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HISTORICAL GEOGRAPHY AND NATURAL RESOURCES

Pratima P. Kamat

Introductory Remarks

THE small and picturesque state of Goa, variously known as "The Tropical Paradise of Tourists", the "Golden Gateway" of commerce, and the "Emerging Little Giant" in the manufacturing sector, is located about mid-way on the west coast of India within the latitudes of $14^{\circ} 53' 57''$ N and $15^{\circ} 47' 59''$ N and the longitudes of $73^{\circ} 40' 54''$ E and $74^{\circ} 20' 11''$ E. ¹

Ensnconced on the slopes of the Western Ghats which skirt its eastern boundary and lapped by the blue expanse of the Arabian Sea in the west, Goa admeasures an area of about 3701 sq. kms. It stretches out to a width of about 60 kms. in an east-west direction and extends to a length of about 105 kms. from the north to the south.²

Politically, the state of Goa is bounded on the north by the Sawantwadi taluka of the Ratnagiri district and the Kolhapur district of Maharashtra. To the east and in the south lie the Belgaum, Dharwar and North Kanara districts of Karnataka. This state is divided into two districts, North and South, administered from Panji, the capital city, and Madgaon, respectively. It is composed of the eleven talukas of Tiswadi, Bardesh, Pcdne, Dicholi, Sattari, Fonda,

Sange, Kankon, Kepe, Sashti, and Mormugaon. Out of the 10.08 lakhs people who inhabit this state as per the 1981 census, 6.85 lakhs live in 398 villages and the remaining 3.23 lakhs reside in fifteen towns.³

Goa possesses not only a long and chequered history but has also been liberally showered with nature's bounties. This chapter attempts to reconstruct the historical geography of this land and identify its kaleidoscopic natural resources.

Historical Geography

On account of its importance as a commercial entrepot and its association with the heroes of Hindu mythology, Goa is believed to have been well known to the rest of the Indian subcontinent and to the outside world since times immemorial.

Goa in the writings of Gudea, the Greeks and the Arabs

Epigraphical evidence is used to arrive at the conclusion that Goa had trade relations with the Ancient Egyptians, Phoenicians and the Greeks. There is a reference to Gubi, which has been equated with Goa, in the records of Gudea (2143-2124 B.C.), the ruler of the Sumerian city-state of Lagash.⁴ Scholars are divided in their opinion as to the exact identification of Goa with any one of the several places on the western coast of India which the Greeks had mentioned in their writings. Goa has been variously identified with Nelkinda, Aigidii and Chersonesus of the *Periplus of the Erythrean Sea*⁵; Nekanidon of Pliny; Melinda, Tricadiba Insula, and Kouba of Ptolemy⁶; Nincilda of the Peutingerian Tables⁷; Tyndis⁸ and Ariake.⁹

The name by which Goa was known to the Arab traders and Persian writers during the Middle Ages is less of a mystery to unravel as compared to its identification in the Ancient Greek sources. This emporium of Indian Ocean trade is generally identified with the Arabic *Kuve* or *Kuwa*.¹⁰ Writers like Al-Eidrissi, Al-Masudi, Al-Bufeda, Rashid-ud-din and Ibn Batuta mention *Sindabur* which is believed to be Goa.¹¹ The Arabs must have heard of an earlier capital of Goa, Chandrapur, and corrupted this name to *Sindabur* and used this term to denote Goa. Hence, *Gowai-Sandabur*, a name referred to by a Turkish admiral, Siddi Ali.¹² The names *Chintabor*

and *Cintabor* are mentioned in some European documents of the 14th century and these are believed to be references to Sindabur.¹³ Juwagad is a port site mentioned in a half compass card of stellar bearings which is centred on the island of Socotra located in the North Indian Ocean. This site has been identified with the territory encompassing Juwa-Sindabur or Goa and Sadashivgad which is situated on the river Kali.¹⁴ The 16th century European traveller, Ludovico de Varthema, writing about the island of Goa calls it Goga.¹⁵

Goa in the Hindu Mythology

Thus, Goa was known to ancient and medieval European and Asian traders, albeit by different names. It is also associated with the mythological lore of the Hindus. Parashurama, the sixth *avatar* of Lord Vishnu, is hailed as its creator. He is said to have settled ten great sages in this land and performed the *ashwamedha* sacrifice at the village of Harmal in Pedne. Another legend tells us that after undergoing a penance lasting over seven million years the *Saptarishis* were blessed with a vision of Lord Shiva who is, therefore, known as *Saptakoteshwar*. According to another tradition, Lord Shiva is believed to have taken up temporary residence in Goa after having a tiff with his consort, Parvati. Lord Shiva is worshipped here as *Gomantakesh*. Another god of the Hindu pantheon, Lord Krishna, is said to have defeated Jarasandha of Magadha in a fierce battle fought near the Gomanchal mountain which is believed to have been situated in Goa.¹⁶

In the *Suta Samhita*, Govapuri is associated with a spiritually cleansing touch : "The very sight of Govapuri destroys any sin committed in a former existence, just as sunrise dispels the darkness. One, even by making up his mind to bathe once in Govapuri attains a high place in the next world. Certainly there is no other *kshetra* equal to Govapuri...".¹⁷

Etymology of the word 'Goa'

Goa, pronounced as Gowa, is known in the Konkani language as *Goem* and in Marathi as *Govem*. It is generally believed that Goa was known as *Gomantak* before the advent of the Portuguese who are credited with the coining of the name Goa for the capital of their

State of India (*Estado da India*), to rhyme with the name of their metropolis, Lisboa. However, epigraphical evidence is available to corroborate the fact that *Gove* was a name by which this territory was known in the twelfth century and also that it was known as Goa during the Vijayanagar rule.¹⁸

The state of Goa receives its name from earlier names like *Gomant*, *Gomantaka*, *Govarashtra*, *Goparashtra* and *Gomanchal* which have been mentioned in the *Mahabharata* and the *Puranas*. The syllable *go*, common to all these words, means cow in Sanskrit. *Govarashtra*, one of the divisions of the *Parashurama Kshetra*, means the country of the cows. From this is derived the name *Govapuri* or the city of cows. The *Mahabharata* makes a reference to *Goparashtra*, the country of cowherds.¹⁹ Lord Krishna is said to have visited this land and entranced by the beauty of the place and its *gopikas*, he christened it *Goparashtra*. Hence, the important port-capital of ancient Goa was called *Gopakapattana* or the city of cowherds.

The trapezoid-like features of the terrain of Goa give it an appearance of a winnowing fan -- a *shurparaka* -- after which it is supposed to have been called *Shurparakadesh*. However, *Shurparakadesh* is generally associated with North Konkan around Sopara, and *Gomantaka* is the name given for South Konkan. Some scholars expound the theory that the *Gomanchal* mountain which dominated the scenery of this *Shurparakadesh* had lent its name to the entire territory. There is a reference to this mountain in the *Harivamsa Purana* as the scene of a battle fought between Lord Krishna and Jarasandha.²⁰ *Aparanta* and *Sunaparanta* or *Sunaparantaka* are two other names by which Goa was believed to have been known as in the ancient times.²¹ *Gomantaka* is another popular place-name associated with Goa. *Gomant* means 'the land where cows abound' and the suffix, *ka* is added to this to denote diminution.²²

