CHAPTER I

GENERAL

1. Introducing the District

The most prominent feature of Dhenkanal district is noticed when one flies over it. It appears as if between two big rivers there is unending forest with a few human settlements dotted here and there. The forests cover 58 per cent of the total area of the district. From the air one cannot also fail to notice the 22 km. long narrow gorge called Satkosia through which mighty Mahanadi passes before it spreads out on the plains of Cuttack district. This gorge is one of world's enchanting spots with thickly wooded hills on both sides reaching a height of 700 metres. The muddy water of the rainy season swelling to a height of 70 metres is imposing. In winter the blue waters reflecting the blue sky, and the towering hills, and morning mist rising from the valley are unforgettable. In summer nature lays on fire works in the shape of forest fire whose reflection at night makes a fiery festoon to entertain the visitor.

Human history had its origin in the valley of the Brahmani where copious finds of stone implements point to the establishment of Homo Sapiens who must have had plenty of food from wild fruits and roots, and wild animals. Tribes inhabiting the district include Juangs whose women in Pal Lahara were topless 40 years ago and in their wild homes may still be wearing aprons of leaves.

The political history of the district is based on a group of principalities ruled by Chiefs whether tribal or Aryan who fought among themselves except when an overlord kept the peace.

In modern times Dhenkanal produces coal and chromite. Coal feeds a large Thermal Plant at Talcher to produce electricity and will shortly be the raw material for a large fertilizer plant.

The phenomenon of boulders in Talcher area is unique in India and had puzzled geologists for a century. The explanation can probably be found now in the theory of drifting continents based on exploration of the ocean floor. Peninsular India was in the Antartic 180 million years ago. It broke away and sailed north till it has reached its present destination. What the geologists had been looking for was evidence of an intensely cold climate which India had during its original residence in the Antartic regions.

Dhenkanal contains a centre of a religious movement called *Mahima Dharma* which is hardly 100 years old, but is spreading its tenets in many neighbouring districts and States. When semi-naked

Sanyasis collect there in February every year in memory of the death of Mahima Gosain and large crowds of devotees collect, it is an inspiring period for the population. These naked Sanyasis are men of learning and are well disciplined. Their leader Biswanath Baba is a philosopher who in future will probably rank among other eminent philosophers.

Some of the Ruling Chiefs were noted for their oppression, while others were noted for their devotion to moral and religious cults. The family of Dhenkanal produced Bhagirathi through whose patronage *Mahima Dharma* started and spread. It also produced the family which left the ghostly monument of Jatan Nagar, the ruins of the Palace on a hill, which has not been lived in for over quarter of a century and is a prominent feature of the landscape.

The same family produced Raja Trilochan who distinguished himself as the only Raja of Orissa to resist the march of the Marahattas. The battle has been immortalised by poet Brajanath Badajena in his *Samar Taranga*. Raja Somanath Singh of Angul martyred himself by defying the British and lost his kingdom.

Religious movement in the mediaeval period did not leave the district untouched. The Kapilas Hill contains monasteries which attract Sanyasis of many sects. On the bed of the Brahmani at Sarang, there is a huge figure of Vishnu (32 feet long) in the Ananta Sayanam posture. Another figure of Vishnu (41½ feet long) is at Bhimakand in sleeping posture. They are the largest figures of Vishnu in the World carved on an outcrop of natural rock.

Dhenkanal district has been the home of elephants for centuries and had numerous tigers prowling its forests. But during the last decade, the tiger has nearly become extinct on account of the vandalism of man caused by lure of fabulous prices.

2. Origin of the name of the District

The district of Dhenkanal, one of the centrally located districts of Orissa, owes its name to the headquarters town of Dhenkanal. The whole of the district, with the exception of the Angul subdivision, consists of ex-feudatory States. The district came into being on 1st January 1948 when new districts were created after the merger of the princely States with the Province of Orissa. It originally comprised the ex-States of Dhenkanal, Hindol, Athmallik, Rairakhol, Talcher, and Pal Lahara. The town of Dhenkanal, the capital of the ex-State of Dhenkanal, was chosen to be the headquarters of the newly formed district and also of the Angul district. The origin of the name of this town which also gave the name to the ex-State of Dhenkanal, remains to a large extent obscure [1]. A tradition relates that the founder of the Raj

1. *See* Chapter XIX regarding the origin of the name of the town

Family of Dhenkanal transferred his seat of Government to this place and named it Dhenkanal after the name of an aboriginal Chief Dhenka Savara who formerly ruled over this tract.

3. Location: General boundaries, area, population

The district lies between 20°-29′ N and 21°-42′ N latitudes and 84°-16′E and 86°-2′ E longitudes.

In shape it somewhat resembles a sector of irregular sides, the arc extends from east to west forming the southern limit and the meeting point of the two radii is as its northernmost tip. The district is bounded on the south along the arc of the sector, by the Jajpur and Athgarh subdivisions of Cuttack district, Nayagarh subdivision of Puri district, and Baudh subdivision of Baudh-Khondmals district. The westernmost part of the district, where the arc meets the western radius, is touched for a very short distance by the Sonepur subdivision of Balangir district. To the west of the district, along the western radius lie Rairakhol and Deogarh subdivisions of Sambalpur district. Further north, close to the apex, is the boundary of the Bonai subdivision of Sundargarh district. The apex itself borders the Champua subdivision of Keonjhar district and south of it, almost along the whole length of the eastern boundary the district is contiguous with the Keonjhar subdivision of Keonjhar district.

The district of Dhenkanal extends over an area [1] of 4,226 square miles or 10,945·34 square kilometres with a population of 1,028,935 according to the Census of 1961. But according to the 1971 Provisional Census, it has a population of 1,294,126 (males 6,53,881 and females 640,245). The area remained the same. From the point of view of area it stands seventh among the thirteen districts of Orissa while on population count it is the eighth.

4. History of the district as an administrative unit and the changes in its component parts:

The district of Dhenkanal consists of five ex-State areas and the Angul subdivision. The latter was a princely State prior to 1848, when its last ruler Somanath Singh Jagadev was deposed by the East India Company for alleged insubordination. Under the direct rule of the

[1] There appears to be some inconsistency in different statements about the area of the district. The Surveyor-General of India, presumably calculating on the basis that the entire country is of one level equal to that of the sea, arrived at a figure of 4,177 Sq. miles or 10,818·43 Sq.km. The old publications, including the Imperial Gazetteer of India, the District Gazetteer of Angul and the Gazetteer of the Feudatory States of Orissa present the area of the constituent parts of the modern district and the total area according to these sources is 4,237 Sq. miles or 10,968·43 Sq. km. In other Government records the area is shown as 4,226 Sq. miles or 10,945·34 Sq. km. As Police Station-wise break up of the area is not readily available from other sources, figures from general Government records as 4,226 Sq. miles or 10,945·34 Sq. km. for the district are relied upon in this publication.

British, Angul was administered by the Superintendent of the Tributary Mahals, and because of its backwardness and local inconveniences, its administration followed a line of its own. The laws and Regulations of the Mogulbandi areas were not followed here and in their place special laws were framed for Angul only. In 1855, the Raja of Baudh was compelled to surrender a part of his territory known as Khondmals as he was unable to enforce effective control over that land. The Khondmal area was also placed under the administration of the Superintendent of the Tributary Mahals. In 1891, Angul and Khondmals were constituted into Angul district, with its headquarters at Angul. The amalgamation of these two tracts, each forming a subdivision, continued upto 1936, when the new Province of Orissa was created. That year Angul subdivision was constituted into a district under the Angul Laws Regulation, 1936. On 1st January, 1948, all the Feudatory States of Orissa, except Mayurbhanj, acceeded to the Indian Union and formed part of the Province of Orissa. New districts were created with effect from that day and the district of Dhenkanal thus came into being, consisting of the ex-State areas of Dhenaknal, Hindol, Talcher, Athmallik, Pal Lahara, and Rairakhol, Later on for administrative convenience the Rairakhol ex-State was transferred to Sambalpur district with effect from 26th October, 1949. Two villages, namely, Kabatabandha and Goliamuhanpatna were transferred to Cuttack district in 1964*. Dhenkanal and Angul were two separate districts with one composite office located at Dhenkanal. The Collector of Dhenkanal was the *ex officio* Collector of Angul. The status of Angul as a district was changed to that of a subdivision of Dhenkanal district since 15th September, 1967 by the Angul Laws Regulation (Repeal) Act, 1967.

5. Subdivisions, Tahasils, and Thanas

At the time of its formation in 1948, the district consisted of nine subdivisions, viz., Dhenkanal (Sadar), Kamakhyanagar, Parjang, Hindol, Talcher, Kaniha, Athmallik, Pal-Lahara, and Rairakhol. Before merger the Dhenkanal State itself consisted of three subdivisions, viz., Dhenkanal Sadar, Kamakhyanagar, and Parjang, while the Talcher State had two subdivisions, viz., Talcher and Kaniha. These subdivisions were maintained for a short period after merger. Subsequently in 1949, Kaniha was merged with Talcher and in 1950, Parjang was merged with Kamakhyanagar. Rairakhol was transferred to the district of Sambalpur and Angul was made a subdivision of Dhenkanal. As a result of which there remained only seven subdivisions in the district. No other district of the State of Orissa has such a large number of subdivisions. The districts, next to Dhenkanal in this respect are Cuttack, Koraput, and Sambalpur with six subdivisions each. The

*Vide Revenue Department Notification No. 35229—II-J-19/64-R., dated 10-6-1964.

subdivisions of this district are, therefore, small in size and population. None of these is more than 1,000 square miles (2,590 Sq. km.) in area and has a population of more than 250,000 (according to 1961 Census). The largest and the most populated among these subdivisions is Angul which is 902·1 Sq. miles in area and had a population of 230,538 in 1961, while the Hindol subdivision is the smallest in size, being 312 Sq. miles in area, and Pal Lahara is the smallest in population having only 52,684 inhabitants in 1961.

Each subdivision consists of two or more Police-Station areas. In all there are twenty three Police-Stations. Each subdivision constitutes a Tahasil. (For population and area of subdivisions and Police-station *see* Chapter III—People). The subdivisions, Police-Stations and Tahasils of the district are as shown below:—

Subdivision/Tahasil		Police-Station
1. Dhenkanal Sadar	..	1. Dhenkanal Sadar
		2. Gondia
		3. Motanga
2. Kamakhyanagar	..	1. Kamakhyanagar
		2. Bhuban
		3. Parjang
3. Talcher	..	1. Talcher
		2. Colliery
		3. Kaniha
4. Pal Lahara	..	1. Pal Lahara
		2. Khamar
5. Athmallik	..	1. Athmallik
		2. Thakurgarh
		3. Handapa
		4. Kishorenagar
6. Hindol	..	1. Hindol
		2. Rasol
		3. Balimi
7. Angul	..	1. Angul
		2. Chhendipada
		3. Jarpara
		4. Purunakot
		5. Bantala

1 Sq. mile=2·59 Sq. Km.

6. Topography

(i) Natural Divisions

The district is for the most part covered with dense jungle and a long range of hills. The country is undulating and contains a number of fertile valleys and the soil varies from a rich loam to the gravelly detritus of the hill slopes. Broadly speaking, the district is formed of the valley of the Brahmani which bisects it in a semi-circular manner with the hilly tracts to its south and north. For practical purposes, therefore, the district may be divided into three natural divisions, viz., the southern hilly region, the valleys of the Brahmani with its tributaries, and the northern hilly region.

