CHAPTER 1
Chapter 1
INTRODUCTION
An Overview

The evolutionary history of our culture is divided into eight major periods viz Palaeolithic (Old Stone Age), Mesolithic (Middle Stone Age), Neolithic (New Stone Age), Chalcolithic (Transitional age- use of stone tools and tools of metals like bronze and copper), Iron Age, Megalithic, Early Historical and the Historical periods. Each of these periods is noted for its specific cultural tradition (Thomsen, 1948). Palaeolithic period is marked by the earliest remains of human existence. In India its traces are recorded from the interglacial period around 120,000 B.P. (Ghosh, 1989). The man during this earliest and longest prehistoric period was a food gatherer and hunter. The way of life was most primitive and was solely based on the food collecting habit. He depended on collecting edible plant parts like berries, pine nuts, tubular stems, gram seeds, leaves of Cyperaceae and some other grasses etc.

In India the Mesolithic age continued upto 4,000 B.C. and is characteristically marked by sophisticated crescent shaped microliths for efficient food collection. This was also the phase of inception of efficient plant cultivation when agriculture may have evolved by cultivation of wild grasses for grains. The most important Mesolithic sites found in India are located at Chhota Nagpur plateau, Central India and south of river Krishna. The advancement of human culture in the subsequent period relied on several factors. The most important of these were the physical factors like the topography, rainfall, climate and soil fertility. The factors created zonal establishment of human groups which ultimately helped them to grow into villages or small township. Next came the Neolithic period, the new stone age when man’s environment and culture
completely changed from food gathering to the food producing stage. The agriculture became well developed with polished stone tools and in the following periods the agriculture expanded with use of metallic tools.

In the archaeological history of cultural development the Neolithic period is considered to be of great significance as this was the time of beginning of agricultural farming and domestication of plants and animals. Man changed to a new way of life of producing food plants. Although we have records of beginning of agriculture in the western and south-eastern parts of Asia as early as 7,000 B.C. but the Neolithic cultures in India go back to only about 2,500 B.C. However some surveys trace it back to between 7,000 to 5,000 B.C. (Sharma et al, 1980 ). No definite dates however are available on account of the vastness and extensive eco-geographical zones. The correlation of linear and horizontal spread of culture has yet to reach a final point in order to determine the actual period of the beginning of agricultural farming. The recent findings based on archaeological and archaeobotanical evidences from Pakistan, Rajasthan and Uttar Pradesh may however suggest the earlier beginning of agriculture. Correlating the archaeological data with the geological sequence in Rajasthan one could conclude the beginning of agriculture sometime in Holocene. This is corroborated by the report of the occurrence of pollen of Cerealia and charcoal pieces from the lake sites in Rajasthan (Singh, 1967, 1971; Singh et al, 1974 ) and the discovery of paddy husk impressions from Koldihawa in eastern Uttar Pradesh (Vishnu Mittre, 1976; Sen Gupta, 1985 ). If taken into account the evidence of these remains the beginning of agriculture in India may be traced back to 7,000 to 5,000 B.C. These dates are also confirmed by 14C dating (Agrawal,1982). From this period onwards the agricultural farming seemed to have progressed alongwith domestication of food plants and necessitating migration and settlement of people for farming.
The archaeological history reveals that there has been no lineal cultural evolution in the Indian sub-continent. We find contemporary cultures eg. Neolithic culture in Kashmir, Chalcolithic in Rajasthan and Madhya Pradesh and Harappa in Indus valley in c. 2000 B.C. Antiquity of various cultivated plants also do not show lineal evolutionary trends because of the following reports.

*Triticum sphaerococcum* (wheat) from Indus valley site of Mohenjodaro and Harappa (c. 2400-2000 B.C.)

*Triticum compactum* from Chalcolithic (c 1500-1000 B.C.) sites of Inamgaon (near Pune) and Navdatoli in Madhya Pradesh.

