CHAPTER 2
GENERAL GEOLOGY OF KAVERI CATCHMENT

2.1 PHYSIOGRAPHY

The Deccan Plateau which lies south of the Indo-Gangetic plain is an elevated area making up the whole of the Southern India tableland and extending over eight states. It is a vast plateau lying east of the Western Ghats, encompassing most of central and Southern India. It makes up large areas of Maharashtra, Karnataka and parts of Andhra Pradesh which lies south of the Vindhyan range and has an elevation which ranges from 100 meters in the north to 1000 meters in the south. It is bounded in the west by the Western Ghats and in the east by the Eastern Ghats. One of the best defined portions of this table-land country is that which forms the Western Ghats- the Sahyadri of Sanskrit – the most important orographic feature of the Peninsula today lying between lat. 08° and 21° 06'N and long. 73° and 78° E (Radhakrishna, 1967) approximately, running in a NNW-SSE direction, fringing the western coast from the Tapti estuary to Cape Comorin. The western declivity is steep and usually terraced, resembling the ghat or “landing stair” from which the range derives its name. The Western Ghats average 1400-m in height but rise occasionally to 2800-m. The distance of their scarp from the sea-shore varies from 20 to 65 miles, but is seldom more than 40 miles. The length of this scarp, which has the appearance of a line of old sea-cliffs, is about 1000 miles and the only breach therein is the broad Palghat gap. The Western Ghats are joined by the Eastern Ghats in the Nilgiri plateau (Gunnel, 1988; Radhakrishna, 1967) the two ranges enclosing between them the Mysore Plateau. It must be remembered that the gneissic plateau of central and southern India is an extremely old one and excepting that portion covered and protected by the Deccan trap, has been subjected to very prolonged denudation.

2.2 MOUNTAIN RANGE:

The most important mountain range of South India is the Western Ghats, which form the western boundary of the state. The Northern section of this range in
Maharashtra accounts for the higher peaks, notably Kalsubai (1646-m) and Mahabaleshwar (1438-m); in southwest Karnataka, Kudremukh at 1862-m and Mullayyanagiri at 1925-m; and in southern part of the range, with Ana Mudi in Kerala at 2695-m being the highest peak in the Western Ghats. The only major gaps in the range are the Goa gap, between the Maharashtra and Karnataka section and the Palghat gap (16 miles wide) that join Tamil Nadu to Kerala.

The northern portion of the narrow coastal plain between the Western Ghats and the Arabian Sea is known as the Konkan Coast or simply Konkan, and the southern portion is called Malabar region or the Malabar Coast. The foothill region east of the Ghats in Maharashtra is known as Desh, while the eastern foothills of central Karnataka state are known as the Malnad region. The mountains intercept the rain-bearing westerly monsoon winds and are consequently an area of high rainfall, particularly on their western side and decreases significantly as one move towards the eastern side.

2.3 RIVERS DRAINAGE

The most important characteristic of the drainage is that with a slight exception all the rivers find their way to the Bay of Bengal, although a good many of them rise in the Western Ghats very close to the Arabian sea. This peculiar characteristic is explained by considering the Western Ghats as an ancient watershed. The country to the west of the Western Ghats was, at an earlier geological epoch, probably quite as extensive as that to its east but foundered beneath the waters of the Arabian Sea soon after the eruption of the Deccan Trap lavas by faulting along the western coast. The evidence available seems to indicate that the Western Ghats owe their present elevation to uplift along a fault zone during the Tertiary period. The marked easterly flow of the rivers is attributable to the regional tilt of the Peninsula towards the east. The westward-facing slopes receive much more rain than the eastward-facing slopes, and the Western Ghats are considerably wetter than the dry Deccan to the east. The Western Ghats form the most important watershed for Peninsular India, the plentiful rain giving rise to numerous streams and rivers such as Chittar river with many waterfalls, Bhima river, Malaprabha river, Kabini River, Kallayi River, Kundali River, Pennar River and the
Tambaraparani River, form the headwaters of the both the short rivers that run to the Arabian sea and the great perennial rivers of the Deccan, including the Godavari river, Krishna river, Kaveri river and their tributaries. The Sivasamudram falls which is the second biggest waterfall in India is formed at a point where Kaveri River drops off the Deccan plateau. There has recently been a strong movement to curb mining operations in the Western Ghats, as this is one of the global biodiversity hotspots.