The tracing of the origin of the word 'Goa' to the Sanskrit word *go* (cow) is regarded as of Aryan origin. However, since this territory was inhabited by pre-Aryan settlers, one wonders by which name it was known then. B.D. Satoskar and R. S. Dhume have made attempts to trace the etymology of 'Goa' to its pre-Aryan nomenclature. While Dhume puts forward the theory that the root-word is *goem-bab*, to Satoskar it is *guwi*. The former states that *goem-bab* is a *mundari* word meaning 'an inclined ear of paddy',

which was later contracted to *goe-ba* from which the word *Goen* is said to have originated. This theory associates the place-name with the major occupation of the earlier Kol people, that is, agriculture. *Guw*, on the other hand, is the Assamese term for arecanut which Satoskar has applied to Goa, a land where arecanut was, and is, cultivated.²³

Some Portuguese chroniclers had undertaken this exercise of tracing the etymology of the name of the territory which they had conquered. Diogo do Couto traced it to *Goemoat* which, according to him, was a local word for "a fertile and refreshing land."²⁴ Although we do not come across any lexical evidence to this effect, similar descriptions of Goa, reflecting the many natural advantages with which it is blessed, are enshrined in ancient texts and traditions like the *Suta Samhita* which describes Goa as the 'Paradise of Indra'. The Kadamba appellation of Goa is believed to be *Kalyan-gude*, that is the 'abode of welfare'.²⁵ While another Portuguese writer Leonardo Paes derives the word 'Goa' from Guhalladeva, an early ruler of the Kadamba dynasty who is considered by Paes to be the first king of Goa, Francisco de Souza conjectures that *Goubat*, whom he describes as the chief local deity, had lent his name to this territory.²⁶

It has also been suggested that the word 'Goa' is derived from the name of Rishi Gautama who is supposed to have resided in this land. Others consider Gomati, the former name of river Mandovi, as a source-word.²⁷ Another theory regarding the etymology of 'Goa' refers to the Parashurama legend. *Gomant* is declared to be the root-word and it is said to mean 'the resting place of the arrow which was shot' (*go* = arrow, *mar* = shoot, *ant* = end). This source-word *Gomant* is given another twist in definition to mean *Gom* + *ant*, that is, 'the end of Gom' or 'the slayer of Gom', although no attempt has been made to identify both *Gom* and his slayer or how and why he was killed.²⁸

The Parashurama legend associated with the creation of the coastal part of Goa is narrated in the *Sahayadri Khand* of the *Skanda Purana*. As the myth goes, Parashurama, the sixth incarnation of Lord Vishnu, faced with an order of banishment from the lands that he had once conquered, set seven arrows fly from the top of the Sahayadris to push back the sea and create a stretch of land which he could claim for himself. The sea-god is believed to have acceded to his wish and created a region called *Shurparaka* (winnowing fan).²⁹

*tatah Surparakan desam Sagarastasya nirmame sahasa
Jamadagnasya so parantamahitalam.*³⁰

The trapezoid of rich soil thus reclaimed from the sea extended from the Vaitaran river to Kanyakumari. It is referred to as the *Parashurama Kshetra* which is divided into the seven sectors of Kerala, Tulanga, Govarashtra, Konkana, Karalata, Varalata, and Barbara. Govarashtra which has been identified with Goa is believed to have been formed around Banauli (*ban* = arrow + *halli* = village), the village where one of the arrows shot by Parashurama had fallen.³¹

This legend personifies the geological process of the elevation of the submerged land along the west coast, which must have taken place about 12,000 years ago. There is evidence to support this theory as is indicated by the presence of marine fossils, buried seashells, sand and other features of a reclaimed topography in the coastal belt.³²

The legend further tells us that having thus created Goa as a part of the coastal *kshetra*, Parashurama brought 96 Brahmin families from around Tirhut and settled them in this land; it is believed that thirty of them inhabited the present-day Tiswadi (*tis* = thirty + *wadi* = villages) islands, while, the rest took up residence in Sashti (66 villages).³³ This is a reference to the Aryanisation of Goa. However, besides the Aryan settlers there were present in Goa *Gowdde*, who are believed to have been the indigenous inhabitants of this territory. The territorial limits of the modern state of Goa have undergone several changes of expansion and reduction before they were sketched to the present-day boundaries in the second half of the eighteenth century. With the help of the lithic, numismatic, epigraphic and literary sources of history that are available to us, learned attempts have been made to understand the geo-historical puzzle of Goa. The path of a researcher tracing the territorial definition of Goa from its centuries-long geo-historical mosaic is beset with innumerable difficulties. In the following pages I have made a humble attempt to reconstruct the historical geography of Goa from the ancient- most part of its recorded history.

Aparanta, the Konkan and Goa

The *Aparanta* of the ancient Indian literature is the name given to the coastal region which stretches from Broach in the north to the

northern border of the Murla river in the south. The rest of the coastal stretch from the Murla river to Kanyakumari is referred to as the Dravida country consisting of Havya or Hayga, Tuluva and Kerala.³⁴ *Aparanta* or western India has been identified as one of the five divisions of India in the *Bhuvanakosa* section of the *Puranas* and in the *Kavyamimamsa*.³⁵ However, in the Mauryan inscriptions and in the *Mahabharata*, *Aparanta* is considered to be the 'Western Border'.³⁶ A thirteenth century A.D. commentary on Vatsyayana's *Kamasutra* also declares that the *Aparanta* was bounded by the western sea.³⁷ In Kalidasa's *Raghuvarsha*, *Aparanta* is equated with the whole of the western seaboard from the Sahya to the sea ["Sahyalagnaivarnavah"] which the armies of Raghu ventured to conquer.³⁸ Bhattaswami, the commentator on Kautilya's *Arthashastra* identifies *Aparanta* with Konkan. However the *Brahmapurana* also included the Shurparakadesh within *Aparanta*. Thus, *Aparanta* is regarded as an umbrella term for Konkan to include the Shurparakadesh in the north and the Gomantaka in the south with the river Kundalika serving as a dividing line in between the two.³⁹

The *Saptakonkan* (Seven Konkan) is said to include Karata, Virata, Marata, Havyaga, Tulava and Kerala besides Konkan proper:

*Karatam cha Viratam cha Maratam Konkanam tatha Havyagam
Taulavam chaiva Keralam cheti Saptakam*

Based on epigraphical evidence, the Konkan can be split up into the following divisions: the Payve or the Hayve-500 in North Kanara; the Konkan-900 which encompasses Goa; Revatidvipa or modern Redi; Iridige including Sawantwadi and a part of the Ratnagiri district; Konkan-1400 around Thana, part of Salsette and Kolaba; Kapardikadvipa or Kavadidvipa around Salsette and the adjacent lands; and Lata or Variavi-116 including the Surat district with the adjoining part of the erstwhile Baroda state.⁴⁰ The territorial limits of Goa adjusted themselves within Konkan-900 and also outside this division.

Gomanchal is the name given in the *Konkannakhyana* to the region in between the Gangas, referring most probably to the river Damanganga in the north and the river Gangavalli in the south. A more reliable estimate of the ancient boundaries of Goa from the point of view of the cultural affinity of the inhabitants can be arrived

at by delineating it in between the rivers Achra in the north and Gangavalli in the south, that is including Banda, Kudal, Sadashivgad, Karwar and Ankola. The writings of the saint-poet Shubhanand or Subanant Swami are cited as evidence to justify the stretching of the southern limits of Goa by 25 miles from Kalinadi to Gangavalli. Although this saint-poet was born at Ankola, he states that his birthplace was in the city of Ankola located in the district of Gokarna, in the country of Govarashtra.⁴¹

Goa had come under the direct or indirect political sway of a host of ancient and medieval rulers like the Mauryas, the Bhojas, the Satvahanas, the Rashtrakutas, the Chalukyas, the Silaharas, the Kadambas, the Khiljis, the Tughlaqs, the Bahamanis, the kings of Vijayanagar, the Adilshah and others.