The southern hilly region forms the watershed between the Brahmani and the Mahanadi, which is the southern border of the district in Athmallik and Angul subdivisions. Almost the whole of the Athmallik subdivision and the southern halves of the Angul and Hindol subdivisions are covered by this region. The region runs parallel to the Mahanadi and is wider to its west. Towards the east, it becomes narrower till it comes to an abrupt halt with the alluvial plains formed of the river Sapua (a tributary of the Mahanadi) and its tributaries. In the Athmallik subdivision, the watershed line, not far south of its northern boundary, is irregular. North of the line, the slope is generally towards the north in which direction the rain water is carried to river Tikra through numerous mountain streams. The rest of the subdivision is drained to the Mahanadi by the Ghosar Jor and the Sindol Jor, both flowing southward. The valleys of these two rivers are undulating and the patches of cultivable tracts that they afford are surrounded by forests. The two valleys are separated by a mountainous high land which is dotted to its north with several peaks none exceeding 2,000 feet (610 metres) in height and is flanked to its south by Hingmandal hill, the highest point of which is 2,973 feet (906 metres). West of Hingmandal hill is the valley of Ghosar Jor and further west lies a mountain belt of lesser height. To the immediate south-east of Hingmandal hill and in alignment with it is the Panchadhar hill. Between Hingmandal and Panchadhar is a narrow pass through which is laid the road to connect Athmallik, the subdivisional head-quarters, with Sambalpur-Cuttack road. This narrow pass appears to have been carved by the Sindol Jor, which winds through it in search of the low lands of the Mahanadi valley. The valley of the Mahanadi is a narrow strip having vegetation similar to that of the Brahmani valley and to its north are found the forest tracts and forest-clad mountains. The valley is wide in its middle and comes to an abrupt end where the Mahanadi, being obstructed by the Chanda Parbat and Sanakania mountain, changes its course from south-east to east. After this, from

the village Sitalpani, the river passes in between solid rocks up to the village Barmul in Puri district, and this narrow gorge is locally called 'Satkosia Ganda'. The whole of the subdivision of Athmallik, excepting the narrow valley of the Mahanadi, is broken up by hills and rocks. The hill slopes and valleys are covered with forest and there are only a few patches of cultivated land. To the east of Athmallik subdivision the mountainous tract is thickly clad with forest and is very sparsely populated. Here the rugged hills occupying a compact area, allow little space for level stretches. The majority of the hills are not of very great height but some of them rise to an altitude of over 2,500 feet (762 metres). Towards further east elevation of the hill ranges gradually lessens and their width becomes narrow. Here the hills form the natural barrier between Dhenkanal district and Narsinghpur subdivision of Cuttack district. In the extreme east of the district right along the Dhenkanal-Cuttack boundary is the Kapilas range, the highest point of which has an elevation of 2,087 feet (636 metres). The cap of laterite covering Kapilas hill is a plateau from which one gets a magnificent look of the Mahanadi and the city of Cuttack.

The valley of the Brahmani comprises major part of the Talcher subdivision, northern part of Angul, Hindol, and Dhenkanal subdivisions and the southern part of Kamakhyanagar subdivision. The valley is dotted with many isolated hillocks and compact hilly tracts and is more or less undulating. It is the rice-growing region of the district but cultivated stretches are often interrupted by forests or forest-clad mountains, important among which are Phuljhari and Kanaijora of of Talcher, Budhi Parbat and Basangbania of Hindol, Saptasajya and Dalar Parbat of Dhekanal, and Sundarkhol of Kamakhyanagar. The extensive Talcher coal-field lies within this valley. The general slope of the country is from west to east and from north to south, the country is undulating and contains a large number of villages amidst fertile land and the soil varies from rich loams to the gravelly detritus of the hill slopes.

The northern mountainous regions cover the east and north of Pal Lahara subdivision and the northern part of Kamakhyanagar subdivision. Here a magnificent hill called Malayagiri (3,895 ft. or 1,187 metres), which is one of the loftiest peaks in Orissa, towers above the hill ranges. The region, for the most part hilly is densely covered with forest abounding in Sal (*Shorea robusta*) trees. The Sal forests are said to be the finest in Orissa but are very inaccessible. The high hills to the north of the region form the central portion of the mass of tangled hill ranges which stretch towards Bonai and Keonjhar. The distinguishing feature of the area is the Malayagiri peak which may be climbed from south-west along a rough hill-path. The ascent is steep and

prolonged but presents little difficulty. The path winds up over bold spurs with magnificent view of the surrounding country. Two ranges are to be climbed before the final ascent is reached. The peak itself is a narrow plateau of no uniform width, about two-thirds of a km. at its widest. It is formed by a depression on the top of the hill. At either end of the plateau rise two bold peaks of bare rock, between which the one to the west is of greater height and is, therefore, taken to be the actual summit of Malayagiri. This summit is steep and precipitous and is inaccessible on its western and northern sides. From the summit, one can see the fine range of hills running westward in two parallel ridges with a valley in between, the level of which is about 1,500 feet (457 metres). To the north-east, the Malayagiri range falls away precipitously but on its south-eastern side for about two-thirds of a km., it has gradual slopes. On the south-western side near the summit is a spring where a small reservoir has been constructed.

(*ii*) Main Peaks

The loftiest peak of the district, as stated above, is Malayagiri in Pal Lahara subdivision which is 3,895 feet (1,187 metres) in height. Besides Malayagiri, there are a few high peaks in Pal Lahara near the border of Keonjhar having elevation of over 2,500 feet (762 metres).

In Kamakhyanagar subdivision, there are important peaks like Baruan (1,274 ft. or 387 metres), Bari Phuljhari (1,718 ft. or 524 metres), Sundarakhol Pahar (1,606 ft. or 489 metres), Udaigiri (1,435 ft. or 437 metres), Ranjagarh Parbat (1,779 ft. or 542 metres) and an unnamed peak near Bahadapal (1,894 ft. or 577 metres).

In Dhenkanal subdivision the most prominent peak is Kapilas (2,087 ft. or 636 metres) and the other notable ones are Gumaria (1,922 ft. or 586 metres), of the Saptasajya hills in the south and Dalar Parbat (1,443 ft. or 440 metres) in the north.

The boundary line of Hindol subdivision of Dhenkanal district and Athgarh subdivision of Cuttack district is dotted with several peaks rising above 2,000 feet (610 metres) in height. Mandaria (2,039 ft. or 621 metres) and Bankmundi (2,087 ft. or 636 metres) are situated to the west and east of the headquarters of Hindol subdivision and offer magnificent view.

Angul subdivision possesses a few peaks of above 2,000 feet (610 metres) in height. Most of them have no specific names, and of them Banmundali (2,591 ft. or 790 metres) is the highest.

In Athmallik subdivision the main peaks belong to Panchdhar and Hingmandal hills. Two unnamed peaks of Panchdhar rise above 3,000 ft. (915 metres) while two of the peaks of the Hingmandal are 2,939 ft. (896 metres) and 2,933 ft. (894 metres) in height.

7. Main Rivers and their Tributaries

The river Mahanadi, marks the southern border of this district in Athmallik, and Angul subdivisions, and the river Brahmani passes right through the district by dividing it almost into halves. Both these great rivers have innumerable tributaries, large and small. Most parts of the district lie within the basin of the Brahmani while the basin of the Mahanadi spreads over Athmallik subdivision and southern regions of Angul and Dhenkanal subdivisions. Excepting the Mahanadi and the Brahmani no other river flows through the district.

(*i*) The Mahanadi

The Mahanadi or the big (Maha) river (Nadi) takes its origin near about Sihawa in Madhya Pradesh. It is also known as Chitrotpala, whose sanctity is highly spoken of in many *puranas*. Taking a winding course and being fed by important tributaries like Seonath, Hadso, Jonk, Mand, Sone, Ib, Ong, and Tel, it grows both in volume and size. About 5 miles (8 km.) west of Baudh town, just from the point where it meets two tributaries, Salki and Karandi Jor, from its south and north, it flows along the boundary of Athmallik subdivision and Baudh-Khondmals district. The river changes its course from south-east to due south near Baudh town but after traversing a few kilometres it again takes a south-eastern course on a rocky bed. After that it proceeds east ward in winding course and a few kilometres west of Tikarpara into the Barmul gorge (known locally as Satakosia Gand). It is 14 miles (22·4 km.) long and here the river winds round the wooded hills, 1,500 ft. (457 metres) to 3,000 ft. (915 metres) in height, crags and peaks of rare beauty overhang its course on both sides, which at one point is so narrow that the water rises about 70 feet (21 metres) at the time of flood. South-east of Tikarpara the river forms the boundary of Dhenkanal and Puri districts for a short distance and then passes entirely through Puri district. Of the tributaries that drain this district, the notable ones are Karandi Jor, Ghosar Jor, Sindol Jor, Chanagorhi and Malia Jor all flowing from the northern side of the river. Total lengh of Mahanadi is 520 miles (832 km.) of which only 48 miles (77 km.) flows on the south-west border of this district.

(*ii*) Karandi Jor

This rivulet forms the boundary of the districts of Dhenkanal and Sambalpur for a distance of about 4 miles (6·4 km.) before it meets the Mahanadi. Its important tributary called San Karandi Jor also forms the boundary of these two districts for some length. It is through the San Karandi Jor that rain water of the western fringe of Athmallik is drained to the Mahanadi.

(*iii*) Ghosar Jor

Several small hill streams that receive water from the northern part of Athmallik subdivision combine together to form Ghosar Jor. It is known as the Mano Jor before it meets the Mahanadi.

(*iv*) Sindol Jor

Sindol Jor or Dandatapa river drains water from the plateau of eastern Athmallik through a narrow valley separating the Hingmandal hill from the Panchdhar hills. It meets the Mahanadi two miles west of the subdivisional headquarters of Athmallik.

(*v*) Chanagorhi and Malia Jor

These two are small mountain streams. Malia Jor runs close to Angul-Tikarpara road at its lower portion and meets Mahanadi near Tikarpara.