2.4 RAIN FORESTS

Western Ghats are considered to be well-covered in dense forests. They contain the largest patches of moist deciduous forest and rain forest in southern India. These forests are home to diverse fauna and flora, many of them showing affinities to the Malayan (Malaysia-Indonesia) region, but are increasingly threatened by human activity. Several national parks and other protected areas lie within the range, but it is estimated that only a small fraction of the Western Ghats remains in pristine condition. The Silent Valley National park in Kerala is considered by many to be the last tracts of virgin tropical evergreen forest in India.

2.5 FLORA AND FAUNA

The Western Ghats are also home to many endemic species and endemism is especially high in the amphibian and reptilian fauna. The snake family Uropeltidae is almost entirely restricted to and diversified in this region of the world. The frog *Nasikabatrachus sahyadrensis* was discovered in 2003 as being a living fossil. The evergreen Wayanad forests of Kerala mark the transition zone between the northern and southern ecoregions of the Western Ghats. The southern ecoregions are generally wetter and more species rich. At lower elevations are the south Western Ghats moist deciduous forests, with Cullenia which is the characteristic tree genus, accompanied by teak, dipterocarps and other trees. One of the endemic species of the Western Ghats is the lion tailed Macaque. The evergreen forests of Nagarhole, deciduous forests of Bandipur National Park and Nugu in Karnataka and adjoining regions of Wayanad and Mudumalai National Park in the states of Kerala and Tamil Nadu form the single largest protected areas in the Western Ghats system comprising some 5500 km². This is also
called the Nilgiri Biosphere reserve. The Biligirirangan Hills lies at the confluence of the Western and Eastern Ghats and is home to unique ecosystems present in both ranges. Western Ghats in Kerala is home to tea and coffee plantations, reserved forests and dense tropical jungle. Elephant, Gaur, Sambar and wild boars dwell in the forests. Sloth Bear, Leopard and tiger are also found. The famous Silent Valley National Park also falls under the Western Ghats.