Ancient Goa

Based on a study of Sanskrit and old Kanarese inscriptions J.F. Fleet has pointed out that the western Deccan and parts of Karnataka had been ruled by the Nagas in the ancient period. It is most probable that given the prevalent nature of Naga worship in Goa, this land too, was governed by Naga tribal chiefs.⁴² The stone inscription, pertaining to the early centuries of the Christian era, found in a cave at Harvale, contains the legend *Sachipura cha sirasi* which has been deciphered as 'in the height of Sachipura' [See Plate 1.1, (a)]. Pandurang Pissurlencar, the noted Goan historian, has identified Sachipur with Sezo in Kudne (Sankali), which is believed to have been a great commercial centre in the ancient times.⁴³

The early recorded history of ancient Goa prior to the third century A.D. is shrouded in darkness. At this time, Goa is believed to have been ruled by the Bhojas. The Shiroda copper plate inscription mentions one "Devaraja of the Gominas" which is in all probability, a reference to the Bhoja king, Devaraja, who is hailed as the ruler of the Goans.

From this inscription we learn that the seat of power of the Bhojas was Chandraura which has been identified with Chandrapur of the Kadambas, that is the present-day Chandor.⁴⁴ This ancient township covered an area of about one sq. mile with mud wall fortifications bordering it in the northwest in the company of a moat running parallel to it.⁴⁵ The Bhoja kingdom not only comprised of the Chandrapur region, but also of Sashti, including Kuthalli to

which there is a reference in one of the inscriptions, Antruz and Bardesh. They must have also held the island of Goa for we have epigraphical evidence that tracts bordering Tiswadi were donated by the Bhojas [See Plate 1 (b) and Map 1.2].⁴⁶ Their domain also included the modern North Kanara district, part of Belgaum district and some neighbouring lands from the third to the sixth centuries A.D. They must have been ruling over these territories in feudal allegiance to the Mauryan emperor of Patliputra. The Ashokan edicts mention the Bhojas as semi-autonomous rulers of the Deccan and the Konkan.⁴⁷

In the second century B.C. the Satavahanas overran the Konkan with the Bhojas probably accepting their suzerainty. Archaeological and numismatic evidence of the Satavahana period has been unearthed in Goa. After the rule of Shak Satakarni, the Konkan is believed to have come under the sway of a north Kanarese dynasty, the Chuttus, ruling from Vanavasi, which probably held parts of Kunkalli, Balli and Kankon under the Bhojas⁴⁸. The Kshatrapa Rudradaman established his rule over Goa in around 150 A.D.⁴⁹ As the Abhiras replaced the Satavahanas in the Deccan, the Traikutas assumed the possession of the Konkan as their feudatories in the second half of the fifth century A.D., and later in an independent capacity after the fall of the Abhiras.⁵⁰ The Kalachuris of Mahishmati (near Indore) replaced the Abhiras by 416 A.D. and under them the Konkan Mauryas, a break-away group of the Mauryas of Patliputra, were given the charge of Aparant-Konkan.

The Bhojas were eased out of Goa by the Konkan Mauryas who held Kumbarjuve, referred to as Kumardvipa in the Bandora copper plate of a king of this dynasty, Anirjitvarman, who probably ruled over Goa in around the sixth or the seventh century A.D.⁵¹ The Sendraka royal family is believed to have controlled the northern border of Goa up to the tenth century A.D. with one branch of the Kaikeya royal family posted in Dicholi and another at Belgaum. The former had apparently accepted the sovereignty of the Bhojas.⁵² Hiouen Tsang, the Chinese traveller, visited Kong-Kien-na-pu-lo or Konkanapur in June-July 640 A.D. He describes this territory as a kingdom which was more than 5000 *li* or 833 miles in circuit and bounded by the sea on the west, Maharashtra on the north, Dhanakakata on the east and Dravida on the south. Thus, it was supposed to stretch along the coast from Vengurla to Kundapur and inland from the ancient fortress of Madgiri to the neighbourhood of Gulbarga.⁵³

In c. 578 A.D. with the defeat of the Konkan Mauryas at the hands of Kirtivarman Chalukya, Goa came under the sway of the Chalukyas of Badami. It now formed a part of the province of Revatidvipa (the fortified promontory of Redi situated in the Ratnagiri district of Maharashtra) and included the Konkan-900. Hence, it comprised of a narrow strip of land stretching along the coast from Sawantwadi, embracing Vengurla, the southern part of Malvan, Goa, down up to the Kalawali river.⁵⁴

The territory of the Konkan Mauryas must have been assigned to the feudatory Swamiraja who belonged to the Chalukya family and ruled from Revatidvipa. The Bhojas were probably still in control of the Chandrapur area. Swamiraja's relations with Mangalesh, the step-brother and successor of Kirtivarman, were not so amicable and in a battle between the two, the former was killed and Revatidvipa was handed over to a member of the Batpura family by Mangalesh. Later, Pulakesi II appointed his maternal uncle, a scion of the Sendraka family as the viceroy of Avaretika *vishaya*, near Chiplun.⁵⁵ Thus, from c. 578 to c. 753 A.D. the Chalukyas of Badami held their sway over Goa. In around 753 A.D. the Rashtrakutas usurped the sovereignty of the Deccan, Konkan, Karnataka and Gujarat from the Chalukyas and held it till c. 973 A.D. when they were superseded by the Chalukyas of Kalyani. Under the overlordship of the Rashtrakutas and later the Chalukyas, Goa was held by the Silaharas who were succeeded by the Kadambas.⁵⁶

In the eighth century A.D. Goa passed into the hands of the South Konkan Silaharas (c. 765-c. 1015 A.D.) who initially ruled the tract from the "Sahya mountain to the sea" ("Samundratira Sahyantadesha")⁵⁷ in a feudal capacity under the Rashtrakutas and later shifted their allegiance to the Western Chalukyas once the former were routed by the latter. Gopakapattana served as their capital with Valipattana developing as an important fortified port and later, perhaps acting as another seat of their power. Valipattana has been variously identified by scholars as Valavli in Sawantwadi, Kharepatana, near Vijayadurg, Bali in Kepe and Veli in Sashti. The Goan Silaharas apparently controlled Tiswadi for we come across references to Simhala (*dvipa*) in the grants of Rattaraja which is believed to have been this island.⁵⁸

Under Aiyapa (c. 820 c. 845 A.D.) the Silaharas subdued Chandrapur with the help of a branch of the Sendraka family and assumed overlordship over this territory either by handing the reins

of its government to their ally, the Sendraka chieftain, or by permitting the defeated ruler (a Bhoja or a Konkan Maurya) to continue in office. Hence, more than a century later, the Silahara King, Bhima (c. 945-c. 970 A.D.) had to annex Chandrapur so as to prevent it from falling a prey to the Kadamba attacks.⁵⁹

Thus, a great part of the present day state of Goa along with the Iridige tract, and later the coastal stretch up to Thana, and the Konkan-900 constituted the domain of the Goan Silaharas.

The Western Chalukya emperor Jayasimha inflicted a decisive defeat on Rattaraja Silahara who had rebelled against him in around 1020 A.D.⁶⁰ Since the Chalukyas did not follow up this victory with the establishment of their direct rule over Goa, the North Konkan Silahara ruler must have moved in to fill up this political vacuum for we learn from his Thana charter that he had declared himself the king of the entire Konkan tract during this period. Goa appears to have passed into the hands of the Southern Maratha Silaharas for a short period before returning to the North Konkan Silaharas who were subsequently overthrown by the Kadambas.

