanced. Many areas such as Greenland and N. Norway had to be abandoned. Of these late 16<sup>th</sup> and 17<sup>th</sup> century were coolest. Temperature difference with present conditions were 2.0–0.5°C. Temperatures in antiquity were lower. They have been high during past 8,000 years. For England there is difference of 12°C in winter temperatures and 8°C in summer temperatures between now and 8,000 years ago.

26. **Effect of Little Ice Age on crops in Sindh:** Rice will grow but not ripen. Short season rice cultivars will grow and mature.

Only millet a short season crop will grow.

Sorghum too can grow but if planted on late rains in August, it will not ripen. Dates may not ripen at all or may not have developed it will not ripen. Dates may not ripen at all or may not have developed flavor. Many fruit crops like mango will be harvest late by 4-6 weeks and will become biannual. After 1650 AD many summers were hot but not regular year after year. Growing season changed by 15-25% between warmest and coldest times of the millennium. Some winter crops will have advantage of long winter and high yield, but there would be less irrigation water. Oats a short season crop will give place to wheat. Wheat yield will be higher. Chick peas will be replaced by beans due to long season. Winter vegetables will grow better and have higher yield and better quality. Some types of citrus will have better quality due to long winter. From 1940 to 1985 there has been drop of 0.4°C in Northern Hemisphere, has reduced the growing season which in England has reduced by about 10 days. The recent agricultural troubles in the world are a consequence of it. Sugdasi Rice disappeared due to steam bore from 1957-1962 due to these changes.

27. **Rainfall patterns in the Central Sindh:** 10,300 – 8,600 BC 6” or less area was deserted.

8,200 BC 32” Beginning of domestication of animals at Mehrgarh.

28. **Warming of earth between 4,000 – 8,000 years ago:** What caused the high level of mean temperature to be maintained during the Altihermal. The possible cause could be the total output from sun or distribution of sunlight between the Northern and the Southern Hemispheres as the earth elliptical orbit around the sun changed. It is even possible that CO<sub>2</sub> content in atmosphere increased but there is no evidence for it.

29. **Influence of 1°C rise in temperature:** 1°C increase in temperature also means 10 day increase in growing season in middle and high altitudes and possibly 20 days in Sindh. There is an evidence of hot and wetter period from 8,000 to 4,000 years ago in the whole of south India, Sindh, Rajasthan, Western Iran from Quetta to the Caspian Sea, Central Arabia (not coastal and south) Turkey, Lebanon, Syria, Iraq, Israel, Egypt, Ethiopia, Eastern Africa, Mozambique, Libya, Tunis, Algeria (not Morocco), the whole of Sahara Mexico Alaska, the whole Europe (Central

and Southern Europe), Korea China, Western Australia and the New Zealand. Climate has been a factor and a controlling one, which has determined, where and when people should hunt, where should they live, what they should wear and where they should practice their agriculture. About 4,500 years ago all houses in the Indus cities were either built of bricks or in brick with stone foundations as the country was wet. It was also warm, so thick brick walls in mud plaster, insulated the interior against outside heat. Windows were scanty for the same reason. There were no verandas to the south like those of today's rural Sindh, as there were no southern winds. The summer trade winds had not yet developed, as low pressure depression had not developed in northern Sindh and there were no ventilators as cold northern winds had to be stopped from entering the houses from that side. By 1500 AD, houses were constructed in Sindh with verandah to the south to protect the main rooms against sun and also to take advantage of southern winds during summer. The houses usually had no opening or ventilators to the south or west to protect against northern cold winter winds. The wind catches of southern Sindh used until very recently below Manjhad, caught south-western winds in summer. There was absence of wind catchers in Karachi where west open houses were preferred as this city had alternate sea and land breeze each day, making wind catchers less useful.