2.6 CLIMATE

The Western Ghats play a critical role in the climate of Peninsular India. Most of the heavy clouds of the south-west monsoon, after shedding much of their moisture upon these mountains, sweep unprecipitated over the plains of the Deccan which, in consequence, constitute an arid tract liable to famine. Precipitation is resumed when the clouds reach the higher ground of Central India and the Central Provinces. A belt of arid or semi-arid climates extends from the north to the south, in southern India dividing the humid climates of the west coast from the central and eastern parts of the country, where the annual rainfall is generally less than 1,000 mm. The areas of very heavy rainfall exist on the windward side of the Western Ghats. 80-90% of the rainfall over the country occurs mostly during the south-west monsoon season. The climate of Karnataka and Kerala states varies from very humid rainy monsoonal climate in the west coast, the ghats and malnad areas to semi-arid warm dry climate on the east. There is a large variation in the rainfall with higher amounts in the Western Ghats (> 4000mm) and reducing towards the eastern plains (<1000mm) (Fig.2.1). As the summer (wet) monsoons approaches the west coast of India, they rise up the Western Ghats (mountains) and the air cools. This cool air does not hold moisture and it is released as rainfall which is termed as orographic rainfall. By the time the winds make it over the Western Ghats they have lost most of their moisture and very little falls on the Deccan Plateau to the east of the Ghats. This reduced rainfall on the leeward side of mountain is termed as the rain shadow effect. In the southern tip of the Indian Peninsular rainfall is less than 2000 mm per year. Rainfall higher than 5000 mm is found only to the North of Lat.11° 15′N, except for the western slope of Anaimalai, Palni and Nilgiri ranges whose high elevations favour condensation. From the Wayanad region almost continuously up
Figure 2.1: [A] General geological map of southern India
Figure 2.1:- [B] Rainfall map of southern India showing sample locations.
to Mahabaleshwar, the annual rainfall exceeds 5000 mm over the entire region between
the foot of the Ghats and the western edge of the plateau. The Nilgiris shows that the
increase in rainfall from 2400 mm to more than 6000 mm corresponds to a marked
elevation of the hill range (Ghats rise up to 2500 m). However after crossing this peak,
the rainfall decreases abruptly and is only 2000 mm just 5 Kms from the plateau edge. A
major part of the high Nilgiri plateau receives scanty rainfall of 1500 to 1000 mm. It is
remarkable that at even low elevation of the Ghats the rainfall is tremendous in this
region. In the Western Ghats wind plays a major role in governing the climate as it
determines the alteration of seasons. In summer they bring large masses of water, the
condensation of which cause the monsoon rains. In the upper reaches, the western part
of Western Ghats receives rain mainly from the S-W monsoon and eastern region from
the N-E monsoon. Present day rainfall over the plateau varies from about 4000 mm/year
in the west to 1100 mm/year in the more sheltered central basin in the east. On an
average this region receives 1092 mm of rainfall. The mean annual temperature of the
Kaveri basin is 25°C although in summer (March to May) the max. Temperature reaches
43°C.

2.7 GEOMORPHIC EVIDENCE

Geomorphic studies afford the most important clues in understanding the
physiography and reconstructing the stages in the evolution of any particular region.
Such studies unfortunately are lacking in the Peninsular region and only a brief mention
can be made of certain characteristic which are as follows

2.7 A Western Ghats not a true mountain range but represent the precipitous Edge
of an Elevated Plateau

A study of the superposed profiles drawn across the Western Ghats at different
latitudes brings out clearly the fact that what we identify as the Western Ghats is only
the precipitous western edge of an elevated plateau. The demarcation from the coastal
plain and the plateau is abrupt and the scarp which forms the Ghats proper has all the
characters of youth stamped upon it.

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2.7 b Senile Character of the Plateau Surface

The plateau east of the Ghats is marked by a mature and senile topography. The ground is covered over by a thick mantle of soil which speaks of a previous degradational history protracted over a long period in which all differences in rock structure had been removed and the land reduced to base level. The rivers flowing over this surface have likewise reached a senile stage of development. Their valleys are broad and even tributary streams are well graded. Such plain land found at elevations of 1000m at present is indicative of rejuvenation and uplift marking the beginning of a new cycle.

2.7 c Rejuvenation Indicative of Uplift

Evidences of rejuvenation of the earlier mature topography and drainage are to be found in many parts of the plateau and more especially in the malnad forming the western edge of the plateau. The mountain tops are accordant and still preserve a part of the initial laterite-covered land surface. The physiographic aspects of the country marking the eastern slopes of the scarp is at once striking leaving no room to doubt that it represents an old land surface subjected to uplift and erosion in recent times. There are some lofty mountain peaks in the malnad region which have all been carved out by erosive action. Large scale differential erosion is made possible only through great uplift. These residuals of mountain size, therefore, appear to be the combined effect of uplift and erosion.

2.7 d Drainage Peculiarities

The fundamental peculiarity of the drainage of the peninsula is that all the major rivers, the Godavari, the Krishna and the Kaveri with the exception of Narmada and Tapti, take their origin on the crest of the Ghats within sight of the Arabian sea, only thirty miles away and instead of taking the short course to the west, cross the full width of the peninsula and join the bay of Bengal. This confirms the inference that the West Coast is of more recent origin than the East Coast and that the easterly drainage is of ancient date. The westerly face of the Ghats on the other hand exhibits characteristics of
extreme youth. The surface falls from a level of about 4000ft on the plateau to 500ft within a distance of three to four miles. They have carved out steep-sided valleys and are rapidly eroding headward. Excellent examples are the rivers Kali, Aghanashini, Gangavali and Sharavati.