(*vi*) Sapua

The Sapua takes its rise about 4 miles (6 km.) south of the subdivisional headquarters of Hindol. It flows through Hindol subdivision and then through Athgarh subdivision and ultimately joins the Mahanadi near Katakia Sahi opposite Naraj. The town of Athgarh is situated on its bank. The Sapua's important tributary is the Kantia which is fed by the Bara Jor, just above its confluence. Both Kantia and Bara Jora take their origin in the Kapilas hills.

(*vii*) The Brahmani

Two rivers called Koel and Sankh both having their origin in Chotnagpur region of Bihar join together near Panposh in Sundargarh district and downstream go by the name Brahmani. The Brahmani has also the usual religious sanctity attached to it which has received recognition in some *puranas*. The meeting place of Sankh and Koel is even today regarded locally as a place of pilgrimage. The name Brahmani appears to be a modern one. It was Brahmi until recently but its old name was Sankhajoti. The Brahmani enters Dhenkanal district two miles (3 km.). west of Banor in Pal Lahara where it is joined by a tributary called Mankra (old name Mandakini). For two miles (3 km.) west of Banor, it serves as the boundary between Deogarh subdivision of Sambalpur and Talcher subdivision of Dhenkanal district. For the next one mile (1·6 km.) it marks the border of Pal Lahara and Talcher subdivisions after which it passes through the Talcher subdivision and meets the tributaries, called Samakoi, Tikra, and Singda Jor. The river has uncertain course which changes occasionally but generally it flows in southward direction. Two miles (3 km.) south of the village Samal, the river flows on the border of Talcher and Kamakhyanagar subdivisions up to the village Kamalang where it receives the Nandir Jor. Therefrom it changes its course and flows generally towards the east on the boundary of Dhenkanal (Sadar) and Kamakhyanagar subdivisions. On its way it is fed by a number of tributaries, including Nigra and Ramiala. After leaving the border of Kamakhyanagar subdivision, it forms for a next few kilometres the borders of Dhenkanal and Cuttack districts and then flows

in to the district of Cuttack. The length of the river within this district is about 100 miles (160 km.). It is navigable for a few month in the year as far as four miles (6·4 km.) below Talcher, where there are some dangerous rocks.

(viii) **Mankra**

It takes its origin in Keonjhar (Sadar) subdivision of Keonjhar district close to the highland wherefrom rises the river Baitarani. While the Baitarani flows north-ward Mankra flows towards the west. It is joined by its chief tributary Kukhra about four miles (6·4 km.) east of Pal Lahara, the subdivisional headquarters, which is situated on its left bank. For the last five to six miles (8 to 9 km.) of its course the stream forms the boundary between Dhenkanal and Sambalpur districts and meets the Brahmani near the village Banor. It drains almost the whole of Pal Lahara subdivision and while during rains it flows in spate, it becomes almost dry during summer.

(ix) **Samakoi**

Rising in the Kalapat reserved forest area of the district it receives a large number of hill streams before it flows into the southern part of Pal Lahara subdivision. It meets the Brahmani four miles (6·4 km.) south of Sirpur in Talcher subdivision.

(x) **Ramiala**

The Ramiala also has its origin from the same Kalapat forest tract and for a greater part of its course flows in the mountainous region receiving many feeder streams before flowing into the plains near Kamakhyanagar. At this point its course abruptly changes from south-west to due south and then to east till it meets the Brahmani.

(xi) **Tikra**

The Tikra, which has a total length of 125 miles (200 km.), rises in Rairakhol subdivision of Sambalpur district and after passing through a portion of Deogarh subdivision, enters Dhenkanal district in Angul subdivision. After only about 3 miles (5 km.) of its course in Angul, it enters Talcher subdivision and joins the Brahmani. Its principal tributary is the Aunli, 45 miles (72 km.) long, which rises in Athmallik, flows through Angul and joins it in Deogarh subdivision.

(xii) **Singda**

The Singda takes its rise among the Sarisua hills and flows through Angul into Talcher subdivision where it joins the Brahmani.

(xiii) **Nigra**

The Nigra, 110 miles (176 km.) long, takes its rise in the hills which form the boundary between Angul and Athmallik subdivisions, joins the Brahmani at Khargaprasad near Meramandali Railway Station in

Dhenkanal subdivision. The town of Angul is situated on its left bank. Among its several tributaries, the principal ones are the Bauli and Mutkuria which are respectively 30 (48 km.) and 28 miles (45 km.) in length.

8. Waterfalls

The mountainous regions of the district possess some waterfalls here and there. There are a few waterfalls in the Kapilas hill three miles (5 km.) to the west of the village Deogan. These falls have an average height of about 30 ft. (9 metres), but the stream, which takes its origin in the Kapilas hills, is not perennial. Even during the rainy season its volume of water is not considerable. There are also waterfalls below Panchdhar hills near the subdivisional headquarters of Athmallik which present scenic beauty. Four important falls have recently been discovered amidst dense forests of northern Pal Lahara near the village Nagira. These falls occur successively in a single stream and are named as Najadev Nund, Saranidarh, Tikadarh, and Garjankhol by the local people. The stream has a perennial flow and the volume of water that passes through the falls even during the summer months is considerable. From reports received, it can be said that they are the largest falls occurring in the district.

9. Tanks

There exist in the district, specially in Angul subdivision and along the banks of the Mahanadi and the Brahmani in Athmallik, Dhenkanal, and Kamakhyanagar subdivisions, a number of tanks some of which are of considerable size and depth. Most of them have been excavated on the very bed of small streams to serve as reservoirs for storage of water for agricultural and other purposes. The names of villlages near which more important of these tanks are situated are shown below subdivision-wise:—

Kamakhyanagar subdivision	..	Bhuban, Basudeipur, Goradia
Dhenkanal subdivision	..	Pengua, Digambarpur
Angul subdivision	..	Angul, Nuasahi, Kankinali, Gara Santri, Dhanurjaipur.
Athmallik subdivision	..	Madhupur
Talcher subdivision		Kalamchhuin

10. Springs

At Kapilas near the Chandrasekhar temple and at Saptasajya are two springs where water oozes out of the mountain surface at a high level. The spring near Chandrasekhar temple passes through different constructions and has attained religious sanctity. The temple, Inspection

Bungalow and the vicinity are served by the spring water. The spring ultimately flows down as a small stream beside which is built a flight of steps to reach the temple from below. There are three hot springs at the western side of the hill range forming the boundary between Keonjhar district and Pal Lahara subdivision near Bankhol and Magarmuhan. In addition to these, there is another hot mineral spring containing sulphur at Beuljhari about 3 miles (5 km.) of the headquarters station of Athmallik. The water of this spring is used for bathing purposes and so the surrounding area remains swampy. Springs of pure water also occur at many places. They are found at the foot of Kapilas hill in Dhenkanal subdivision, Khatakhura in Kamakhyanagar, Karanda in Hindol, Baghamunda in Angul, and Patamunda in Pal Lahara. The springs near Karanda are close to the road to Hindol from Hindol Road Railway Station. A fair is held here every year in the month of July.

11. Geology

(*i*) Physiography

Physiographically the district of Dhenkanal can be divided into four regions which are described below:—

The southern and south-western part comprises hill ranges persistently trending WNW-ESE and is covered by the subdivisions of Athmallik, Angul, and Hindol. The elevations vary from 60 to 971 metres above sea level. In this region of folded mountains most of the prominent hills and ridges are composed of very ancient metamorphic rocks — Khondalities and quartzite with charnockites and gneisses forming the flanks and valleys. In general the ridges represent synclinal structures while the valleys are anticlinal, indicating a very advanced stage of denudation.

The eastern part comprises predominantly alluvial terrain with stray hills and ridges. The elevations vary from about 42 to 636 metres above sea level. The valleys and plains in this region are formed of granitic gneisses which are the predominant rocks, while the hills are composed of the khondalites which are resistant to denudation. There is no well-defined strike trend, but E-W strike is more prevalent than of any other direction. The denudation here is even more advanced.

The central part of the district is an undulating terrain extending in the west into broad flat topped hills which reach an altitude of about 564 metres above sea level. This region is covered by Kamakhyanagar and Talcher, and northern parts of Angul and Athmallik subdivisions. The Brahmani valley portion of this region exposes mainly granites and gneisses with occassional hillocks of khondalites, while the remaining portion from west of Murhi and north of Angul up to the western end

of the district is covered by flat-lying sedimentary rocks of Gondwana system. The flat topped low hilly terrain in the northern part of Athmallik and N. W. Angul is characteristic of these flat lying sedimentary rocks. The straight line boundary of these sedimentary rocks against gneisses particularly on the north is due to steep faults.

The northern and north-eastern part of the district contains WNW-ESE trending hills immediately north of the Talcher coal field and NW-SE trending hills towards the boundary of Keonjhar district which locally change to east-west trends like the Malayagiri hill south of Pal Lahara. These hills and ridges are separated by broad valleys and low hilly areas. The heights above sea level in this region vary from about 76 metres at the Brahmani river to 1,204 metres on Malayagiri. The higher hills of this region are composed of quartzites (Iron-ore series and Kolhan series) while the lesser hills are made of quartz-mica-schists granites and other rocks. The broad valleys are mostly of gneisses.

(*ii*) Drainage

The major portion of the district is drained by the Brahmani river and its tributaries. From Ruhila, where it enters the district up to Tarava, north of Dhenkanal, the river flows in a general S. E. direction, broadly parallel to the general strike trend of the prevalent rock formations, but locally guided by major joints and faults. In the eastern part the river takes a turn to NE and then to east, in conformity with the change in the regional strike of the rock formations. The major tributary streams have a general right angle pattern, joining the main river normal to course, except in the eastern part where they are mostly parallel or at acute angles. The ESE flow of the Tikra Nala which joins the Brahmani at Bijigol is guided by a major fault at the northern boundary of the Gondwana formations. The Mahanadi along the south-west boundary of the district flows parallel to the strike of khondalites and is guided by a major shear zone. The major tributaries of this river in Athmallik and Angul flow SSW, normal to the flow of the main river.

(*iii*) Geological Antiquity

The oldest rock formations of the district are Khondalites, Charnockites and their variants. They are succeeded by a series of younger formations of iron-ore series. Both the formations were however, grouped in the pre-Cambrian age. These are in turn succeeded by the rocks of Gondwana system belonging to upper palaeozoic to mesozoic age. The laterite and alluvium were deposited during quarternary period.

13, 993 fr 2

From the available data, the stratigraphic sequences of the district is as follows :—

Quarternary.....		Laterite and alluvium.
Upper Palaeo- Gondwana zoic to mesozoic system	Mahadeva (?)	Sandstone and Conglomerate
	Barakars ..	Sandstone, shale, Coal, Fireclay.
	Karharbari	Sandstone, Conglomerate.
	Talchirs	Green needle shales, red sandstones and Talchir boulder beds.
.....	unconformity	.....
Precambrians	Kolhan series(?)	Sandstone, shale Grit and Conglomerate pegmatites, aplites, quartz veins, Granophyre, granite gneiss. Ultrabasic intrusives, Epidiorites.
	Iron-ore Series	Upper Traps and Tuffites. Banded hematite Jasper, Lower Traps and Tuffs. Hornblende-chlorite schist, quartzites and quartz mica schists.
	Dharwars	Charnockites— Hypersthene bearing gneisses and granulites of acid to basic composition. Khondalites— Quartzites, Khondalites, Calc silicate rock.