Kadamba Goa

The Kadambas ruled over Goa from the 10th to the 14th centuries A.D. [See Plate 1.2 (a)]. The founder of this dynasty in Goa had probably established his rule over Sashti and a part of the adjoining Konkan, after having wrested this territory from the Silaharas, except for the island of Goa and the port of Gopakapattana which continued to remain with the latter. The original kingdom of the Kadambas must have consisted of the territory lying south of the island of Goa inclusive of a large part of Sashti and a strip of land approaching the Sahayadris. During this period Chandrapur served as their capital. Under the Kadamba ruler, Sashtadeva I, the North Konkan Silaharas had made deep forays into South Konkan up to Gopakapattana. However in the early years of the 11th century A.D. these Silaharas were considerably weakened by both external as well as internal factors. Taking advantage of this situation, Shastadeva I struck a death blow to the North Konkan Silahara rule in Goa. He captured Gopakapattana, the island of Goa, the Konkan-900 and even Kapardikadvipa. He annexed all these territories except the last-named one which he returned to the North Konkan Silaharas who now accepted his overlordship. Though he had assumed the

overlordship of the North Konkan Silaharas, he himself was a *mahamandaleshvara* of the Western Chalukyas. Shashtadeva I probably elevated Gopakapattana to the status of a second capital of his kingdom.

The next Kadamba ruler, Jayakeshi I, expanded his Goan kingdom to such an extent that he declared himself the ruler of the Konkan *rashtra*, including Kapardikadvipa. From one of his charters we learn that several of the neighbouring chieftains had accepted his suzerainty (See Map 1.3).⁶²

Jayakeshi I had firmly entrenched himself in the port-capital of Gopakapattana which was located at the mouth of the river Siridaon and was bounded by Pali-Talauli in the west, Karmali in the north, Neura in the east, and Agshi in the south.⁶³ There is a reference to Gopakapattana being the capital of Jayakeshi I in the Sanskrit text, *Dvyasharaya* written by the Jain guru, Hemachandra in the twelfth century A.D. The port of Gopakapattana had commercial contacts with other ports of the Indian Ocean from Zanzibar (Zungava) in the west to Bengal (Gauda) in the east and Gujarat (Gurjara) in the north to Ceylon (Simhala) in the south.

This city has been described in contemporary records as being not only aesthetically pleasing and materially prosperous but spiritually cleansing as well. On account of its commercial nature, Gopakapattana possessed a cosmopolitan look. The capital was served by an important highway called the *Rajayithi* or the *Rajpath* which linked it with Ela (Old Goa).⁶⁴

The Goa Kadambas lost Kapardikadvipa and perhaps Iridige too, during the rule of Guhalladeva II who, subsequent to this defeat at the hands of the North Konkan Silaharas shifted his seat of power to Palasige (Halsi) while retaining his hold over Gopakapattana and South Konkan. He was styled as the ruler of Palasige-12000 and Konkan-900.⁶⁵

It was under Jayakeshi II that the Kadamba empire stretched from Thana in the north to South Kanara in the south with the easternmost limits of the present-day districts of Belgaum and Dharwar in the east. Thus, under Jayakeshi II, the Goan Kadamba kingdom reached the pinnacle of its glory. It included, the Konkan Nine Hundred, the Palasike twelve-thousand, the thirty of Unukal and Sabbi (Unkal between Dharwar and Hubli, Sabbi must be part of it), the thirty of Kontakuli, the five-hundred of Hanumgal (Hangal), the thirty of Utsugrame and Kadaravalli (Kadaroli in

Belgaum District; Utsugramme must be a part of it), the thirty of Palalgunde, the seventy of Velugrame (Belgaum), the five-hundred of Haive (North Kanara) and the Kavadivpa lakh and a quarter" (See Map 1.4).⁶⁶

It appears that Jayakeshi II had declared himself independent of the Chalukyan emperor at a time when the latter had been attacked by the Hoysala king, Vishnuvardhan. The Chalukyan emperor, Vikramaditya VI, had dispatched one of his feudatories, the Sinda chief, Achugi II, against the rebellious Jayakeshi II. Achugi took Goa and burnt it down. This show of Chalukyan strength resulted in the reacceptance of the feudal status by the Kadambas.⁶⁷

This empire was preserved by the next Kadamba king, Permadideva who, taking advantage of the defeat of the Chalukyas by the Kalachuris renounced his feudal status and designated himself as 'Konkan Chakravarti' with an additional title of 'the Lord of the Western Ocean'. The fluid political situation present in the Deccan during this period soon witnessed the Kadambas as independent rulers or as feudal vassals of the Kalachuris, Hoysalas, Hangal Kadambas or Yadavas. As a result of this the Kadamba empire of Jayakeshi II shrunk under Vijayaditya II. Later Beluvadesa (Beluvala region) was added to the Kadamba imperial patrimony by Jayakeshi III.

By the mid-thirteenth century the Kadambas had become a spent force in the politics of the Deccan. They were now reduced to the position of petty chieftains who ruled Goa under the feudal sway of the Yadavas of Devgiri to whom they had lost the province of Halasige.⁶⁸

Goa, especially the port capital of Gopakapattana, was looted and destroyed by the Khilji general, Malik Kafur, in the second decade of the 14th century. Consequent to this invasion, the Kadambas shifted their headquarters to Chandrapur which was razed by Muhammad-bin-Tughlaq in 1327 resulting in a shift back to Gopakapattana. In about 1344, as a result of dynastic infighting, the Kadambas were subjected to an attack by the Nawab Jamal-ud-din of Honawar.⁶⁹

The above-mentioned Muslim conquests lacked permanency resulting in the periodical revival of the Kadamba dynasty which now came to exercise its sovereignty over a much restricted kingdom. The Vere (Ponda, Goa) copper-plate of Malik Bahadur Timma Mantri of c. 1348 A.D. indicates that a part of Goa was administered by

Malik Bahadur who might have been the local officer appointed initially by the Delhi Sultans and later by the Bahamanis.

The Korgaon copper-plate (c. 1351 A.D.) refers to Bhimabhupal as the king of the Konkan-900, ruling from Gopakapuri. He appears to have controlled at least Tiswadi, Bardesh and Pedne. Bhimabhupal must have belonged to the family of a local feudatory of the Kadambas which must have taken advantage of its overlord's weakened condition to declare its independence.⁷⁰

Post-Kadamba Goa

From 1374 A.D., when Hasan Gangu founded the Bahamani kingdom in the Deccan, the main competitors on the political chessboard of Goa were the Bahamanis and their arch-rivals, the kings of Vijayanagar, with the Kadambas being a poor third.

The kingdom of Vijayanagar, on an expansionist spree in the south, soon acquired Malerajya and Palasige which had once formed a part of the Kadamba kingdom and set their eyes on the commercially lucrative port of Goa. At this time only Konkan-900 and Haive were retained by the Kadambas who lost the former to the Bahamanis by 1356. Between this year and 1378, the pendulum of the sovereignty over Goa oscillated irregularly from the Bahamanis to Vijayanagar, with a few interruptions from the Kadambas.