2.7 The Palghat Gap

The Palghat Gap is the only break in the continuity of the long scarp of the Western Ghats. It is 1000-ft in elevation, at its highest point and is about 20-miles in width. This is considered to represent a valley of a major west-flowing river of the Tertiary times. It seems possible that in the same way as the rifts are responsible for the troughs of the Narmada and Tapti, there was in this region, now represented by the Palghat Gap, a rift which was occupied by a westerly-flowing river which was cut off after the block-faulting of the coast. The valley forming the floor of the Palghat Gap was, in all probability, a plain of marine denudation, now uplifted to its present position.

2.8 GEOLOGY OF THE KAVERI CATCHMENT AREA

The South Indian Shield is a composite continent formed by accretion of various crustal blocks from Mid-Archean to Neoproterozoic (Drury et al., 1984; Radhakrishna, 1989; Krogstad et al., 1989; Radhakrishna, 1993; and Balakrishnan et al., 1999). Based on geochronology and isotope data different age provinces with distinct precrustal histories have been recognized. For example in the Dharwar Craton the crust formation was mainly Archean (3.58 – 2.50 Ga) whereas, south of Palghat – Kaveri shear zone (Southern Granulite Terrain), crust formation occurred mainly during late Archean to Neoproterozoic (Harris et al., 1994; Jayananda et al., 1995; Brandon and Meen, 1995). Dharwar Craton and Southern Granulite Terrain, both, are traversed by various NNW-SSE, NNE-SSW, and E-W to ESE-WNW trending faults and shear zones (Grady, 1971; Drury et al., 1984; Ramakrishnan, 1994; and Mahadevan, 1995). The Kaveri River and its various tributaries more or less follow the trend of these shear zones and faults and receive water and sediments from both the terrains. There is limited evidence of Neoproterozoic activities, which prompted numerous workers (Powar, 1993; Radhakrishna, 1993; Vasudev, 1993; Ramasamy and Balaji, 1995; Rajendran and Rajendran, 1996;
Valdiya, 1998). To suggest intermittent reactivation of these shear zones. The soil/regolith cover in the upper reaches of the catchment area is the major source of sediment supply to the river. So, understanding on the soil and weathering profiles in these terrains require an understanding of the Kaveri river course and the regional geology of the region, climate (including palaeoclimate) as well as the topography in the catchment area.

**Kaveri River Course**

Kaveri river basin covers a large area of 87,900 Km$^2$ over the states of Kerala (2,930 Km$^2$), Karnataka (36,240 Km$^2$) and Tamil Nadu (48,310 Km$^2$). The river originates at Talcauvery in the western edge of Sahyadri range of the Western Ghats at an altitude of 1350m, and it takes easterly course over the Mysore plateau and Tamil Nadu plains and drains at Bay of Bengal (Fig. 2.1B). However, the general easterly course becomes southward between Hogenekal and Bhavani in Tamil Nadu. The total length of the river is approximately 800 kms. The course of the river can be split into four stages.

**Initial Stage**

The traditional source of the river is at Talcauvery in the Sahyadri range of Western Ghats at an elevation of 1335m above msl. The river loses height rapidly across a hidden fault which registers uplift of the order of 100-m (Valdiya, 1998). The terrain over which it flows is hilly with deep valley and has a youthful aspect.