The khondalite and the associated rocks are the oldest rock formations of the district and are exposed to the south and south-west of Brahmani river. They are also seen to the S. E. of Kamakhyanagar (20° 58′ : 85° 33′). The common rock types are khondalites containing quartz, felspars, silimanite and garnets with graphite and boitite etc. as accessories. Quartzites are often silimanite and kyanite bearing. The khondalites and quartzites crop out in hills running WNW-ESE along the south western part of the district, through Athmallik, Angul, and Hindol. The Panchdhar hill range composed of these rocks in Athmallik attains a height of 3168′ above the mean sea level. Scattered outcrops of khondalite are found around Dhenkanal township and south east of Kamakhyanagar.

The Charnockite exposures are found in Athmallik, Angul, and Dhenkanal. The rocks are subjected to regional metamorphism.

The rocks of the iron ore series are exposed to the north and north-west of Brahmani river. Quartzites and micaschists are the most predominating rock types. They are subjected to the lesser degree of metamorphism. The quartzites, generally flanked by the epidiorites, from the Malayagiri hill range, Dipali Parbat and Shikheswar Parbat in Pal Lahara and continues towards Dhenkanal to the south east. Quartzites are also exposed in Baruan range, Bariphulbari hill. △1718, just north of Anantapur State forest. Ferruginous quartzites occasionally manganiferous are noticed near Nandijhari (21° 18′ : 85° 07′), Khondabeda (21° 16′ : 85° 03′) and Khemla (21° 20′ : 85° 03′). Hornblende schists are seen in the hills △870, △855, △702 and at north and north-east of Kunjam, east of Chhanchuria (21° 21′ : 85° 15′) and west of Kandha (21° 03′ : 85° 33′) where they occupy low lands. Ferruginous purple shales and phylities are found overlying the quartzites and quartz schists in the hill △703, east of △301, north of △1112 and south of △609.

Banded hematite quartzite along with quartzites and quartz schist are found in the Malyagiri range. Banded cherts with alternating white and dark bands are seen in the mounds north of △653. The rocks are traversed by veinquartz. Extensive trap exposures are seen to the north of Pal Lahara and extends for several miles into the adjoining Bonai-Keonjhar area.

Epidoirites and amphibolites occur as sills near Kataboi (21° 21′ : 85° 23′) and the area NE of Boitasari (21° 19′ : 85° 17′) and as irregular bodies at the SE of Khulari (21° 22′ : 85° 17′) and between Lambakani (21° 12′ : 85° 23′), Tangri, and △777.

North of Nandijhari and Bankhol are seen two small veins of pyroxenites. Pyroxenites also occur to the north east of △1444 hill, North of Kuturia (21° 12′ : 85° 20′) and near Baghamunda (21° 02′ : 85° 22′)

Dunites and peridotites with which chromite is associated are found near Maruabil (21° 03′ : 85° 43′) which extends further east into the Cuttack district. Ultrabasics associated with the chromites are also seen at Maulabhanja △611 and north of Asurabandh (20° 53′ : 85° 47′) etc. Occurrences of chromite has also been marked near Umundira, Kantol, Ekul, and Chotrirga. Out-crops of dunite are seen on hill △578, NNW of △777 hill and south west of Asanbahali (21° 09′ : 85° 18′).Olivines in these rocks are mostly serpentinised.

Major outcrops of granite are found at Maruabil and further WNW extending into Keonjhar district. Other exposures are marked at Bharatimundia △672 and to the NE of Bhuban. The granitic rocks of this area are represented by hornblende gneisses, biotite-gneisses, granite and veins of pegmatite aplite, and quartz, and are best developed in Pal Lahara and adjoining areas of Talcher and Dhenkanal. Veins of pegmatite and aplite are few, small and those near Gurusulai and Naogaon are important. Small veins and stringers invade almost all the older rocks in the area.

Sandstones, conglomerates and slates of possible Kolhan age are found overlying the tuffites of the iron ore series and granites and gneisses in the northern most portion of Pal Lahara, in the Mankarchua state forest and along the boundary with Keonjhar district.

Dolerites are found north of Hamparkola, they are found intrusive into Kolhans and into the granite rocks towards the south. South of the Brahmani they are found as intrusive into the khondalites.

The Gondwana formations extend from Kamakhyanagar in the east through Talcher, Angul, Athmallik areas and further west into Rairakhol area of Sambalpur district.

The lowest member of this formation is the Talchir series which is about 150 metres thick. They consist of Tahchir boulder bed of glacial origin *, sandstone and greenish shales. They are mostly exposed at the southern part of the basin. Some outcrops are also marked at the northern margin also. A thick horizon (of about 450m) of sandstone and shales of Damuda age is found overlying the Talchirs and is coal bearing. These coal bearing rocks are chiefly confined to the area

* The Talcher boulder bed marks a very significant stratigraphic horizon in the stratography of India. This boulder bed known as the "Talcher boulder bed" contains boulders of all specifications which have straition marks on them, the phenomena being attributed to scratching under tremendous pressure of the glaciers. The Talcher rocks also contain altered Felspars which is another indication of severe cold conditions arising out of the glaciation phenomena. The age of this glaciation vizs-a-vis Talchir boulder bed is approximately 90 million years which in geological terminology is known as the "Carboniferous Age". (Also, vide Appendix I.).

west of the Brahmani river but a small portion is exposed on the eastern and north-eastern side of the river opposite to Talcher township. The Damudas are overlain by a series of gritty and pebbly sandstones of 450 metres thickness (Mahadeva sr.) which are devoid of coal. Out crops of these rocks are found within a few kilometres north-west of Talcher, 12 to 16 Km. NW of Angul town, in the Madalianala south of Patrapara (21° 05′ : 84° 46′), etc.

12. Economic Minerals and Rocks

(*i*) Beryl

Beryl is found associated with the pegmatites at Nanguliabera (20° 48′ : 83° 11′).

(*ii*) Building Materials

Dhenkanal district is well provided with building and construction materials of various kinds. The charnockites, granites and khondalites, etc., can very well be used as building stones as well as for decoration of the buildings. They are also suitable for road metals. Laterites occur, at various localities of the district such as near Kantol (21° 07′ : 85° 33′), etc. They are massive and can be used as building stones. The Gondwana sandstones are also available in plenty and are mostly used in this district for building purpose. The ferruginous shales and sandstones are used generally for colouring the walls, etc. Kankars are found at Raghunathpur (20° 46′ : 85° 15′), Muktapasi (20° 56′ : 85° 25′), Chararagaria (20° 48′ : 85° 17′), Gundichanali (20° 50′ : 85° 31′), Dimirai (20° 50′ : 85° 39′) Meramandali (21° 48′ : 85° 18′), Gopalpur NE of Dhenkanal, Dhundrapal (20° 52′ : 84° 40′), Arkhadud (20° 48′ : 85° 40′) and Jhenjmunda (20° 46′ : 84° 26′) which are widely used for lime burning in the district.

(*iii*) Chromite

The important chromite deposits of the district are found at S. & S.W. of Maruabil (21° 03′ : 85° 43′), north of Muktapasi and Maulabhanja Parbat, etc. Minor occurrences have also been marked at Ghotringa (21° 03′ : 85° 35′), Umundira (21° 05′ : 85° 42′), around Ekul (21° 09′ : 95° 41′), west of Kantol and north of Asurabandh. These are the western extension of the Sukinda Chromite belt.

The chromite is associated with ultrabasic rocks which are, at many places, covered by laterites. In Maruabil area the lodes vary from 1 m to 80 m in length and 2 to 11 metres in width. Chromite occurs as massive banded and pitted ores in 36 Nos. of exposures. On the preliminary examination the probable reserve is estimated 122,000 tonnes up to a depth of 15 metres. The deposits to the south-west of Maruabil is bronze to brass colour, massive to granular in nature. The probable reserve estimated to a depth of 14 m is 36,360 tonnes. The chromite ores available in this district are mostly lumpy and of metallurgical grade.

(iv) Clay

The china-clay occurrences have been marked at north of Karanda (20° 42′ : 85° 20′), north of Sibulposi (20° 56′ : 85° 30′), Machhakata (21°04′ : 84°50′), Purunagarh (21°02′ : 84° 50′), Rayhara (20°57′ : 84°59′), Banarpal (20° 50′ : 85° 13′), Sibpur (20° 48′ : 85° 16′), east of Nua Ruro 20° 49′ : 85° 21′), east of Parang (20° 50′ : 85° 16′), Hingirdaghatipass, south-west of Babandh, and east of Dudurkot (20° 41′ : 85° 15′). They can be used for potteries industry.

(v) Fire clay

Fireclay is mostly confined to the Gondwana formation. The occurrences are seen at Kaniha (21° 05′ : 85° 01′), Chhendipada (21° 05′ : 84° 52′), Raghunathpur (21° 01′ : 85° 16′), Brahmanbil (21° 03′ : 84° 56′), Gopalprasad (20° 59′ : 85° 01′), and Malibandh. They can be used for fire bricks, moulds and casts, etc.

(vi) Coal

The coal bearing Damuda formations of the Talcher coal field extend over 518 Sq. kilometres including the area in Sambalpur district. Outcrops of coal are found only at a few places.

The history of coal in Talcher dates back to 1837 when Lt. Kittoe examined coal outcrops near Gopalprasad. Mapping of this coal field was first done by W. T. Blandford, H. F. Blandford and W. Theobald (Jr.) of the Geological Survey of India, during 1855-56. In 1918 L. L. Fermor examined some localities. In the early twenties the East India Prospecting syndicate carried out prospecting for coal over 29 Sq. kilometres west of Talcher town. Some areas were leased out to M/s. Bengal-Nagpur Railway Co., M/s. Southern Marhatta Railway Co. and M/s. Talcher Coal field Ltd., Madras. Production started in 1924 in the Handidhua Colliery, in 1930 in the Dera Colliery, and in 1932 in the Deulbera Colliery. The last two collieries are now operated by the National Coal Development Corporation. Three important coal seams are met within the area so far explored. The bottom seam (seam No. 1) which is termed the main seam is 3·7 to 4 metres thick. The middle seam (seam No. 2) is shaly and is not worked. The top seam (seam No. 3) is 2·4 to 3 metres thick. At places the seams have coalesced to form a composite seam. In general coal in this coalfield has low ash, high moisture and is non-coking but has proved to be quite suitable as locomotive fuel.