Under Vijayanagar, Goa formed a part of its Aragagutti *rajya* (province) whose capital was Govapuri although at times it was shifted to Chandragutti. Not only Tiswadi (Trinchadvaatika) and Sashti (Shat-Shasti) but Fonda (Antruz), Saptate (Sattari), Dvadasha-desh (Bardeshi), Dicholi and Pedne were included in this province and by 1391 Sawantwadi too, was added to it [See Plate 1.2 (b)]. By about 1448, Chandragutti, came to be separated from Goa.⁷¹ There appears to have been a revival of a local dynasty in Goa in around 1445 either in an independent capacity or as a feudatory of the King of Vijayanagar.⁷²

In 1472 the Bahamanis took over Goa and merged it with their province of Junnar for administrative purposes. The Bahamani kingdom fell a prey to internal dissensions and by the end of the fifteenth century five Deccani Sultanates emerged out of its ruins. One of these was the Adilshahi kingdom of Bijapur (1489-1686) which soon extended its suzerainty over Goa and established its

capital at Ela (Old Goa). Under Vijayanagar, the ancient port of Gopakapattana had lost its commercial significance on account of silting and it might have been replaced by Raibandar in Tiswadi with Ela being developed along similar lines. Yusuf Adil Shah developed the port of Ela which soon became an important emporium of Indian Ocean trade. While Goa was classified as a port, Ponda and Panchamaharaj formed parts of the Kudal division of the subha of Dabhol (Mustafabad), and so did Pedne, Dicholi and Sattari. It is not known whether southern Sashti, Kepe and Kankon constituted a part of the kingdom of Bijapur or remained under the direct or feudal rule of Vijayanagar.⁷³

Portuguese Goa

Spurred on by the desire to possess the strategic and wealthy commercial entrepot of Goa and at the same time determined to deal a death blow to the commercial and military status of the Adilshah of Bijapur, Afonso de Albuquerque, the Governor of the Portuguese possessions in the East (1509-1515) attacked and captured Goa in March, 1510. Although it is generally believed that at the time of this first conquest, the Portuguese succeeded in capturing only the island of Goa from the Adilshah, it has also been suggested that at this time the entire Bijapuri province of Goa, stretching from Banda to Sadashivgad had been conquered by Albuquerque and his ally, Timmayya. The chiefs of the Kudal region had also pledged their allegiance to the European conqueror, it is believed.⁷⁴

The Portuguese were driven out of the island of Goa by the middle of May, 1510 by the Adil Shah who now offered to them the territory around Sadashivgad in exchange for their renouncing their claims on Goa.⁷⁵ However, this does not explain how the Adil Shah could make such a proposal when Sadashivgad was supposed to have been under Portuguese control, as has been mentioned in the preceding paragraph, unless he had recovered it immediately from Albuquerque. Negotiations failed on account of the Portuguese adamant refusal to accept any compromise. It was only on 25th November, 1510 that the latter succeeded in recapturing the islands of Goa from the Sultan of Bijapur.

By 1543 the Portuguese had annexed the adjoining lands of Bardesh (Bardez) in the north and of Sashti (Salcete) in the south.

These three territories of Tiswadi (Ilhas), Bardesh and Sashti have been designated as the Old Conquests (*Velhas Conquistas*) since they were the early acquisitions of the Portuguese, captured in the 16th century.

The island of Goa has been extensively described in the travelogues of Europeans who passed through or resided for some time in this territory during the sixteenth, seventeenth, and early eighteenth centuries. It is said to have been "six or seven leagues circuit" or "27 miles in compass". Carved out from the mainland by the rivers Mandovi and Zuari, this island is believed to have consisted of thirty villages. The port of Goa was hailed as one of the finest in Asia. While to Tavernier "The island is abound in corn, rice, mangoes, pineapples, bananas, coconuts", Thevenot describes it as "being plentiful in corn, beasts and fruit and hath a great deal of good water". The city of Goa was located on this island some "ten miles up the River, Stands upon Seven Hills..."⁷⁶

In 1555, it appears that the Konkan part of the Adilshahi kingdom included Dabhol in the north and Chitakul in Karnatak, except for Portuguese Goa.⁷⁷ Hence, it included Pedne, Dicholi, Sattari, Chandravadi, Bali and Kankon. In the mid-seventeenth century, Chhatrapati Shivaji took over the territory of the Sawants of Wadi and in 1675 that of Fonda. With the extinction of the Sultanate of Bijapur in 1686 and the execution of Sambhaji in 1689, the Mughals became the overlords of the territory surrounding Portuguese Goa. During this period, the Bhosles of Sawantwadi and the King of Sonda controlled lands beyond the northern and the southern and southeastern borders of Portuguese Goa respectively.⁷⁸

In 1763, the Portuguese succeeded in capturing Fonda from the Marathas. At this time, the ruler of Sonda, who had Sange, Kepe and Kankon under his jurisdiction, was subjected to an invasion of his territories by Hyder Ali. Hence, in 1764 he placed these three territories in the custody of the Portuguese till such a time when he would be in a position to recover from Hyder Ali's onslaught. This condition was never fulfilled and Sange, Kepe and Kankon became a part of the Portuguese *Estado da India*. Between 1781 and 1788, taking advantage of the Bhosle's hostilities with the Raja of Kolhapur, the Portuguese captured Pedne, Dicholi and Sattari from the former and annexed these territories to Goa. Thus, by 1788, the modern territorial boundaries of Goa had been chalked out. These included the lands of the Old Conquests and Pedne, Dicholi, Sattari,

Fonda, Sange, Kepe, Kankon which were termed as the New Conquests (*Novas Conquistas*).⁷⁹

With these political boundaries, Goa remained Lusitanian till 19th December, 1961, when with the success of the Indian Army's Operation Vijay, it was liberated from the shackles of colonialism, and integrated with the Indian Union as Union Territory of Goa, Daman and Diu.

Natural Resources

The state of Goa has been gifted by nature with a verdant, undulating landscape which is crisscrossed by a fine network of rivers and streams and long stretches of golden beaches. As has been already brought out in the foregoing paragraphs, the political boundaries of this state coincide very comfortably with certain geographical landmarks of this region, making Goa not only a political division but a geographical entity as well.

"To a visitor from the parched plains of the North, Goa is one cavalcade of natural beauty descending from the Western Ghats to the Arabian Sea. A drive in any direction brings tantalising glimpses of pools reflecting the sun, trees stretched and etched against the skyline, palatial mansions encircled with greenery, golden beaches, emerald forests, bushes, climbers, creepers,....One instinctively feels in tune with nature."⁸⁰ Although the physiography of Goa has several features which it enjoys in common with the western coastal belt of India, it does possess a fine local charm, as has been described in the preceding sentence. This has helped to place the state on the tourist map of the world. The following paragraphs attempt to describe the salubrious climate and the enticing physiography of this territory.

Climate

Girdled by the arc of the Sahayadris in the northeast, east and in the southeast, and lapped by the waters of the Arabian Sea in the west, Goa enjoys a salubrious, sub-tropical, monsoon type of a climate. It is equable and humid throughout the year with alternating wet and dry seasons. The wet season normally lasts from June to September when Goa experiences the onslaught of the southwest monsoon. The rest of the year can be categorised as essentially dry. Besides seasonal changes, as one moves into the mountainous interior, the

temperatures vary to a greater extent and the rains are also heavier. The temperatures, rainfall, intensity and direction of the winds, the relative humidity and the rate of evaporation are thus subjected to seasonal fluctuations and orographic influences.