**Meandering Course over the Mysore Plateau**

Leaving the mountainous region of Coorg, it enters the flat to undulating terrain of Mysore Plateau where it flows in its wide meandering valley. The Kaveri and its tributaries Hemavati, Shimsa, Akravati and Kabini have built a wide flood plain west of the N-S trending range of the Closepet granite. This sweeping and meandering course of river is maintained up to Sivasamudram.
Rejuvenated Course from Sivasamudram
After crossing the Mysore Plateau it deflects northwards along the N-S trending Sivasamudram fault (Valdiya, 1998), which caused abrupt northward swerving of the Kaveri near Kollegal. It rushes and drops 78m, 70m, 56m, and 23m down in a succession of waterfalls into a gorge. From Sivasamudram to Hogenekal it flows in the hilly terrain of Billigirirangan – Mahadeswaramalai range (BR – MM Hills) and again form a gorge at Mekadatu in BR hills. However, the general eastward trend remains same in this area. At Hogenekal, where it leaps into the state of Tamil Nadu the easterly course of the river abruptly becomes southward and flow along the N-S trending Hogenekal fault.

Senile Course over the Tamil Nadu Plains
Leaving Mettur and still keeping a straight, narrow course it captures the course of the river Bhavani joining it from the west. From this point onwards, it once again turns eastward. From Trichy onwards it flows over a very wide sandy bed with all its erosive power completely lost, depositing its sediment load over a vast flood plain. The senile river now branches into two, the northern branch known as kollidam (Coleroon) and the southern branch retaining the name of Kaveri.

2.9 GEOLOGICAL SETTING IN THE UPPER REACHES OF KAVERI
The geological units of the upper reaches of Kaveri River include rocks of Dharwar Craton and southern high grade Granulite Terrain (SGT).

Dharwar Craton
The rocks of the Dharwar craton are majorly granitic gneiss, termed as peninsular gneisses and metabasalts confined in the schist belts. The gneissic rocks of the western Dharwar craton are about 3400 – 3000 Ma, whereas, those of the eastern Dharwar craton are younger and are about 2700- 2500 Ma (Balakrishnan et al., 1999). Between eastern and western blocks there occurs a polyphase late batholithic intrusion, identified as Closepet Granites. Peninsular gneisses and schist belts form low lying terrains with occasional residual hills. Some of the mylonitised shear zones occur as
ridges of significant elevation. Closepet granite occurs as stocks and bosses of remarkable relief. Shimsa and Akravati, two of the tributaries of Kaveri, originate from the terrain of the Closepet granite and Peninsular gneisses. At the southern most part of the Dharwar craton the rocks have undergone incipient charnockitization as reported from Billigirirangan – Mahadeswaramalai hills and Kabbaldurga hills (Mahabaleswar et al., 1995).

**Southern Granulite Terrain**

This terrain comprises of granitic, granodioritic, gneisses and amphibolitic suits with prolific development of pyroxene. All such rocks are termed as charnockites. The rocks of this terrain are high metamorphic grade with development of garnet. There are some linear fault planes along which alkaline and carbonatitic intrusions were emplaced as at Hogenekal, Tirupathur, Semalpatti, Korati, Dharmapuri (Natarajan et al., 1994). The entire region is heavily affected by the shearing and faulting of rocks. The details of the major shear zones of this region are described below.