The Villiers Ltd. estimated a total reserve of 312 million tonnes in the 28 Sq. Km. near Talcher. Reserves of only the main and top seams in this area were estimated by Geological Survey of India at 246 million tonnes.

The coal field has been remapped in detail in recent years by the Geological Survey of India. Drilling by the Indian Bureau of Mines in the last few years in the Balanda block revealed 488 million tonnes of proved and indicated reverses. Enormous reserve of high ash upper coal seams exist to the north and west of the existing mines. They can be utilised for thermal plants. Directorate of Mines have proved a reserve of 5·65 million tonnes of Class II coal in Natada area to the west Nandira. An indicated reserve of 334·54 million tonnes of high ash coal has been calculated in Natada and Gopalprasad area*.

(*vii*) Garnet

Occurrences of garnet are seen near Chintamanipur (21°07′ : 85° 05) west and south-west of Poipal (21° 09′ : 85° 08′) and just on the bank of Bagchua nala on Burubahal Huri at the foot hill of Malayagiri in between Boitasarai and Sapthara village and near Dangapal.

(*viii*) Glass Sand

Sandstone occurring in the hillock west of Keotpada and in the western parts of Sorodiapahar south of Nindipur, are fairly pure and possess a uniform grain size. They can be used in the manufacture of glass. Some of the Gondwana sandstones may be suitable as a source of glass sand.

(*ix*) Gold

Small amounts of alluvial gold are recovered from the sands of the Aunli and the Tirka rivers, after the rainy season. The sands of the Ramiala and the Betali nala also on washing yield very small amounts of gold. It is expected that the gold is derived from the conglomerate beds of the Gondwana formations.

Recovery of gold by washing of gravels from the streams is carried out at Katni (20°58′ : 85° 36′), Dolia (21°07′ ; 85° 29′), Kandhara (21° 03′: 85° 33′) and at Gundichanali.

(*x*) Graphite

Local concentrations of graphite are noticed in khondalite formations at their contact with pegmatites on the southern flanks of the Barakanya Parbat (20° 39′ : 85° 45′) and on the mound south of Mangarajpur.

Traces of graphite are seen at many places in the kondalite hills of Panchdhar Range.

---

* Coal from the main seam has usually 6—11 per cent moisture, 34 to 35·5% volatile matter, 8 to 12% ash and 46 to 47·5% fixed carbon with calorific value 10,900 to 11,200 B. T. U./lb. The top seam coal has 6—11.5 % moisture, 29—32 % volatile matter, 13 to 21 % ash and 40 to 45·5 % fixed carbon with calorific value, 9·500 to 10·300 B. T. U./lb.

(*xi*) Iron-ore

Ferruginous grits and shales of the Mahadeva formations are locally smelted for iron at Ichhapur (20°52′ : 84°45′), Mandan (20° 58′ : 84° 37′), Purunapani (20° 59′ : 84° 35′) and Dalpaka (20° 59′ : 84° 30′). Though locally these are used in making indegenous agricultural implements, these are of no importance in modern iron and steel making practice.

About two and half kilometres WNW of Sankamur (21°15′ : 85° 09′) lenticular deposits of magnetite (Fe-56·4%) occur in granite gneiss. The reserve is estimated at 48,000 tonnes.

On the quartzite hill east of Nandijhari (21° 18′ : 85° 07′) there are concentrations of limonite and botroydal hematite with minor amounts of manganese ore. The reserve is estimated at about 400,000 tonnes.

Massive hematite with limonite (Fe-55·94%) are found in banded-hematite quartzite which form a low ridge east of San Baghadari (21° 24′ : 85° 01′). There is a minimum reserve of one million tonne of ore here.

(*xii*) Kyanite and Sillimanite

Crystals of kyanite exposed on the surface have been recorded east of Torodanali and Jhili in quartz-kyanite-mica-schist. Pieces of kyanite about 11 Cms. across are found at the foot of Baruan range. Kyanite occurs about one and half kilometres to the east of Torodanali in the form of coarse bladed kyanite in the quartz-mica-schists. Boulders of kyanite rich rock are also seen. The kyanite zone is mainly restricted to the flanks of the hill. Occurrence of kyanite is found in Magarmuhan area (21° 14′ : 85° 17′).

Aggregates of sillimanite, 10 to 12 Cms. long and 5 to 8 Cms. across, are found near the contact of granite and khondalite, south of hill 634 (20° 32′-30″ : 85° 33′-33″).

(*xiii*) Limestone

A narrow outcrop of limestone is reported from the Gondwana sediments east of Sapuanala (21 °06′ : 84° 49′). Talcher coal field shales weather into calcareous concretions which are locally burnt for lime.

(*xiv*) Manganese Ore

Minor occurrences of manganese ore in the form of boulders, pebbles or concretions have been reported near Santipur (20°54′ : 84°22′) in the Talaipathar reserved forest, in a nala between the hill south of Podapadar (20° 51′ : 84° 34′) and the nala south-east of △ 1551 hillock near Hatasimili (20° 47′ : 84° 40′). Small pockets and lenses of manganese ore in highly sheared khondalite rocks are noticed near Dandatopa (20° 48′ : 84° 36′).

(xv) Mica

A deposite of muscovite mica has been worked at Soratnali (20°-49′ : 85°-26′) in the ex-State of Dhenkanal. Minor mica-bearing pegmatites are at Majur (20°-38′ : 85°-34′), Chandpur (20°-49′ : 85°-25′), Bharnia (20°-51′ : 85°-25′), Kusuki (20°-51′ : 85°-22′), Pathargarh (21°-04′ : 85°-27′), Torodanali, Mangalpur (20°-51′ : 85°-17′-30″), Kharagprasad (20°:49′ : 85°-19′), North of Kikuta (20°-41′ : 85°-19′), west of Krishnachakra (20°-42′ : 85°-15′), east of Sarasingh (20°-39′ : 85°-16′) in Hindol subdivision, east of Kantiaposi (21°-13′ : 85°-11′) and in a well excavation at Dangapal in Pal Lahara subdivision and Dangarpal. Suajhari, Sapkata, Bulihar and Durgapur in Talcher sub-division. In Angul, mica bearing pegmatites have been recorded at Burhapankha (20°-52′ : 84°-14′), Girang (20°-51′ : 85°-10′), Nangulibera (20°-48′ : 85°-11′) and Basala (25°-44′ : 85° 06′). The mica books measure about 15 Cms. in diameter but are much spotted.

(xvi) Mineral Pigments

Red clay is associated with Gondwana sandstones and shales in the Balikudia jungle about 3 kilometres north-west of Pasalhani (21°-0′ : 84°-52′). The deposit is fairly large and occurs as a bed within 1·2 or 1·6 metres of the surface. The material is slightly gritty but has a good covering power. In colour it compares favourably with that of standard good quality India red ochre. It is locally used for dying cloth.

Some of the red clays found associated with the Mahadeva grits and sandstones on the hills south of the village Simlipal (21°-04′ : 84°-47′) are of good colour and covering power. Pebbles of hematite weathered out from the Mahadeva grits and found lying in the surface detritus on the slopes of hills south of Simlipal and lenses of soft hematite which are likely to yield material suitable for colouring purposes.

(xvii) Mineral Springs

Three hot springs are reported from the west of hill range forming the boundary between the Keonjhar district and Pal Lahara near Bankhol (21°-14′ : 85° 22′) and Magarmuhan (21°-13′ : 85°-22′). Hot springs are also seen near Athmallik and about 8 km. west of Kaniha.

(xviii) Quartz-crystals

Transparent crystals of quartz are reported to have been collected from the area south of the Baruan Range and from the bed of the Brahmani river. The occurrences are sporadic in nature.

(xix) Quartzites

Quartzites suitable for refractories are found at the following places : Tangiri Parbat, △649, south of Lohamunda (21°-14′ : 84°-59′) mound south of Bajrakot (21°-13′ : 85°-03′), east of Bondabeda (21°-10′ : 85°-04′ Mankadchua pahar (△650), north-west of Talapada (21°-08′ : 85°-09′) hill △832 and Phuljhari hill △971.

13. Earthquakes

Ordinarily there is no occurrence of any earthquake or earth tremor of any magnitude in this district. But the unprecedented earthquake of Bihar of the year 1934 was felt throughout the district though there was no reported damage.

14. Flora

The district may roughly be divided into two botanical divisions, the one comprising the narrow valleys and the alluvial plains and the other consisting of undulating tracts broken by hills and mountain ranges. The former is best utilized for paddy and other agricultural crops.

The vegetation in the district is mostly of dry deciduous type. At places. tropical moist deciduous and semi-evergreen mixed types are also noticed, the latter being mostly in Dhenkanal subdivision and along some perennial stream in Angul and Athmallik subdivisions.

The principal species, found throughout the district is Sal (*Shorea robusta*).. The more important associates of Sal (*Shorea robusta*) are Asan (*Termi alia tomentosa*), Aonla (*Phyllanthus amblica*),Bahara (*Terminalia belerica*), Gambhari (*Gmelina arborea*), Giringa (*Guazama tomentosa*), Harida, (*Terminalia Chebula*), Jamu (*Eugenia Jambolana*), Kendu *Diospyros embropteris)*, Kumbhi (*Careya arborea*), Kurum (*Adina cordifolia*), Kusum (*Carthamus tictorius*), Piasal (*Pterocarpus marsupium*). Sisoo (*Dalbergia sisoo*), Sunari (*Cassio fistula*), Kangra (*Xylia dolabiformis*), and Rai. In localities with moister climate Kangra is found in, abundance with Sal and sometimes forming pure patches. Bamboo is another important associate of Sal. Teak, not found naturally in the locality has been successfully introduced in the forests of Angul subdivision.

The aesthetic value of some species is also noteworthy. Among the ornamental plants and trees found in the district are Palasa or flame of forest (*Butia frondosa*), Ashoka (*Saraca indica*), Champa (*Michela champaca*), Krushnachuda (*Delonix regia*), Simul (*Bombax mala baricum*), Bharima (*Kydia calycina*), Kanchana (*Bahaunia variegata*), *Peltopherum pienocarpum* and *Cassia fistula.*

(*i*) Forests

Out of the total extent of 4,226 Sq, miles (10,945 Sq. km.) of the district, a major part comprising 2,454 square miles (6,356 Sq. km.) is covered with forests. Of the forest area, 1,244 Sq miles (3,222 Sq. km) constitute Reserved Forests and the rest 1,210 Sq. miles (3,134 Sq. km.) protected forests. Total forest areas thus constitute more than 53 per cent of the total area of the district. The forest areas are scattered throughout the district but they occur generally in Pal Lahara and Athmallik subdivisions.