The maritime nature of the climate results in only slight variations in the mean daily temperature from around 30° C to about 25° C. The average annual temperature, however, stands at 21° C.⁸¹ The mean annual maximum and minimum temperatures are 32° C and 22° C respectively.⁸² By and large, the weather is quite pleasant in Goa all the year round, except for the months of May and pre-monsoon June when the heat is quite sweltering. The Western Ghats prevent the cold, dry winds of the inland from sweeping down on Goa and hence the state does not experience a normal winter. The maximum temperature generally does not dip lower than 12° C. The diurnal range of the day temperatures varies from 4° to 6° C in the wet season and from 10° to 12° C in the last two months of the year.⁸³

Goa gets 90% of its rains from the southwest monsoon (during the wet season) as it lies along the coast and on the windward side of the Sahayadris. The average annual rainfall is between 2800 mm to 3500 mms. About 36% of the annual rains lash Goa in the month of July. The rainfall, which is 2500 to 3000 mm in the coastal belts, increases to a copious extent, in between 3000 and 5000 mm, in the Sahayadrian region.⁸⁴ For example, the average annual rainfall recorded at Panji was 2690 mm, whereas it was nearly 4757 mm in the vicinity of Kolem, located along the Western Ghats.⁸⁵ Again the total number of rainy days (that is, days receiving more than 2.5 mm of rain) in the year 1985 were 71 in Panji and 112 in Valpai in the east (*Appendix 1*).⁸⁶

The skies are clouded to overcast during the monsoon months, after which the cloudiness generally lessens till the onset of the next wet season. The strong westerly winds which sweep across Goa during this period, decrease in their intensity in October and remain moderate in strength throughout the dry season. These winds blow in an easterly to northeasterly direction in the morning and assume a westerly tending in the afternoon. The average speed of the wind is 13 kms. per hour. The pre-and post-monsoon weeks are characterised by strong winds accompanied by frequent outbursts of thunderstorms. Occasionally, this territory is affected by cyclonic disturbances which arise either in the Arabian Sea or in the Bay of Bengal.⁸⁷

The climate of this state is generally humid on account of its proximity to the sea. The relative humidity in Goa almost always exceeds 60% . During the period June to October, it varies in between 87% in July and 78% in October, while during the rest of the year, it ranges between 66.5 % in December and January to 73% in May. The average annual relative humidity stands at 69.5% . Goa experiences an average annual evaporation of 4.8 mm. During the wet season, this figure dips to 3.6 mm in July, whereas it rises up to 6.6 mm in the month of May.⁸⁸

Physiography

Several geomorphic factors such as tectonic movements and climatic and eustatic sea level changes which took place after the west coast was faulted in the late Mesozoic to early Tertiary periods, have combined to carve out the present geomorphic features of Goa.⁸⁹

The geomorphology of Goa is made up of dominantly marine, fluvial and aeolian landforms in the coastal plains such as tidal flats, mesas, river terraces, wave-cut platforms, dunes and old beaches. These are followed by the etch plain which stretches to the east which in turn is succeeded by the low dissected denudational hills and the tableland. Finally in the extreme east the deeply dissected Sahayadris help to complete this fourfold geomorphological make-up of Goa. These marine, fluvial and denudational landforms are indicative of four erosional or planar surfaces. These are the coastal plains (60 metres), the Madgaon-Dicholi surface (300 metres), the tract stretching from Betul, Kankon, Fonda to Valpai (600 metres) and the surface which is present around Sonsagad in the east (900 metres). These surfaces vary in age from the late Mesozoic to the late Tertiary periods (See Map 1.5).⁹⁰

The verdant and undulating landscape of Goa is characterised by mountains and hills interspersed with narrow valleys which give way to flood plains and linear sandy beaches as one moves from the east to the west. The general topographical configuration of Goa displays a gradual east-west slope from the Western Ghats to the Arabian Sea. Hence, physiographically, Goa can be divided into three distinct zones : (1) the Sahayadris in the east; (2) the intermediate low, broad valleys alternating with the undulating highlands which occasionally jut into the sea, and (3) The Western coastal plains.

(1) *The Eastern Sahayadris*: The Goa sub-region of the Western Ghats covers an area of about 1724 sq. kms, that is, about 43% of

the total area of the state of Goa, comprising chiefly of the eastern parts of the talukas of Sattari, Sange and Kankon.⁹¹ It runs in a general northeast to southwest direction from the Surla Ghat in the north to Salgini in the south. This sector consists of parallel ridges with precipitous slopes and steep valleys whose altitudes range from 300 metres to over 1000 metres.⁹² After skirting a large part of the northeastern borders of Goa, the Sahayadris branch off westwards into innumerable ridges and spurs. The arc-like crestline of these mountains stretches to a length of about 125 kms.⁹³ This mountain-wall consists of peaks jutting out into the sky, often crowned with a halo of mist during the monsoon season. The most important peaks which stud the landscape of this mountainous tract are the following: Sonsagad, (located in Sattari), the highest, rises to a height of 1022.50 metres above sea level, while Kumbari in Sange occupies the second highest position with a height of 883.31 metres. The other well-known peaks of this region are Surla (815.95 metres), Zorme (726.08 metres) which possesses two fountains of drinking water and Dudhsagar (603.79 metres).⁹⁴ There are some hills in this sector situated much west of the Sahayadris which appear to enjoy an anomalous position. The most notable of these are the Vageri hills located in the vicinity of Valpai. However, on closer examination of the midlands it is quite apparent that such hills are linked to the Surla Ghats by a narrow strip of highlands.⁹⁵

The scarp face of the Sahayadris contains a number of cataracts, rapids and waterfalls. The prominent among them are the Dudhsagar falls in Sange and the Harvale falls in Dicholi which add to the scenic beauty of the state. This physiographic division possesses a number of river valleys and is the source of a major part of Goa's drainage.

(2) *The Central Uplands*: The middle sector consists of a chain of rolling hills with gentle to moderate slopes and long, narrow intermediate valleys. The hills vary in height from about 150 metres to 300 metres and are chiefly formed of the buttresses which sprawl at the foot of the main scarp of the Ghats. This transitional submountainous division with undulating uplands runs from north to south and stretches across a width of about twenty kms, occupying approximately 35% of the total area of the state.⁹⁶

This pedimented section of Goa's topography also consists of lateritic mesas at varying levels of planation (thirty metres to a hundred metres), some of which are worn-out stumps. Asnoda,

Kundai, Farmagudi and Bamboli display a generally flat-topped topography. This tableland geography comes to possess harsher and elevated features south of Kepe.⁹⁷ The tops of the plateaux are "fairly level, but are in places notched by gullies; the plateau rims are noticeably sharp; a scarp slope usually marks the quick transition to the alluvial plain below."⁹⁸ Headlands are formed where these plateaux meet the coastline as at Aguada on the northern bank of the river Mandovi with Cabo on its southern bank, Mormugaon on the Zuari and Cabo de Rama, further to the south. These promontories possess immense strategic value as is evidenced from the fact that the historical rulers of Goa had built forts atop them.

The river valleys of the Kaisua and those of the middle Kushavati, Mandovi and Zuari support much agricultural activity. Many springs have their origin in the gullies of this region and descend to feed the riverine network which crisscrosses this rugged topography.

(3) *The Western Coastal Plains*: The coastal belt, which accounts for about 22% of the total geographical area of Goa, is 120 kms long and varies in width from two to fifteen kms. with an altitudinal range of zero to fifty metres.⁹⁹ It is formed by the "constructional landscape" of the Arabian Sea and includes long river basins, estuaries, narrow stretches of sandy beaches, off-shore bars, spit-bars, lagoons, bays and islands.¹⁰⁰

The flood plains of the rivers Mandovi and Zuari serve to link the central physiographic sector with the coastal stretch. The alluvial lowlands are made up of sediment deposits accumulated along the banks of the rivers which having descended from the heights of the east now run towards the west to debouch into the sea. Goa's major alluvial embayment is formed by the basins of the Mandovi and Zuari rivers.

The coastline consists of a narrow strip of sandy plains. The most important palm-fringed beaches of Goa are those of Calangute, Baga, Vagator, Miramar and Colva. These are studded with both longitudinal as well as transversal types of sand dunes which at places rise to a height of ten metres. The sandy shore is interrupted at places by estuaries and at other places by the lateritic plateaux of the central sector which jut out into the sea to form headlands.