*Hordeum vulgare* (barley) from the Harrapan site of Mohenjodaro and Kalibangan, from Neolithic level of Chirand in Bihar and from Chalcolithic levels in Inamgaon and Navdatoli.

*Oryza* sp. (rice) from the Harrapan sites in Gujarat, Neolithic sites in Bihar and Tamil Nadu and Chalcolithic levels in Rajasthan and West Bengal.

*Eleusine* (ragi) from Neolithic sites in Karnataka (c. 1500 B.C.) and Tamil Nadu, Harrapan site in Saharanpur and Gujarat.

*Pennisetum typhoides* (bajra) from Neolithic level at Hallur (c. 1000 B.C.) and Harrapan site at Rangpur.

*Sorghum* (jowar) was found at Chalcolithic Ahar and Inamgaon (c. 1500 B.C.) and Harrapan site at Saharanpur.

*Pisum arvense* (pea), *Lathyrus sativus* (grass pea), *Lens esculenta* (lentil), *Dolichos biflorus* (horsegram) from Neolithic sites in Bihar, Maharashtra, Madhya Pradesh and Karnataka and Chalcolithic sites of Inamgaon and Navdatoli.

*Sesamum* (til) from Harrappa and Navdatoli.
Cotton from Harrappa.

Fruits of Tectona grandis (teak) from Neolithic Hallur in Karnataka.

From the Neolithic phase at Burzahoam (Kashmir) evidence has been found of wild fruits and seeds assigned to Lithospermum arvensi, Medicago denticulata, Medicago falcata, Euphorbia, Ipomea, Lotus corniculatus.

Neolithic is thus characterised by the development of a very different culture than the preceding Mesolithic culture of Pleistocene which is significantly marked by transition from food hunting and gathering to food producing habit besides their specific dwelling habitats. The potential factor to the adoption to this way of life is believed to be a gradual climatic change which seemingly occurred as early as 10,000 B.C. (Holocene).

This change of climate led not only to cultural differentiation but also to the development of agronomy and regional settlement for specific agricultural purpose. Since the agriculture at that time was at the primeval phase selective hunting for food gathering continued to supplement their needs. The resultant change also culminated in domestication of animals and adoption to refine cultural technologies in relation to agronomic farming and dwelling habitats. One could infer that this was also the beginning of a planned development with growth of culture as well as selective settlement to localised areas in relation to palaeobiotic and agronomic conditions like climate and the soil fertility. The Neolithic culture tentatively is divided into five specific eco-geographic zonations of inhabitation as mentioned below (see Agrawal, 1982):

1. **North-west zone** covering Kashmir.
2. **East zone** covering Assam, Chittagong and sub-Himalayan region including Darjeeling
3. *Chotta Nagpur plateau* with adjoining areas of U.P., Bihar, Orissa and West Bengal.


5. *South zone* covering Penninsular India.

To this may also be added Pakistan in context of Indo-Pak subcontinent covering Baluchistan, Swat and adjoining areas of Upper Sind valley in Pakistan (see Thapar, 1978, 1984; also see Agrawal, 1982).

There are about 200 and odd localities where archaeological excavations have revealed Neolithic cultures in these widely scattered regions including Koldihawa and Allahabad district along the banks of Belan river (Sharma, 1980). The earliest sites which provide antecedents about the origin of Neolithic cultures in India are Sangankallu in Karnataka (Subbarao, 1948), Kuchai in Orissa (Thapar, 1985), Nagarjunakonda in Andhra Pradesh (Sarkar, 1975) and Burzahom (Khazanchi, 1960) which is the type site of Neolithic culture in Kashmir. These sites have yielded archaeological evidence of two phase culture in neolithics viz (1) food gathering and (2) food producing. Excavations are being carried out with the help of modern technologies with a view to determine the palaeoclimatic conditions, the nature of the palaeosoil profile of that period, the vegetational aspects, plant domestication, agriculture and finally reflect the relationship between plant and man and man and animal during this period.