The principal species is Sal with other associates mostly bamboos. Other important timber species are also found depending upon the climatic condition and other local factors. An important feature of the forests of Angul subdivision is the introduction of teak (*Tectona grandis*) which is an exotic species not found naturally in the locality. Large areas have been planted successively with teak and the results are very promising. Some of the older plantations have produced timbers of over 6′ in girth or even more. In "1926—Plantation" of Raigada Range, Angul the maximum girth recorded is 7′-6″ and in '1889—Plantation' of Purunakot Range it is 8′-8″. Besides, some exotics like eucalyptus, mahogany (*Swietenia mahogani*), bamboo (*B. tulda, B. nutans, C. phr*), sandal wood tree (*Santalum album*), Pepper (*Piper nigrum*), Cashew (*Anacardium occidentalis*) and *Prosofris juliflors* are being introduced on an experimental basis.

Forests in general however can be divided into two classes, viz., village forests and reserved forests. The village forests are called the Khesra forests or open forests where from the tenants are allowed to collect fuel and to graze their cattle without levy of any fee or royalty. Forests other than these are reserved forests (including protected forests). To get fuel or timbers from the reserved forests, the tenants are liable to pay the prescribed fee or royalty.

Rights and concessions enjoyed by the people of the district in different classes of forests are as follows:

(*i*) To take dry fallen firewood from reserved forests and Khesra forests free of royalty.

(*ii*) To remove unreserved species free of royalty from Khesra forests.

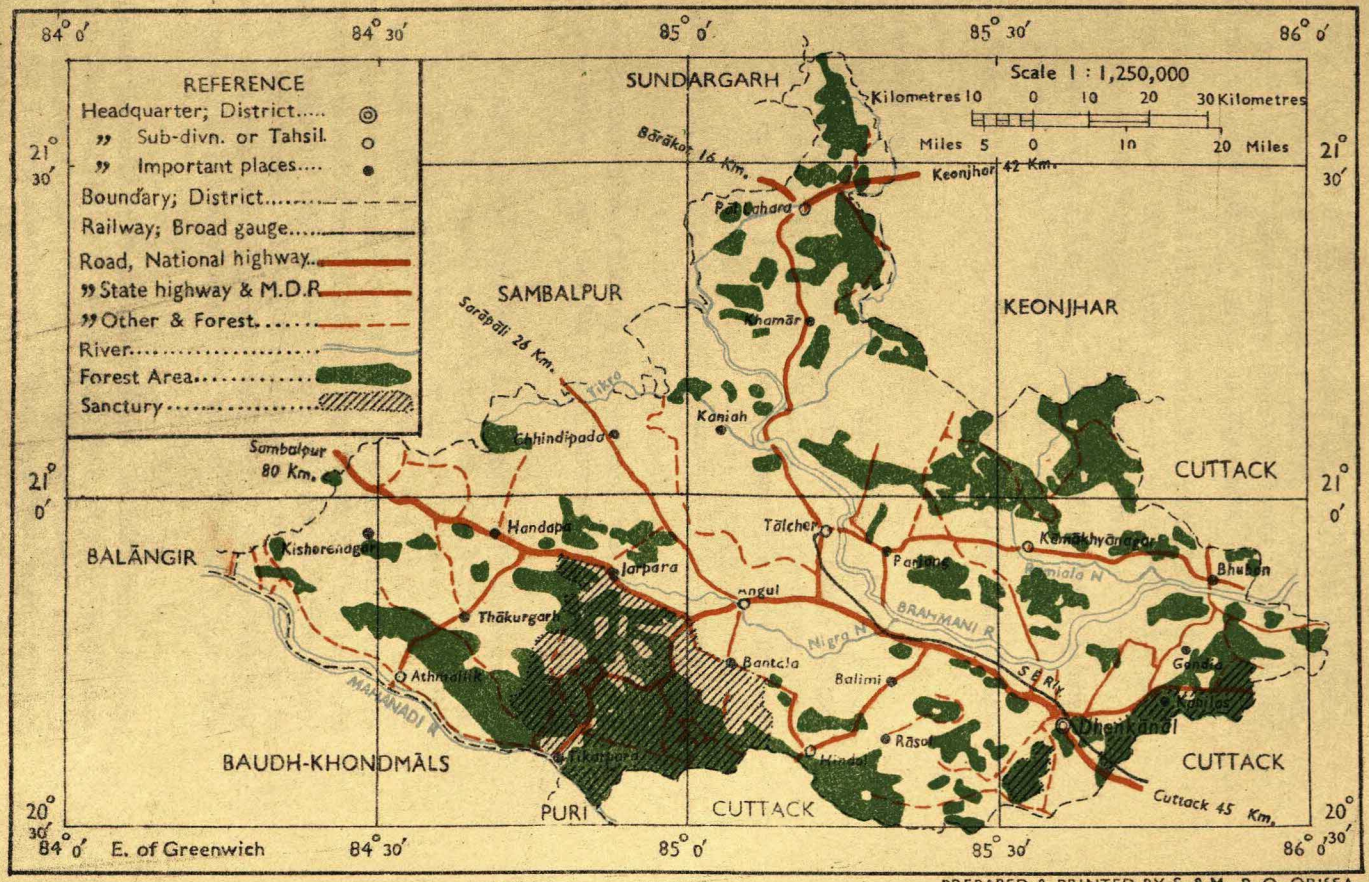
(*iii*) To take timber of reserved species from Khesra forests or from the current year's *coupice* of protected forests at half the royalty.

(*iv*) To enjoy small quantities of minor forest produce i. e., *mahua* (*Madhuca indica*) flower, honey, wax, *harida, bahara* and *aonla,* etc., from all classess of forests free of royalty.

(*v*) Firewood, brush wood and bamboo for fencing and timber for making agricultural impletments can be obtained from the Khesra forests on payment of *nister* or forest cess.

Besides all these, considerable quantities of timbers and bamboos are supplied free to the fire-affected persons to reconstruct their houses.

FOREST & FOREST ROAD MAP OF DHENKĀNĀL DISTRICT



PREPARED & PRINTED BY S. & M. P. O., ORISSA

(ii) Conservation of wild life

The Wild Birds and Animals Protection Act, 1912, is in force in the district. Close season for shooting in reserved forests is, however, regulated by the Orissa Government Reserved Forest Shooting Rules, the relevant portion of which is given as Appendix II.

For conservation of wild life the whole of Raigada Block of Reserved Forest, with an area of 10,551 acres has been constituted as a game sanctuary, where the following game is generally found:—

(*a*) *Animals*—Tiger, Leopard, Wolf, Cheetal, Bear, Sambar, Barking deer, Spotted deer, Wild Boar.

(*b*) *Birds*—Jungle fowls, Pea-cock, Kochilakhai, Green Pigeon.

15. Fauna

(i) Wild Animals (Mammals)

The extensive and dense forests of the district harbour a great number of wild animals. There are wild elephants and bisons in deeper recesses; leopards, deers, wild pigs and wild dogs in the lighter jungle and bears on all the hills. The yearly loss of human life and cattle and damage to crops from the depredations of wild animals are naturally considerable. With the spread of communications, wild animals are depleting.

The carnivorous animals include tiger, leopard, bear, hyaena, wolf and wild dog besides other smaller species, such as fox, jackal, weasel and otter.

Tigers (*Panthera t gris*) were fairly numerous in hilly tracts covered with dense forests, their spoor being seen along the beds of streams. Generally they do not frequent beyond certain localities except during the rutting season. But in rare cases they have been found straying in open country miles away from any jungle. In some localities one was almost certain to meet them along certain paths which they regularly patrolled. During the last 15 years tiger population has been almost completely exterminated. Tigers were poisoned to sell the skin to foreigners who paid un-imaginably high prices. Among Sikaris of Talcher there were a few who knew the art of doping a tiger with opium.

A census taken in 1968 showed 31 tigers in Dhenkanal district. At present, there will probably be not more than 10, i. e., 3 in Raigada forest block in Angul subdivision, 3 in Kamakhyanagar subdivision and 4 in Pal Lahara subdivision. There has been rapid depletion mainly by poisoning. Now that the killing of tigers has been stopped by law some improvement is expected.

Leopards and Panthers (*Panthera pardus*) are mostly found in the hills adjoining the cultivated area where they levy toll from the flocks of goats and sheep. They are rarely found in the largest and more extensive forests.

The Kalarapatria (Leopard) is fairly numerous and it is chiefly due to this species and *Falis chaus* (Common Jungle Cat) that the scarcity of ground game is attributed.

The large civet cats (*Viverra zibetha*) are found but not in large number. The palm civet (*Paradoxurus hermaphroditus*) which is very destructive to poultry is fairly common in areas close to villages.

The jackal (*Conis aureus*) chiefly inhabits the scrub-jungle near villages. The jackal and the common fox (*Vulpes bengalensis*) usually prowl about the villages, of which they may be said to be scavengers. They also take off a number of poultry during the rains when the jungle is high.

A species of red coloured flying squirrel (*Pataurista petaurista philippensis*) is found in dense forest areas. The common Indian ground squirrel (*Iciurrus palmarum*) is plentiful everywhere. The common Indian porcupine (*Hystrise lencura*) inhabits the rocky hills but being entirely nocturnal in its habits is seldom seen. Its food consists chiefly of roots.

The *Lepus ruficandatus* is the only hare found but is not common.

The pangolin (*Mahis crassicandata*) is found living in deep burrows. The quiet beast feeds chiefly on insects, its favourite diet being the white ant. Pangolins grow from 2 to 2½ feet (60 to 75 centimetres) in length and are covered with scales of a light olive colour.

Hyaenas (*Hyaena striata*) are very common in the vicinity of villages where they live principally on carrion. The village dogs are frequently carried off by them, and to this reason is ascribed the comparatively small number of pariahs or mongrels in most villages.

Wild dogs (*Cuon alpinus*), extremely destructive to game, are fairly numerous. They chiefly belong to the larger species. In height more than a jackal, their ears are erect and the tail very bushy with a dark tip. In the cold season they have a bright chestnut brown coat. They systematically hunt game in small packs. When hunting their prey, they are quite fearless and it is known that even Sambars and bisons find it difficult to escape their charge.

Wolves are few, they are of the grey species and usually haunt certain localities. They are very destructive to goats and sheep but molestation of human beings is not known.

The common Indian sloth bear (*Melursus ursinus*) is found everywhere and is the only representative of the family. The rocky, scrub-clad hills are their habitat from which they usually descend to the villages and waste land during the night in search of food. Although their favourite food are the Mahua flowers (*Bassia latifolia*), berries and white ants, they do a great deal of mischief to sugarcane and maize and now and again one develops carnivorous tendencies. They seldom attack people except when taken by surprise, yet as they are numerous, a number of people are killed or injured by them. A she-bear with cubs is decidedly dangerous when taken by surprise.