The promontories of Bardesh and Sashti created by the estuaries of the Mandovi and the Zuari have given Goa a fine natural harbour with two anchorages, the southern one of Mormugaon and its

northern counterpart at Aguada. The ancient ports of Gopakapattana (Goa Velha) on the banks of the Zuari and Ela (Old Goa) on the banks of the Mandovi have been rendered unusable by heavy siltation. However, their loss is made up by the fine natural harbour of Mormugaon which is an all-weather port and features amongst the major ports of India. The seasonal port of Panji is more of a jetty where the Goa-Bombay steamers, fishing trawlers, passenger ferries and country crafts dock. The port of Betul, along with those of Terekhol, Chapora and Talpona are seasonal in character and cater to country crafts, trawlers and other small vessels.¹⁰¹

Its well-knit drainage and long coast has gifted Goa with islands such as those of Chodan, Divade, Tiswadi, Juve, Kumbarjuve, Khorjuve and Anjediva, which stud the landscape of the western sector. These islands are of two types. To the first category belong the alluvial islands like those of the Kumbarjuve group which are formed from silt deposited by the rivers around isolated features of a drowned topography found in their basins. The island of Tiswadi has been carved out from the mainland by the Mandovi river in the north and the Zuari river in the south with the Kumbarjuve canal linking up these two rivers in the east. The second group consists of rocky islands such as those of Anjediva or those off the coast of Mormugaon which are "the protrusions of a drowned topography separated from the mainland by faulting".¹⁰²

Geology

A major part of the state of Goa is occupied by schistose and gneissose rocks which belong to the Dharwar Supergroup and Peninsular Gneiss Complex of the Archaean and early Proterozoic ages, respectively. The Goa Group of the Dharwar Supergroup consists of "an eugeosynclinal assemblage of rocks" which, as has been just mentioned, are schistose in nature.¹⁰³ These rocks can be divided into the following four formations according to their superimposition: (1) The Barcem Formation stretching from Pole in the south to Pirla in the north; (2) The Sanvorde Formation existing between Sanvorde and Periudoca; (3) The Dicholi Formation from Naibaga in the northwest to Salgini in the southeast and (d) the Vageri Formation in the northeast from south of the Madei river to Zorme, Keri, Sirdi, Ibrampur and Mopa.¹⁰⁴

In addition to these rocks, the northeastern corner is covered by a narrow strip of Deccan Trap, while another small strip in the northwest, along the coast is occupied by quartzite, probably of the Proterozoic age.¹⁰⁵ The basaltic flows of the Deccan Trap belong to the upper Cretaceous to the lower Eocene periods.

They exist along the border from Vaingini in the southeast to the north of Choraunde in the northwest. This region exhibits a northwesterly dip with a thickness of about 60 metres and an outcrop which has an average width of five hundred metres. The basaltic scarp of the Sahayadris dominates the scenery of the mountainous east in the north and in the centre. Goa also possesses basic intrusives like dolerite and acid intrusives like granite gneiss. Much later, during the recent and sub-recent times, laterite has covered nearly two-thirds of the territory. The presence of the laterites is an important feature of the geology of Goa. A typical laterite profile exhibits a hard indurated top horizon called the duricrust which varies in thickness from two metres to over five metres. This zone is followed by a mottled clayish horizon which varies in thickness from three metres to over fifteen metres as seen in some of the deep mines in Goa. This horizon in turn is found to be gradational into the parent rocks. A chart of the stratigraphic succession of rocks in Goa is given in *Appendix 2*.¹⁰⁶

Goa is not only blessed with a picturesque scenery and an equable climate but it also abounds in natural resources of a diverse nature as its above-mentioned geographical profile suggests. The total landscape of Goa with its warm and humid climate, its strategic headlands and islands, its fine natural harbour, its mineral-bearing rocks and fertile soils, its hydrogeology, its running and falling waters, and its flora and fauna, make up its rich natural resource base. It thus possesses both abiotic as well as biotic exhaustible and inexhaustible and developed and potential natural resources.

Mineral Resources

The territory of Goa is endowed with rich mineral deposits such as those of iron and manganese. In addition to these ores, Goa also possesses other industrial minerals such as those of bauxite, asbestos, feldspar, graphite, quartz, talc, silica sand and limestone. This coastal state also has limonite and magnetite along with other heavy mineral concentrations on the continental shelf. The

possibility of hydrocarbons in the offshore sector also cannot be ruled out (See Map 1.6).¹⁰⁷

The land-based mineral resources of Goa are chiefly located in Sange, Dicholi, Sattari, Kepe, Fonda and Kankon. Dicholi accounts for about 60% of the value of the total mineral production of this state.¹⁰⁸

The iron and manganese ore deposits are largely concentrated in an arcuate belt extending from the river Talpona in the northwest to Salgini in the southeast for over a length of 95 kms. This tract is approximately 3 to 7 kms wide.¹⁰⁹ As one moves southwards in this belt, one encounters a decrease in iron deposits and an increase in those of manganese.

The iron ore deposits of the territory are associated mainly with the ferruginous quartzites and phyllites and are essentially of haematite. These reserves are localised mainly in the northwestern and central parts of the territory as northwest to southeast trending belt that extends in general from Dicholi-Sankali in the north to Pali-Kurti in the south. The best and the largest of these deposits, that is about 75% of the total reserves, are found to the north of Usgaon. Medium-sized iron ore deposits of a moderate grade lie in the central part of the state along with few pockets of manganese ore. Finally, "narrow, irregular, lensoid and pockety iron ore deposits of medium to low grade" are located in the south in the company of more extensive better grade reserves of manganese ore.¹¹⁰

The important manganese deposits are those of Rivona; Pirla-Netorli; Matani-Kanvode-Naveli; Tudon-Saligi; and Salauti-Vitian. The Sange taluka contains more than 90% of these deposits. The manganese ore reserves of Goa are mostly of the laterroid type and occur in maximum concentrations near the surface of the anticlinal crests. They are also located in manganeseiferous phyllites and quartzites as lensoid concordant beds.¹¹¹

The bauxite deposits occur in patches and are mainly confined to the thirty to hundred metres planar surface which includes the plateaux areas from Pedne in the north to the region around Betul in the south where there are heavy concentrations of this mineral. These plateaux are made up of the thick laterite duricrust that conceals some of the important bauxite deposits of the state.¹¹²

Silica sand is found along the coast, especially in Sashti and Bardesh. Clay deposits, on the other hand, are localised more in the central part of Goa around the villages of Konce and Kakoda in the talukas of Fonda and Kepe, respectively.¹¹³

Limestone can be mined in the northeast corner of Sattari. Reserves of crystalline limestone which are rich in magnesium stretch from north of Vaingini to Ivore Kurdo in the northeast for over a length of twenty kms. A few bands of cement grade limestone have been identified in the Surla Ghat.¹¹⁴

Goa's deposits of usable iron and manganese ore have been estimated at 480 and 2.5 million tonnes, respectively.¹¹⁵ Bauxite reserves have been calculated at 10.58 million tonnes.¹¹⁶ While those of silica sand are stated to be 15 million tonnes, with the clay deposits trailing in the rear at 0.17 million tonnes. The mining industry is the most important contributor to the exports of Goa with iron ore, whose production is entirely export-oriented, as its backbone. This major foreign exchange earner nets about Rs. 180 crores of foreign exchange every year.¹¹⁷ During the 1970s Goa contributed to about 32% of the national production of iron ore and about 55% of the national exports of this mineral.¹¹⁸

These mineral deposits of Goa have been subjected to extensive and at places, haphazard mining, especially during the pre-liberation period with least regard for the conservation of this exhaustible resource. This has adversely affected the mineral wealth of the state. Some of the minerals have been the target of large-scale export and are more likely to be exhausted within a decade. The open-cast method of mining has also created a negative impact upon the environment of Goa.