Many Neolithic sites have been reported in the Kashmir area in the recent explorations but the extensive excavations at Burzahom, Guskratal and Semthan have provided evidence of a large number of domesticated plant and animals (Buth and Kaw, 1985) and also some evidence of wild plants at Burzahom.

The approach to archaeological history through the palaeobotanical studies has yielded invariable information not only in understanding the cultural history of
ancient people but the history of plant economy and origin of farming cultures and the ancient climatic changes. Thus the botanical studies of plant remains from archaeological sites have played a significant role in reconstructing the diversification of culture through ancient times. This study has emerged altogether into a new discipline of plant science called as archaeobotany and therefore it would not be out of place to provide here a brief note on the aspects of archaeobotany in archaeological studies.

**Botany and archaeology**

The study of plant remains which become fossilized in the rock sediments is called *palaeobotany*. A number of new disciplines like archaeobotany, palaeoethnobotany, palaeoclimatology, palaeoecology and palaeopalynology have emerged out of the study of palaeobotany. All these disciplines are related to the study of fossil plant remains in one way or the other and these studies have yielded significant information in reconstructing the ancient history of culture, vegetation and the climate. In archaeobotany we deal with remains of plants which show relationship with archaeological settlements. *Palaeoethnobotany* also deals with the same aspect and some workers even prefer to use this term for archaeobotany. However, palaeoethnobotany has been developed largely on the source of ancient literature as well as archaeological relationships discovered through depictions on potteries and pictures. In *palaeoclimatology* specific plant characters are used as indicators of climate and thus the plant fossils are considered as one of the important sources for determining the ancient climate. *Palaeopalynology* deals with the study of pollen grains produced by seed plants and the spores produced by pteridophytes and the thallophytes and other similar remains of ancient vegetation (organic microfossils). Both of these (pollen and
spores) are product of reduction division (meiosis) and both on maturity need transportation (pollen dispersal) through various agencies of air, water or insects for their ultimate function. The study of pollen and spores has proved to be of great significance in archaeology, palaeoclimatology, palaeoecology and fossil plant taxonomy. During dispersal the pollen and spores are disseminated enmass in the atmosphere and a large number of these settle on the ground and become preserved in different situations under the desired environmental conditions over a period of time and thus they serve as one of the important plant indicators of climate and vegetation.

During the last four decades there has been an increasing emphasis on the archaeobotanical investigations in archaeological studies (see Vishnu-Mittre, 1989 and the literature quoted therein) as it has universally helped in reconstructing the past climatic changes and the archaeological settlement in relation to the origin and history of crop plants, the agricultural settlement (plant economy), human civilization (culture), and the vegetational pattern (see Vishnu-Mittre, 1968a). The plant remains discovered from the archaeological sites commonly comprise wood fragments, seeds, grains, pollen, spores and other micro-objects of similar nature which become preserved in a variety of materials in the form of impressions, sometimes as carbonised compressions, petrified remains, as charcoal fragments or preserved in mud, bogs, peats, soils and other kinds of sediments deposited in the lakes, springs or other water logged locations, caves, tufaceous cherts, ice, loess etc.

The archaeobotanical study of these fragmentary remains have been utilised in tracing the origin and distribution of various crop plants or economically important plants like Triticum, Hordeum, Oryza, Pennisetum, Eleusine (Vats, 1941; Vishnu-Mittre, 1961, 1962, 1966b, 1968a, 1968b 1969, 1970,1971, 1972,

Other crops include:


The more recent advanced techniques like use of SEM are also being attempted for proper identification and structural details of these plant remains (see Buth and Bisht, 1981; Buth, 1986; A. Sharma, 1985; Dixit et al., 1987; Khan, 1987; Lone, 1987) for archaeological interpretations.