**Shear Zones of Upper Reaches of Kaveri**

Shear zones are one of the most prominent major deformational features of orogenic belts. They define the major boundaries of the deeply eroded orogenic belts as well as zones of more intense deformation within the belt. The shear zones generally occur in arrays and cut through many terrains irrespective of the age they belong to, and divide the region into compartments of different geometrical and geological characteristics. The Southern Granulite terrain (SGT) of India is recently subdivided into discrete tectonic blocks separated by extensive Proterozoic shear zones (Gopalkrishnan et al., 1975; Drury and Holt, 1980; Drury et al., 1984). The major shear zones that are exposed in SGT include Kaveri shear system and the Achankovil shear zone (Chetty 1996); however, the Kaveri river course and other geomorphological features in the Kaveri catchment area are dominantly controlled by the Kaveri shear system only.
The Kaveri Shear System: The Kaveri shear system (KSS) is located in the northern part of SGT, separating the northern granulite block to the north and the Madurai granulite block to the south and is situated between latitude 10° 45' and 12° 00' N. The KSS, striking east west, is 60 km wide and 200 km long. Presence of isolated charnockitic massif of Nilgiri hills, Kollimalai and Pachaimalai hills along the KSS is a notable feature. Other major rock units include sheared charnockitic and migmatitic gneisses intruded by layered anorthositic rocks around Bhavani and Sittampundi. It also consists mainly of high-grade remnants of greenstone belts along with supracrustal enclaves (Ramakrishnan, 1994). Rocks of eclogite affinity are also reported. Some workers consider the KSS as an ancient suture zone (Gopalkrishnan et al., 1990; Vishwanathan et al., 1990).

2.10 EVIDENCE OF NEOTECTONIC ACTIVITIES IN THE UPPER REACHES OF KAVERI

At the close of the Mesozoic, East Gondwanaland broke up and Indian plate started moving in the northward direction. This northward drift was blocked by the Eurasian plate, which not only gave birth to Himalayas but reactivated the faults of Precambrian antiquity also. Southern Granulite terrain of Peninsular India which is 4 to 5 km thicker than the Dharwar Craton (Rai et al., 1993) compressed the continental crust and because of this movement, buckling and breaking occurred along the zone of sudden change in crustal thickness. The breaking up of the Southern Indian crust manifested in the northward thrusting up on steep faults and thrusts which have brought up deeper rocks to great elevation above sea level. Eventually giving rise to the block mountains and development of conspicuous shear zones. Movements on these E-W trending shear zones have continued through the Quaternary (Valdiya, 1998).

Repeated reactivation of ancient faults of this cratonic regime is responsible for the evolution of the high south Indian table land and the peculiar landforms of southeastern Karnataka are attributable to Holocene movements on active faults (Valdiya, 1998). The nearly 900 m high plateau is bordered on all sides by escarpments and steep slope breaks. Its very ancient and matured topography and drainage have been
perceptibly rejuvenated. Conceivably as a result of repeated faulting up of crustal blocks of the fractured craton (Radhakrishna, 1952, 1968, 1993; Vaidhyanadhan, 1967, 1971; Kailasam 1979; Vardarajan and Balakrishnan, 1982). More than 2500 m high Nilgiri Massif with ~2100 m and ~2400 m high plantation surfaces (Vaidhyanadhan, 1967; Demangeot, 1973; Parthasardhy and Vaidhyanadhan, 1974) in the southwest, > 1200m high Sahyadri range with 1200m and 1340m plantation surfaces (Babu, 1975; Vardarajan and Balakrishnan, 1982), in the west and >1800m high Billigirirangan-Mahadeswaramalai hills with 1200m, 1500m and 1800m high plantation surfaces in the centre owe their present height and striking geomorphic youthfulness within the geomorphically mature ancient landscape of the east Gondwanaland also considered as a resultant of intermittent movements along these faults taking place since the Late Mesozoic through Quaternary (Radhakrishna, 1993; Powar, 1993).

These features of larger wavelength are superimposed by smaller features developed as a result of smaller pulses of uplift in the Late Quaternary. The evidence of recent movements could be seen in different parts of the southern Indian shield. Some of those are following

(1) Physiographically, the landscape near Bangalore comprises a series of N-S trending linear en echelon hills and isolated hillocks, which suddenly rise 300 to 400 m above the flat to undulating surface carpeted thickly with red soil. One of the slopes of these linear hills is very steep while the other gentle slope merges with the plain. In composition, structure and age, the rocks of these ridges are not much different from those of the adjoining flat terrain. However, the rocks are strikingly fresh and devoid of soil capping even larger part of their surface, as if these rocks were brought to the surface recently (Valdiya, 1998). Belts of mylonite and bracciated or highly sheared rocks line the flanks of these linear hills and hillocks (Jayaram, 1923).