The ratel or honey-badger (*Mallivora capensis*) is closely allied in appearance to the above but is small in size. It measures about 3 feet (one metre), the upper part of the body being of an ashy-grey and the rest of it coal-black. Being nocturnal in its habit it is rarely seen. It lives chiefly in rocky caves in the hills and its diet consists of lizards, insects and honey.

The Sambar (*Rusa unicoler nigra*) has his abode in dense forests and generally frequents the high and inaccessible hills. It is the largest of the Indian deer. They are nocturnal in habit grazing chiefly at night and returning to the hill tops during the day, where they rest in some shady spot. It is most difficult to get at them owing to the density of the forests. They are extremely destructive to crop which necessitates special precautions against their inroads.

Thr spotted deers (*Axis axis*) or Chittal are commonly seen in small herds in low-lying lands near water, where the forest is open and undergrowth scanty. They are gregarious in their habits and care little for the neighbourhood of man. Like Sambar, they do great damage to the winter crops and also to the young paddy.

The Indian mouse deer (*Moschiola memina*), the smallest of its tribe, exists but owing to its diminutive size is seldom seen. It stands 10 to 12 inches (25 to 30 centimetres) at the withers and in colour is brown with white or buff spots and longitudinal stripes. The muntjac or barking deer (*Muntiacus muntjak*) is easily recognised by its dog-like bark although it is seldom seen.

The Nilgai (*Boselaphus tragocamelus*) is found in all the less heavily-wooded forests, where it feeds largely on wild berries.

The four-horned antelope (*Tetracerus quadricornis*) is fairly common. The female and young male so resemble the barking deer that they are frequently mistaken for the latter.

Wild boar (*Sus serofa cristatus*) swarm in the forest tract and wander about in large herds, doing great damage both to the young growth in the forest, as well as to the crops in the fields, which they do not infrequently invade at night and from which it is well-nigh impossible to drive them out. A number of them fall victim to tigers which find them quite palatable.

Bison (*Bos gaurus gaurus*) usually called Gayal occur in the denser and remoter forests. They generally graze in close proximity to elephants, often moving amongst a herd.

Elephants are found in the district, particularly in the sourthern part of Angul and the dense jungle of Athmallik. They wander about in herds ranging from 10 to 60 animals, doing incalculable damage to the forest by uprooting young saplings and stripping of the bark of valuable trees. They are a scourge to villagers living within or on the skirts of the jungle. Previously Kheddah operations used to be conducted at regular intervals by the British Government in Angul and by some of the Rajas in their respective territories. Now-a-days Kheddahs are no more conducted.*

Two species of monkeys are met with, the black faced Hanuman (*Presbytes entellus*) and in certain localities close to villages, the ordinary small-brow Bandar of the brown species (*Macaca mulatta*). The former, which is the commoner, avoids settlements in villages and keeps more to the hills and jungles. It is hunted by a wandering tribe called Sabakhia, which considers its flesh a great delicacy.

(*ii*) Birds

Like wild animals, bird life is also plentiful in this district. The pea fowl, jungle fowl and common spur fowl are fairly common.

The patridge are rare. The grey hornbill is often found in the forest tracts.

The common blue-winged teal, whistling and cotton teal are found in numbers round the year in tanks scattered throughout the district. The comb-duck is found along the Mahanadi river.

---

* In 1953, the ruler of Talcher killed a rogue elephant in the Dhenkanal forest which was eleven feet (3·53 mtr.) in height, each of its tusks weighing 92 lbs. (41·73 kg.) and measuring 8 feet 5 inches (2·59 meters) in length out side the curve. (Stracey, 1956).

A list of birds commonly found in the district is given below:

English name	Scientific name	Local name
(1)	(2)	(3)
(*i*) Greylag goose ..	*Anser anser* ..	Kaja
(*ii*) Comb duck ..	*Sarkidiornis melanotos* ..	Nakata
(*iii*) Pea fowl ..	*Pavo cristatus* ..	Mayura
(*iv*) Hornbill ..	*Tockus birostris* ..	Kochilakhai
(*v*) Green pigeon ..	*Treron phoenicoptera* ..	Harada Chadhei
(*vi*) Blue rock pigeon	*Columba livia* ..	Golapara
(*vii*) (*a*) Black patridge	*Francolinus francolinus* ..	Kala titiri
(*b*) Grey patridge	*Francolinus pondicerianus*	Titiri
(*viii*) Red jungle fowl ..	*Gallus gallus* ..	Banakukada
(*ix*) Grey heron ..	*Ardea cinerea* ..	Kantia baga, Matia baga
(*x*) Parakeet ..	*Psittacula eupatria* ..	Sua, Tia
(*xi*) Maina ..	*Acridotheres tristis* ..	Bani, Raja bani

(*iii*) Crocodiles

Large-sized crocodiles are not seen in the district but the little Thantia and the long-nosed fish-eating Gharial are found in large rivers.

Monitor-lizard called Godhi is also commonly found in the district.

(iv) Reptiles

The following sankes are commonly found in the district :—

(*a*) *Poisonous*—Cobra (*Bara tripudians*), Rusell's Viper (*Viprera Russelli.*), Krait (*Bungarus caeruleus*).

(*b*) *Non-poisonous* Python, *dhomana, dhanda, Kandanali,*

(v) Fish

In the rivers Rohi (*Labeo rohita*), Bhakura (*Catla catla*), Chitala (*Notopterus chitala*), and a host of smaller varieties of fish are found. Rohi, Bhakura, and Magura (*Clarias batrachas*) are generally reared in the tanks under pisciculture. In other tanks innumerable varieties of fish of smaller dimensions are to be found.

16. Climate

The climate of this district is more like that of the Deccan plateau than of the east coast region. Being in the north-eastern corner of the Deccan plateau the climate is milder than in the main Deccan region. The year may be divided in to four seasons. The hot season is from March to May. The period from June to September is the south-west monsoon season. October and November constitute the post-monsoon season and the cold season is from December to February.

(i) Rainfall

Records of rainfall are available for 13 stations for periods ranging from 14 to 70 years. The detail of the rainfall at these stations and for the district as a whole are given in Appendices III and IV. The average annual rainfall in the district is 1,421·1 mm. (55·95″). Pal Lahara near the northern border of the district has an annual rainfall of 1,782mm (70·17″). The central parts of the district comprising the Talcher-Angul-Chhendipada region get much less rainfall than the surrounding regions. The variation in the annual rainfall from year to year is not large. In the fifty-year period-1901 to 1950 the highest annual rainfall occured in 1933 when it amounted to 131 per cent of the normal. There were only 4 years in this period when the rainfall was less than 80 per cent of the normal. It will be seen from Appendix IV that the rainfall in the district was between 1200 mm. and 1700 mm. (47·24″ and 66·93″) in 40 years out of fifty.

On an average there are 73 rainy days (i. e., days with rainfall of 2·5 mm. 10 units or more) in a year. This number varies from 66 at Athmallik to 84 at Pal Lahara.

The heaviest rainfall in 24 hours recorded in the district was 306·8mm. 12·08″) at Pal Lahara on 4th October, 1936.

(ii) Temperature

The only meteorological observatory in the district is at Angul, which provides 55 years' data. The data of this observatory may be taken as representative of the meteorological conditions over the whole district. The hot season commences by about the beginning of March when temperature begins to rise rapidly. May is the hottest month with mean daily maximum temperature at 40°C (104°F). With the onset of the monsoon early in June, day temperature drops appreciably and throughout the South-West monsoon season the days are generally cool, but nights continue to be warm. After the withdrawal of the monsoon by the first week of October, both day and night temperatures begin to drop steadily. December is usually the coldest month of the year with a mean daily minimum temperature of 12·90°C (55 °F.). In association with the passage of western disturbances across North India during the winter months short spells of cold occur and the minimum temperature sometimes drops down to about 7°C (44°F.).

The highest maximum temperature recorded at Angul was 46.1°C (115° F) on the 24th May, 1947 and on the 6th June, 1958, and the lowest minimum temperature was 6·7° C (44° F) on the 3rd January, 1923.

Angul, Talcher and neighbourhood are de-forested, are the hottest parts of the district and have lower rainfall than forested areas.

(iii) Humidity

The humidity of the air is generally high, especially in the South-West monsoon and post-monsoon months. In the other months, the afternoons are comparatively drier. In the summer afternoons the relative humidities are between 25 and 40 per cent.

(iv) Cloudiness

During the South-West monsoon season the sky is generally heavily clouded. In the summer and the post-monsoon months there is moderate cloudiness, the afternoons being more cloudy than the mornings. In other months the sky is generally clear or lightly clouded.

(v) Winds

Winds are generally light to moderate with some increase in force in the summer and South-West monsoon seasons. Winds are mostly from directions between south-west and north-west in the monsoon. In the post-monsoon and cold seasons they are mainly between west and north. In the summer months the winds become variable in direction.

(*vi*) Special weather phenomena

In the hottest part of the year sea breeze reaches as far as Dhenkanal town.

The district is affected by storms and depressions in the monsoon season and in October, when winds increase in force and widespread heavy rain occurs. Thunderstorms, mostly in the afternoons occur in the summer months and in October. Rain during the South-West monsoon season is also often associated with thunder. Occasional fog occurs in the cold season.

Appendices V, VI and VII give the temperature and humidity, mean wind spread and special weather phenomena respectively for Angul.

APPENDIX I

Talcher boulders

Boulders small and big found at different places on the surface and under-ground in Talcher have puzzled Geologists for over a century. In Manual of the Geology of India (1879) by Medlicott and Blanford it is stated at page XXXV :—

"*Climate of Gondwana Epoch*—The climatological evidence contained in the Gondwana rocks is very curious; and although it cannot be said to prove an epoch of low temperature, it certainly suggests it. In the Talchir formation, almost wherever that extensively developed group is exposed, fragments of metamorphic, transition or Vindhyan rocks are found imbedded. These fragments are always rounded, often of large size (many having been measured 6 feet in diameter, and some are probably larger), and in many cases imbedded in the finest silt. It is difficult to understand how such large blocks can have been transported and deposited in a fine mud without the agency of ice; roots of trees are out of the question where the occurrence is on so large a scale. In one instance, moreover, some of the blocks were found to be polished and striated, and the underlying Vindhyan rocks were similarly marked. The appearances are not such as would be produced by glaciers; and it appears more probably that if ice transported the blocks, it was in the fluviatile form known as ground ice. It was at first suggested that this might be the case without any change in the temperature, as the Talchir formation might have been deposited on a plateau sufficiently lofty for ground ice to be formed. But the additional evidence since obtained of similar deposits apparently of glacial origin, in South Africa, in beds precisely corresponding to the Talchirs in position, the likelihood that the Permian breccias of England are also glacial, the poverty of the Permian fauna, and the great break in forms of life at the close of the palaeozoic period, together with the additional astronomical data in favour of variation in the Sun's heat— all combine to suggest the possibility of recurrent epochs of diminished temperature having taken place at intervals in the earth's history, and of one of these intervals having coincided with the Permian epoch. This might perhaps also explain the migration of Australian and African plants to the tropics, and the subsequent dissemination of these same plants in the temperate regions of Europe and Asia, as the earth's temperature increased again. There is nothing in the Lower Gondwana flora to indicate tropical affinities : the flora, as already noted, is poor, and the ferns might as well have inhabited a damp temperate climate as a tropical one; whilst the beds containing the Talchir boulders are singularly devoid of life, either vegetable or animal."