Thus the value of pollen analysis and its application in the archaeological studies is being increasingly realised. The first study of pollen grains from the archaeological deposits was made by Vishnu-Mittre in 1957 and this was followed by a number of other workers (Guinet, 1966; Singh, 1970; Pant and Pant, 1980; Vishnu-Mittre, 1983). However, pollen remains in various archaeological materials are found with great difficulty both in quality and quantity but where available the pollen analytical data is helpful in establishing the palaeoenvironmental conditions and the vegetational dominance (preponderance of species), early farming communities and other adoption to plant economy. The important features of pollen and spores which are of morphological significance and are helpful in their identification include nature of aperture-pore, colpus, the shape of the pollen and sporoderm ornamentation (see Wodehouse, 1935; Erdtman, 1943; Faegri and Iversen, 1964; Tschudy and Scott, 1969; Moore et al., 1991). Sometimes the size of the spore is also helpful in delineating the spore or pollen taxa. The *Cerealia* pollen are identified from non cereal grains mainly on their size (Firbas, 1937; Erdtman, 1943; Faegri and Iversen, 1964; also see Vishnu-Mittre, 1973b). However there is a need to supplement the morphologic features with the infrastructural details of the sporoderm as seen under phase-

The identification of pollen et sporae dispersae may lead to the identification of a species or a taxon or major plant groups (vascular - non vascular plants) which may help in determining not only the type of vegetation but also its environment as well as the prevailing climatic conditions. In a pollen grain the thick walled sporoderm is resistant to degradation than most other plant parts on account of deposition of sporopollenin, (Zetzsche, 1931, 1937) which helps survival of pollen and spores through ages in the sedimentary rocks, peats, bogs or other kinds of formations in a fossilized condition. The study of palynology has proved to be helpful both in palaeobotany as well as archaeology in understanding the plants of the past, their environment and their age.

**Palaeoclimate**

The reconstruction of the past climatic changes encompasses a wide range of studies based on climate indicators such as individual plant species which may represent a climatic index (see table 1) or there may be multivariate indicators constituting the vegetation as a whole of a specific climatic zone. The evidence of such plant indicators may be drawn from palynology, diatomaceous rocks and tree ring data. In addition the geochemical and radiometric methods are also used. These studies are helpful in reconstructing the plant diversity through time and space and also in understanding the plant environment relating to habitat, altitudinal variations and other climatic factors like humidity etc. and in the later phases with the advent of man, the human activity.
Dominance of a plant species may indicate the kind of climatic situation in which they thrive. Some plants which have been used by various authors as indicators of climate are listed below.

**TABLE-1**

*Plants as Climatic Indicators*

<table>
<thead>
<tr>
<th>Plant Indicators</th>
<th>Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abies</td>
<td>Cold temperate conditions</td>
</tr>
<tr>
<td>Picea</td>
<td>Cool temperate conditions</td>
</tr>
<tr>
<td><em>Pinus wallichiana</em></td>
<td>Temperate</td>
</tr>
<tr>
<td>High values of <em>Cedrus</em> and <em>Abies</em> along with aquatics</td>
<td>Temperate and wet</td>
</tr>
<tr>
<td>Cedrus</td>
<td>Cool and moist conditions</td>
</tr>
<tr>
<td>Picea and <em>Quercus</em></td>
<td>Moist and cool</td>
</tr>
<tr>
<td>Fraxinus, <em>Quercus</em>, <em>Abies</em></td>
<td>Mean summer temperature below $12^\circ C$</td>
</tr>
<tr>
<td><em>Juglans</em></td>
<td>Found within moist temperate deciduous forests</td>
</tr>
<tr>
<td><em>Potamogeton, Myriophyllum</em></td>
<td>Cool temperate, deep water</td>
</tr>
<tr>
<td>High values of aquatics (<em>Potamogeton, Urtica, Cyperaceae</em>) with good frequency of ferns</td>
<td>High precipitation (rain) and humidity</td>
</tr>
<tr>
<td><em>Carpinus, Larix, Quercus, Juglans, Rosaceae</em></td>
<td>Temperate moist climate</td>
</tr>
<tr>
<td><em>Oldenlandia</em></td>
<td>High precipitation of sub-humid and humid regions</td>
</tr>
<tr>
<td>Oleaceae</td>
<td>Transition between temperate and subtropical zone</td>
</tr>
</tbody>
</table>