(2) In this region, at many places stream ponding due to the uplift of the downstream fault block has given rise to formation of lakes, now represented by thick clay fills. Preliminary dating done by G.Rajagopalan of BSIP (Lucknow) shows that the bottom
sediments of three lakes are approximately 26,500, 25,500, and 1900 years old (Valdiya, 1998).

(3) The 1971 and 1972 earthquakes at Karnataka-Tamil Nadu border (Ramasamy and Balaji, 1995) and earthquakes between 1829 to 1993 (Vasudev, 1993) south and southeast of Bangalore all seem to be related to the movement on the northerly trending faults, particularly those that demarcate the boundaries of the Closepet granite, BR hills and MM hills. In the western Dharwar Craton, the NNW-SSE oriented faults and to some extent ENE-WSW trending faults are likewise seismogenic.

(4) In the Bhavani shear zone, three levels of fluvial terraces and deformed sediments in Bhavani river valley also suggest neotectonic activity. Three major earthquakes of Coimbatore and Waddakoncheri are related to the active faults of the shear zones. According to Rajendran and Rajendran (1996) there is indeed continued low-level of seismic activity in this area, indicating enhanced stress concentration within the belts.

(5) The 2500m high Nilgiri massif is geomorphically very mature at the top but is bound on all sides by very steep scarps. These scarps expose remarkably fresh charnockites and granulites amidst a landscape matteled with 30-40m thick laterite and colluvial material at the base of escarpments are products of neotectonic movements (Valdiya, 1998).

(6) Palaeolakes formed due to blockade of the streams at many places in Nilgiri massif show peat deposits. Peats recovered from some of the palaeolakes situated at Sandyanallah, Kakathole, Wanjanad, Colgrain and upper Bhavani have given age of >44,000, 20,000 to 16,000, and 10,000 to 5,000 years BP (Sukumar et al., 1993; Rajagopalan et al., 1997).

2.11 GEOLOGY OF THE STUDY AREA

This study was carried out in the upper reaches of Kaveri River. The upper reaches of the river have continuous annual flow, mid and lower sections are damned
and bled for irrigation water. The Kaveri river basin extends from lat. 10°7' to 13°28' N and long. 75°28' to 79°52'E (Fig.2.1B). The climate of the basin varies from perhumid in the northwest, to humid, moist humid, dry sub-humid to semi-arid climatic zones in the east. The Kaveri River is approximately 800 km long. Hemavati and (Yagachi) join the river in upper reaches and Kabini from the south west of Karnataka. The Malnad (Mountainous region) of the Mysore plateau, also known as Western Ghats, constitute the catchment area of Kaveri River and its tributaries. The average elevation of Western Ghats is 1216m and that of Mysore plateau is 950m above sea-level. The Ghats rise precipitously from the narrow western coastal region and slope gently towards the east. The Kaveri river drainage region includes dominantly granite gneisses, charnockites and amphibolites of Archean age (>2500 Ma).

The geological map is shown in figure 2.1. It clearly shows the course of the river Kaveri and its tributaries. The drainage region includes two major terrains, a northern greenstone-granite terrain (Dharwar Craton) and a southern granulite terrain. The two terrains are separated by a zone, the north of which the granitic rocks with included supracrustal belts (schist belts) are metamorphosed to grades lower than amphibolite facies. South of the transition zone, both granitic and supracrustal rocks are commonly metamorphosed to granulite grade resulting in charnockite, pyroxene granulite and high grade amphibolite assemblages.

Samples were collected from ten different locations, five of the locations were sampled for amphibolites and another five, were sampled for the gneisses. The name of the location for amphibolite samples are as follows: Yashodapura, Bababudan, Daripura, Galeebedu, and Kakkavayal. For the gneisses the name of the locations are as follows: Bacchalkad, Galeebedu, Kushalnagar, Gorur and Katlbare. Detailed description of sample locations is given in table 2.1.