A solution may probably be sought from the latest theory of drifting continents derived from investigations of the ocean floor. According to this theory, peninsular India was a part of Antartica, about 180 million years ago. It broke away and sailed north 8,800 km. at the rate of roughly 5 centimetres in a year. In the course of many millenia, there was plenty of opportunity for a freezing climate to leave its mark on land.

APPENDIX II

Close season for shooting of birds and animals in the district of Dhenkanal

1	2
BIRDS	Close Time
Herons, Egrets, Horn-bills, Rollers, King-fishers, Hoopoes, Indian Orioles, Black-headed Orioles and purple wood pigeons.	Whole year
Ducks, Florica, Jungle fowl, Pea-fowl, Spur fowl, Orioles, Sandgraoese and painted suipe.	15th April to 30th September.
Partridges ..	15th March to 30th September.
All pigeons other than purple wood pigeon...	1st Frebruary to 31st July.
ANIMALS	
Tigers, Leopards, Panthers, Buffaloes, the females of bison, deer, gazelles and antelope and male deer when hornless or with horns in velvet.	Whole year
Hares, the females of Nilgai males of deer, gazelles and antelopes.	1st May to 30th September.
Chital stags ..	1st June to 30th September.

APPENDIX

Normals and Extremes

Station	No. of years of data	Jan.	Feb.	March	April	May	June	July	Aug.
1	2	3	4	5	6	7	8	9	10
Dhenkanal	49 (*a*)	14.0	34.5	19.6	32.5	82.0	221.2	369.8	337.6
	(*b*)	0.9	1.9	1.4	2.1	4.6	10.6	16.3	16.4
Kamakhyanagar	50 (*a*)	17.3	27.2	17.5	35.8	79.3	201.2	359.7	331.0
	(*b*)	1.1	1.5	1.4	2.5	4.7	10.6	16.8	15.9
Talcher ..	50 (*a*)	15.0	26.4	17.3	25.1	61.7	198.4	351.8	300.5
	(*b*)	1.1	1.7	1.5	1.8	4.6	10.5	16.4	14.6
Pal Lahara ..	50 (*a*)	18.5	30.2	20.1	34.3	68.6	252.5	546.9	470.9
	(*b*)	1.1	1.9	1.7	2.3	4.3	11.7	20.9	19.8
Athmallik ..	47 (*a*)	9.7	30.0	15.7	18.8	40.9	246.4	435.9	358.7
	(*b*)	0.6	1.6	1.1	1.7	2.9	9.5	16.7	15.3
Handapa ..	48 (*a*)	14.2	27.9	15.2	22.9	54.4	221.5	428.5	361.4
	(*b*)	1.0	1.4	1.5	1.7	4.4	10.2	17.8	16.4
Krishnanagar ..	14 (*a*)	18.8	34.5	19.8	14.5	38.9	184.7	460.3	394.7
	(*b*)	1.3	1.6	1.6	1.6	3.5	9.2	16.4	16.5
Hindol ..	48 (*a*)	14.0	33.5	26.2	37.9	68.3	226.8	339.9	312.2
	(*b*)	1.1	2.1	1.8	3.1	4.7	11.5	16.6	14.9
Angul ..	45 (*a*)	12.5	29.5	18.8	28.7	54.9	199.6	325.6	293.9
	(*b*)	1.0	2.0	1.8	2.3	4.3	11.4	15.5	14.9
Chhendipada ..	50 (*a*)	16.8	27.4	19.8	28.2	53.3	203.5	340.4	297.4
	(*b*)	1.1	1.8	1.6	2.1	3.6	19.2	15.5	15.2
Purunakot ..	50 (*a*)	14.5	31.0	19.6	28.2	65.0	214.1	354.8	322.6
	(*b*)	0.9	1.7	1.6	2.2	4.3	10.7	17.1	16.4
Jayapara ..	34 (*a*)	20.1	24.6	18.0	26.4	49.3	176.5	302.5	280.4
	(*b*)	1.4	1.7	1·6	2.0	4.2	9.2	15.4	14.6
Bantala ..	15 (*a*)	15.7	43.9	14.0	41.1	56.4	169.7	349.3	268.2
	(*b*)	1.1	2.4	2.0	2.4	3.7	9.3	15.5	14.0
Dhenkanal district	(*a*)	15.5	13.8	18.7	28.8	59.5	208.9	382.0	333.0
	(*b*)	1.1	1.8	1.6	2.1	4.1	10.4	16.7	15.8

(*a*) Normal rainfall in mm. (*b*) Average number

* Based on all available data upto 1950.

III
of Rainfall

Sept.	Oct.	Nov.	Dec.	Annual	Highest annual rainfall as percent of normal and Year **	Lowest annual rainfall as percent of normal and Year **	Heaviest rainfall in 24 hours*	
							Amount	Date
11	12	13	14	15	16	17	18	19
233.2	102.9	35.1	4.1	1,487.9	155 (1936)	57 (1918)	230.0	1908, June 24
12.9	5.9	1.4	0.4	74.8				
234.2	100.6	23.9	3.8	1,431.5	154 (1936)	57 (1918)	233.7	1936, Oct. 5
13.4	25.9	1.2	0.4	75.4				
206.8	71.6	19.8	3.8	1,298.2	148 (1943)	61 (1918)	294.6	1881, July 14
11.6	5.0	1.2	0.3	70.3				
228.1	87.6	18.0	6.6	1,782.3	132 (1929)	63 (1905)	306.8	1936, Oct. 4
13.4	5.1	1.0	0.4	83.6				
325.5	69.9	19.3	3.6	1,474.4	137 (1919)	64 (1923)	289.1	1910, July, 4
11.1	4.3	1.2	0.3	66.3				
259.1	94.7	21.6	4.6	1,526.0	149 (1939)	68 (1947)	268.0	1933,Sept. 21
11.8	5.9	1.4	0.5	74.0				
237.5	78.5	20.6	6.9	1,509.7	148 (1948)	66 (1948)	294.6	1942, July 10
11.6	4.9	1.2	0.4	68.8				
234.2	128.5	38.9	3.6	1,460.0	131 (1933)	64 (1918)	298.5	1934, Aug. 10
12.8	6.6	1.6	0.3	78.1				
194.8	103.9	29.7	3.6	1,295.5	141 (1925)	67 (1913)	260.1	1883, June 28
11.6	6.0	1.6	0.4	72.8				
195.6	78.2	29.6	7.1	1,288.8	160 (1917)	65 (1918)	241.3	1825, June 28
11.3	4.4	1.1	9.4	68.3				
228.3	110.7	24.4	2.8	1,416.0	146 (1925)	62 (1902)	256.0	1936, June 14
13.0	5.7	1.3	0.3	75.2				
199.9	93.2	27.9	2.8	1,221.6	150 (1933)	57 (1923)	179.8	1886, June 14
11.2	5.3	1.7	0.3	68.6				
190.2	100.1	27.2	4.8	1,280.9	117 (1936)	83 (1938)	179.1	1947, Aug. 29
10.0	6.3	1.2	0.5	69.1				
220.6	93.6	25.2	4.5	1,421.1	231 (1933)	65 (1918)	..	..
12.0	5.5	1.3	0.4	72.8				

of rainy days (days with rain of 2.5 mm. or more)

** — Years given in the braket.

APPENDIX IV

Frequency of Annual Rainfall in the district

(Data : 1901—1960)

Range in mm.		No. of years
1		2
901—1000	..	1
1001—1100	..	2
1101—1200	..	3
1201—1300	..	6
1301—1400	..	10
1401—1500	..	10
1501—1600	..	9
1601—1700	..	5
1701—1800	..	2
1801—1900	..	2

APPENDIX V

Normals of Temperature and Relative Humidity

(ANGUL)

Month	Mean Daily Maximum Temp.	Mean Daily Minimum Temp.	Highest ever Maximum recorded		Lowest ever Minimum recorded		Relative Humidity	
							0830	1730 *
	°C	°C	°C	Date	°C	Date	%	%
January ..	27·7	13·5	33·9	1930, January 31	6.7	1923, January 3	73	43
February ..	30·4	16·2	37·2	1934, February 27	8.8	1950, February 14	68	38
March ..	35·4	20·2	42·2	1953, March 28	10.6	1906, March 2	60	26
April ..	37·6	24·1	45·6	1941, April 2	16.1	1920, April 15	62	30
May ..	39·9	26·3	46·1	1947, May 24	18.9	1910, May 9	65	38
June ..	35·8	26·2	46·1	1958, June 6	21.1	1957, June 16	71	60
July ..	31·2	25·2	37·8	1912, July 2	21.7	1945, July 2	80	80
August ..	30·9	25·0	36·1	1945, August 6	21.1	1956, August 6	81	80
September ..	31·6	24·8	35·6	1943, September 8	21.7	1950, September 29	82	79
October ..	31·3	22·1	35·6	1918, October 2	14.4	1926, October 29	78	68
November ..	28·7	16·9	33·9	1918, November 8	8.9	1910, November 26	73	54
December ..	26·7	12·9	31·7	1957, December 13	7.2	1937, December 29	73	47
Annual ..	32·3	21·1	..	..	..	..	72	54

* Hours I. S. T.

APPENDIX VI

Mean wind speed in Km./Hr.

(ANGUL)

January	February	March	April	May	June	July	August	September	October	November	December	Annual
1	2	3	4	5	6	7	8	9	10	11	12	13
5·1	5·8	6·9	7·9	9·5	8·5	8·2	7·9	6·3	5·3	5·1	5·0	6·8

APPENDIX VII

Special weather phenomena

(ANGUL)

Mean No. of days with	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Thunder ..	1·0	3·4	5·0	9·5	10·8	14·2	10·5	12·2	13·4	5·6	0·4	0·0	86·0
Fog. ..	3·0	2·4	0·5	0·2	0·0	0·0	0·0	0·0	0·6	2·0	1·2	1·7	12·0
Hail ..	0·1	0·0	0·2	0·0	0·1	0·1	0·0	0·0	0·0	0·0	0·0	0·0	0·5
Dust storm ..	0·0	0·0	0·1	0·2	1·3	0·5	0·0	0·0	0·0	0·0	0·0	0·0	2·1
Squall ..	0·0	0·0	0·0	0·0	0·2	0·0	0·0	0·0	0·0	0·1	0·0	0·0	0·3