contd.
<table>
<thead>
<tr>
<th>Plant Indicators</th>
<th>Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apiaceae</td>
<td>Temperate and sub-alpine regions Some species sub-tropical inhabiting open meadows and moist situations</td>
</tr>
<tr>
<td>Ulmus</td>
<td>Moist and warm conditions</td>
</tr>
<tr>
<td>Cereal pollen, Plantago, Artemisia</td>
<td>Warm and moist conditions favouring farming culture</td>
</tr>
<tr>
<td>Alnus</td>
<td>Moist and dry climate temperature about 14°C</td>
</tr>
<tr>
<td>Artemisia and Urtica</td>
<td>Open conditions</td>
</tr>
<tr>
<td>Artemisia</td>
<td>Open and arid conditions forms component of dry alpine regions as well as dry temperate forests</td>
</tr>
<tr>
<td>Typha</td>
<td>Occupies lake margins when there is reduction in water level</td>
</tr>
<tr>
<td>Typha, Carex, Salix</td>
<td>Margins of lakes</td>
</tr>
<tr>
<td>Nymphaea</td>
<td>Fresh water</td>
</tr>
<tr>
<td>Low values of aquatics</td>
<td>Low level of lake</td>
</tr>
<tr>
<td>Brassicaceae</td>
<td>Inhabits mainly swampy or dried margins of lakes and ponds</td>
</tr>
<tr>
<td>Corylus</td>
<td>Dry temperate deciduous forest</td>
</tr>
<tr>
<td>Pinus roxburghii with low frequency of Abies, Alnus, Quercus, Juglans</td>
<td>Subtropical warm and dry</td>
</tr>
</tbody>
</table>
Geological and Physiographical features of the Kashmir Valley

It will be necessary to provide a brief account of the geological and physiographic features of the Kashmir valley in the context of the present investigation.

Kashmir which forms the northernmost region of South Asia lies between 32°-35° N latitude and 72°-80° E longitude. The valley is flanked by the Himalayas on the north-east and by the Pir Panjal on the south-west. The major part represents the loess deposit. The ecological correlations reveal the use of old lake beds for settlement in the Kashmir valley which during the Pleistocene was a vast lake covering a span of 140 km in length and 40 km in width. According to the model of De Terra and Paterson (1939) this lacustrine lake basin is exposed in the form of a flat topped plateau known in geologic literature as "Karewa beds", the name which has been in local usage. Its origin is related to the uplifting of a massive mountain range, the Pir Panjal during Pliocene about four million years ago (Burbank and Johnson, 1982; Burbank and Reynolds, 1984) which resulted in the formation of a vast lake by impounding the drainage of water on the south-west side gradually transforming this region of the Kashmir valley into a fluviolacustrine basin (Godwin Austen, 1859; De Terra and Paterson, 1939). The basin is marked by a stronger glacial touch in the upper region extensively covering the Srinagar area and extending between the height of 1,600 - 5,000 meters above the sea level and 1.2 km in thickness. Later due to a fault in the Pir Panjal mountain range at Baramulla there was the emergence of the river Jhelum which drained out the Karewa lake and exposed the lake sediments due to subsequent erosion and tectonic changes. This is considered as one of the important phases in the Himalayan orogeny. The Siwalik ranges also arose at this time southwards. The upheavel mountain building activities that started forming the Himalayan ranges
towards the end of Mesozoic era reached its last phases of upheaval activity towards the end of Pleistocene when the Himalayas acquired its present geomorphic structure with its mountain chains comprising Himalayan ranges in the north-east, Pir Panjal in south-west and Siwalik range on the south contributing to the outer Himalayas. There also developed the drainage system through the rivers cut across and lake segments. There are lakes like Anchar, Dal, Manasbal, Wular and many others which lie in the north-western fronts of the valley along with swampy lowlands cut out of the Karewa terraces in the flood plains of river Jhelum (De Terra and Paterson, 1939). Radiocarbon dating of some of these lakes indicate their Holocene age. The fossil bearing sediments deposited in the lake beds of the Pir Panjal range reveal the existence of plants belonging to modern species.