Details of individual sites, in terms of rock types, structures, weathering features and element mobilization, are given in the following chapters: (i) Chapter 3 deal with the research methodology. Sample collection, sample preparation and analytical
### Table 2.1 General Description About the Location of the Samples

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>AVG. TEMP.</th>
<th>AVG. RAINFALL</th>
<th>ALTITUDE</th>
<th>TOPOGRAPHY</th>
<th>VEGETATION</th>
<th>ROCK TYPES</th>
</tr>
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<tbody>
<tr>
<td>Galeebedu</td>
<td>20°C</td>
<td>500 cms</td>
<td>1300m</td>
<td>Undulating</td>
<td>Extremely Dense</td>
<td>Granitic gneisses, much more deformed</td>
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<tr>
<td>Bacchakad</td>
<td>22°C</td>
<td>400 cms</td>
<td>2000m</td>
<td>Moderate Undulating</td>
<td>Moderately dense</td>
<td>Granodioritic gneisses, massive in nature</td>
</tr>
<tr>
<td>Kakkavayal</td>
<td>22°C</td>
<td>400 cms</td>
<td>2000m</td>
<td>Moderate Undulating</td>
<td>Moderately dense</td>
<td>Thick lateritic Amphibolitic profile</td>
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<tr>
<td>LOCATION</td>
<td>AVG. TEMP.</td>
<td>AVG. RAINFALL</td>
<td>ALTITUDE</td>
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<td>VEGETATION</td>
<td>ROCK TYPES</td>
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<td>Gorur</td>
<td>32°C</td>
<td>80-100 cms</td>
<td>1000m</td>
<td>Flat</td>
<td>Sparse</td>
<td>Granite gneisses (gray gneisses)</td>
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<td>Katlbare</td>
<td>35°C</td>
<td>70-80 cms</td>
<td>800m</td>
<td>Flat</td>
<td>Sparse</td>
<td>Granite gneisses (more migmatites)</td>
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<tr>
<td>Kushalnagar</td>
<td>27°C</td>
<td>120-140 cms</td>
<td>1100m</td>
<td>Flat to moderately</td>
<td>Sparse to Moderately</td>
<td>Granite gneisses (more tonalitic in composition)</td>
</tr>
<tr>
<td>Daripura</td>
<td>32°C</td>
<td>70-80 cms</td>
<td>740m</td>
<td>Undulating</td>
<td>Dense</td>
<td>Amphibolites enclave occurs within the gneisses</td>
</tr>
<tr>
<td>Bababudan</td>
<td>30°C</td>
<td>80-100 cms</td>
<td>1168m</td>
<td>Flat to moderately</td>
<td>Sparse</td>
<td>Core-rind complex of amphibolites</td>
</tr>
<tr>
<td>Yashodapura</td>
<td>32°C</td>
<td>80-100 cms</td>
<td>908m</td>
<td>Flat</td>
<td>Sparse</td>
<td>Core-rind complex of amphibolites</td>
</tr>
</tbody>
</table>
techniques used in this study are dealt in detail in this chapter. (ii) Chapter 4-6 deal with the dynamic aspect of weathering - a field observation illustrated with pictures, weathering of amphibolites and gneisses in different climatic setup (i.e. semi-arid and humid) respectively. Weathering profiles have been selected on the basis of extent of weathering observed in the field and samples have been collected from different sections of the profile, which have distinct physical characteristics. Geochemical studies are carried out to determine the chemical extent of weathering and mobility of elements during weathering. Chapter 7 gives an overall picture about the factors controlling weathering processes, behavior of major and trace elements including REE during weathering of amphibolites and gneisses under different climatic setup (i.e. semi-arid and humid) along with the relative importance of local structures in rocks and rainfall in the extent of chemical weathering.