The Karewa beds representing deposition of a span of about four million years (Agrawal et al, 1979) have attracted attention of scientists of different disciplines in order to understand its origin, geomorphology, stratigraphy, the climatic and environmental changes, vegetational pattern in relation to these changes and the cultural horizons with advent of man. These findings have helped in establishing an interdisciplinary relationship in tracing the palaeoclimatic and environmental history of the valley and based on these the archaeological information related to farming culture and archaeological settlement in the evolution of cultural phases are being traced out. Most of the recent attempts concentrate on the reconstruction of changes which occurred with the advent of man after the last glaciation during the last 10,000 years of the Holocene when the activity of man started showing an impact on the global vegetation (Godwin, 1975; Bryant & Holloway, 1985).
Quaternary palaeobotanical research in India commenced in the nineteenth century when Godwin Austen (1864) for the first time reported the occurrence of leaf impressions in the lower Karewa deposits of the Kashmir valley. Middlemiss (1911) added more taxa discovered from various localities in the Pir Panjal. Sahni (1936) and Stewart (1936) collected fossil plants from lacustrine beds in the Gulmarg-Baramulla region and demonstrated that they were deposited in the low level lake basin where the climatic conditions were milder. In 1939 De Terra and Paterson published a comprehensive list of plant remains from Lower Karewa followed by Puri (1945, 1947, 1948, 1957) and recently Awasthi (1982) and Awasthi and Guleria (1982) have added new information on the leaf impressions and carbonised woods from these beds.

The Quaternary palynology in the Indian subcontinent can be traced back to 1906 when Huntington pollen analysed the sediments from Pangong lake in Ladakh. Wodehouse & De Terra (1935) initiated pollen analytical work on the lower and upper Karewa sediments in Kashmir. He claimed that the climatic conditions under which the Karewa deposits were laid down were generally the same as those found at Manasbal lake at the present times. Nair (1960, 1968) reported a number of arboreal and non-arboreal taxa and discussed migration of plants. He observed that the composition of the flora of the lower Karewa presents a vegetational succession of aquatic plants, followed by the forest vegetation and then replaced by open vegetation dominated by Plantago, Artemisia and Chenopodiaceae. He also observed the presence of trees like Quercus, Alnus, Carpinus and Betula which are otherwise now absent from the valley except for their isolated occurrence. Vishnu-Mitre (1963a) showed a prominent oak (Quercus) phase which was later replaced by pine mixed-woods which are preceded and followed by a phase each devoid of vegetation. The Postglacial
decline of elm (Ulmus) was studied by Vishnu-Mitre (1964) on the basis of pollen study. The vegetational history of the valley has been traced out by Singh (1963) and Vishnu-Mitre & Singh (1963). Pollen analytic work was also carried out on Postglacial deposits by Vishnu-Mitre, Singh & Saxena (1962), Sharma (1964) and Vishnu-Mitre (1966a). Based on their studies Vishnu-Mitre (1963b, 1973a), Vishnu-Mitre & Savithri (1978) reviewed the demarcation of the Plio-Pleistocene boundary and the history of oaks in the valley. The lower Karewa samples were pollen analysed by Vishnu-Mitre & Robert (1973) for a comparative study between the micro and megafossils but their results were not complementary. Based on the studies of diatoms of the Karewa sediments Roy (1974) assigned Miocene age to the base of the lower Karewas. Similar studies were also carried out by Rao & Awasthi (1962), Singh, D (1977), Gandhi & Mohan (1983), Gupta & Khandelwal (1987).

In order to get a complete and clear picture of the vegetation during the Quaternary the palynological studies have been carried out from various sites of different lithofacies. Efforts to synchronize the palynological findings with the Karewa lithostratigraphy by Bhatt (1979, 1989) and chronostratigraphy by Agrawal et al (1979, 1989) have been made. Pollen investigations of about 200m thick strata are now available. Gupta et al (1984, 1985, 1990) and Gupta & Sharma (1989) have made palynological investigations at Hirpur localities I, III and V. At Hirpur locality III the investigations suggest an unstability in vegetation due to changing climatic conditions. Besides Hirpur palynological investigations have also been carried out at Krachipathra (Sharma & Gupta, 1985), Ningle Nullah (Gupta & Sharma, 1992), Wapzan (Dodia et al, 1982), Dubjan (Sharma et al, 1985), Baltal (Dodia, 1988a). Investigations on some lakes and swamps which represent the postglacial and Holocene period have been carried out to study the
Late Quaternary vegetational history. The two sites Toshmaidan and Butapathri which depict a postglacial vegetation have been dated to 15,000 B.P. (Singh, 1963; Singh & Agrawal, 1976) and 17,000 B.P. (Dodia et al, 1985) respectively. Besides these similar investigations have been carried out at Haigam by Vishnu-Mitre and Sharma (1966), at Baba Rishi and Yus Maidan by Sharma & Vishnu-Mitre (1969) and at Anchar and Hokarsar by Dodia et al (1985). The vegetational pattern at these sites is in concordance with the scheme of postglacial climatic changes as suggested by Von Post (1946).

The extensive excavations reveal evidence of archaeological remains from Stone age to the latest period in the Kashmir valley (Sankalia, 1971). The first settled evidence in the valley has been obtained from excavations at Burzahom (Khazanchi, 1960) and Gulkral (Sharma, 1982) which has brought to light the use of plants and animals in settlement by early settlers in the valley and advancement of cultivation in the later phases as we get carbonised remains of grains and seeds of wheat, barley and rice.

Aims, Objectives and Scope of Work

Palaeoclimatic studies are concerned with the evidence left by long term climatic changes on the earth. Palynological investigations form a crucial component of palaeoclimatic studies particularly in delineating the periodic warm and cold phases that have alternated in the climate. The present work therefore has been carried out with the aim to correlate the vegetational patterns with the climate and settlement of man in the Neolithic culture for food producing habit.

The study thus includes three aspects

1. To investigate the palaeoclimatic changes which occurred nearly 4,000 years ago during the late Quaternary
   (Holocene - Neolithic) in Jammu and Kashmir.
2. To correlate the palaeoclimatic data of the present study with palaeoclimatic data from other parts of Kashmir in order to build a comprehensive picture of climatic changes.

3. Another major application of the study will be to relate the palaeoclimatic pattern of Kashmir with that of the human environment in the region including the aspects of farming culture. This archaeobotanical aspect of the study will provide insight into subsistence pattern and survival strategies in the Neolithic period and thereafter.

Palaeoclimatic surveys based on palynodata conducted at a number of other sites like Anchar (Dodia et al, 1985), Hokarsar (Dodia et al, 1985), Butapathri (Dodia et al, 1985) and Haigam (Vishnu-Mitre & Sharma, 1966) reveal the occurrence of several climatic changes which influenced a particular kind of forest growth with marshy lands. Archaeological surveys show evidence of densely distributed Neolithic culture in the Kashmir valley but except for the extensive work at Burzahom and Gufkral little is known about plant domestication habit by these settlers in other parts of the valley. With this end in mind it was thought to undertake the present investigation in order to study the climatic and environmental changes in the later phases of Holocene and look for the vegetational composition on the basis of palynodata from other lake sediments. For this purpose borehole cores from two different lakes viz. Manasbal which is near Srinagar, Kashmir and Mansar which is near Jammu were obtained. A detailed palynological study of the sedimentary profiles of these lakes have been made. The details of materials and methodology used is given in chapter two and the observations are provided in chapter three.
CHAPTER 2