The mining industry has caused considerable harm to the agricultural fields, forests, water streams, rivers, beaches and also the hydrogeological reserves of Goa. This degradation of the physical environment arises from the felling of trees to undertake mining operations. About 70% of the area leased out to mine-owners had been under forest cover.¹¹⁹ Besides this denudation of the forest cover the mining industry produces pollutants in the form of mining rejects, slimes from the beneficiation plants and muddy water pumped out from the pits. Their negative impact is all the more severe during the monsoon when these effluents are washed down into the neighbouring fields and water courses, causing both contamination of these sources of food production and the silting of the waterways. Mining dust is a major air pollutant present not only in the mining areas but also at the river loading points or at the railhead as is exemplified by the ore dumps near the Sanvorde river/rail-head.¹²⁰ Hence, mining leases should be granted subject to

the observance of certain regulations imperative for the maintenance of the ecological balance. This should include not only careful disposal of mining rejects but also long-term plans for the rehabilitation of abandoned mines through afforestation.

Salt is another important natural resource of Goa. The main salt pans of this territory are located in the lower banks of the Mandovi river, especially at Panji, Raibandar and Santa Cruz, along the Zuari river at Siridaon, Kurka and Santana, and also on the banks of the Terekhol, Siqueri and Sal rivers.¹²¹

Although oil and natural gas have not been located in the coastal waters of Goa, the discovery of off shore reserves of these resources in the vicinity of Goa, along the Ratnagiri shelf has opened new vistas for the eco-development of this state.¹²²

Soil Resources

The nature of the soil cover of the territory of Goa is determined largely by its geology, topography, drainage, vegetation and climate. Surveys conducted by national and regional institutions have identified eleven soil series in Goa. These are located in Chapora, Betim, Saligaon, Calangute, Zuari, Rivona, Colva, Uge, Zaimolo, Netorli, and Darbandora.¹²³ While the soils of Zaimolo, Rivona and Uge have been formed on a gently sloping or an almost even terrain, those of Darbandora and Netorli cover slopes with a moderately to a very steep gradient. The Precambrian crystalline gneisses and metamorphic rocks which underlie a major part of the territory, exhibit intense weathering. Denudation of the laterites and the parent rocks has given rise to lateritic, alluvial, red loamy and mixed red and black soils which are found along hill slopes and river valleys. Along the sea-front one encounters sandy soils.

Lateritic soil covers an extensive area of about 2,75,900 ha. (81% of the soil cover) and are well-drained from the surface. These are generally rich in organic content, but deficient in phosphorus and calcium. The lateritic soils vary in thickness depending upon various factors like the composition of the rocks, their topographical formations and their proximity to the sea. The laterite cover is thick on schistose metasediments, flat, gentle slopes and in the coastal belt.

The loamy soils result from the mixing of moorum with humus at the foot of the hills. The alluvial soils of the Rivona series are

yellowish-brown to dark brown in colour and have developed on the laterite outwash. The lighter coloured alluvial soils tinged yellowish-red to reddish-brown have been formed from the heavy sediment deposited by the rivers in their valleys. They possess a coarse texture and display fast permeability on the surface which recedes downwards. These soils are generally protected by dykes. The fertile soils of the plains are largely argillaceous, mixed up with humus and light sand (the Calangute, Betim and Colva series). These are acidic in nature and generally exhibit rapid permeability. The coastline is covered with sandy soils and dunes.

The saline soils (Zuari series) are found in the flood plains of the Mandovi and Zuari rivers. They are acidic and fairly organic in nature. These soils are deep and possess fine textures of silty-clay and silty-clay-loam. However, they are poorly drained. The marshy soils occurring in the lowland of Bardesh, Sashti and Kankon display poor permeability and are subjected to floods during the monsoons.¹²⁴

Although Goa is endowed with favourable agro-climatic and physical condition the net area sown is first 38.6% of the total area of the territory, the area that is sown more than once is just 2.62%. The rest of the land utilisation pattern consists of forests (28.4%), non-agricultural lands (5.6%), barren and uncultivable lands (4.3%) permanent pastures and other grazing lands (0.35%), cultivable wastelands (22.6%) and lands under miscellaneous tree crops and groves not included in the net area sown (0.16%).¹²⁵

The coastal talukas of Tiswadi, Bardesh, Sashti and Mormugaon have about one-third of their area under the plough and another one-third under tree crops. The agricultural picture in the hilly and forested talukas of Pedne, Dicholi, Fonda, Sange, Kepe and Kankon is quite reverse with 15% of the area being under cultivation and another 12% under fruit production.

The coastal belt is favourable for the cultivation of rice. Here 92.5% of the cultivated area is under paddy. Rice is grown in the fertile, saline *khazans*, in the highland *marad* (terraced) plots, in the well-drained alluvium *ker* lands, and in the high, forest-encircled *kulne* lands. In certain areas where there is an assurance of easy availability of water in the post-monsoon season, two rice crops are grown, the *sarad* or the kharif crop and the *vangana* or the rabi crop.

Lands of an inferior fertility like the hilly *barad* lands which are

not suited for the production of rice, are devoted for the cultivation of other food crops like *nachne*, *kulithi*, beans, *urd*, *mung* and *tori*. The talukas of Sange, Fonda, Sattari and Dicholi contain 72% of the total area of Goa which is under the cultivation of such cereals, millets and pulses.

Luxuriant coconut groves dominate the coastal belt of Goa in the company of the rice-fields. Arecanut plantations are cultivated in the valleys in the vicinity of perennial natural springs. Cashewnuts and sugarcane are also grown in Goa. The cultivation of rubber has recently been taken up on a commercial scale in the eastern sector where the structure of the soil and the heavy rains are considered to be suitable for this type of plantation. The land of Goa grows vegetables and several types of fruit trees like the mango, pineapple, banana and papaya.¹²⁶

An increased exploitation of these soil resources for agricultural purposes can take place with the adoption of cropping intensification, the use of superior agricultural technology and the introduction of diversification in the cropping pattern.

Biotic Resources

The above-mentioned geology, topography and climate of Goa have contributed to the growth of a typical flora and fauna. Goa is largely bathed in greenery whose luxuriant growth is attributed chiefly to the fact that this territory enjoys a heavy rainfall. The flora of this state is rich in plants, shrubs and trees. The dark green forest blanket on the mountains and hills provides an impressive backdrop to the fields and meadows which gently slope into the turquoise waters of the Arabian Sea. The vegetation of Goa is of the following types: The semi-evergreen and the evergreen forest of the elevated Sahayadrian region; the moist deciduous forests at lower elevations; the coarse grasses and an open scrub cover of the acacia sundra type in the plateau region; the strand and Greek types in the coast belt with coconut palms, scrub and marine grasses; the estuarine mangrove forests, and the growth of shrubs, grasses and especially the casuarina along the dry and barren shoreline.¹²⁷ Goa possesses several plants of medicinal and botanical value.¹²⁸

Forests

The Goa sub-region of the Western Ghats is a rich storehouse of

forest wealth. About one-third of the territory is under forest cover which envelops almost 95% of the area of the talukas of Kepe, Kankon, Sange and Sattari. According to the national forest policy, the forest area in a hilly state like Goa should be at least 60% of the total geographical area. In Goa, it is only 84%.¹²⁹ The main varieties of this natural wealth are of the evergreen, semi-evergreen and moist deciduous types.

The high altitudes of the Ghat division possesses tropical wet evergreen forests with tall trees, creepers and thick overhead canopies. These are found in large patches in Pendra, Kadval, Zarani, Karanzol, Oxel, Sanauli and Bome. A cane and bamboo undergrowth is found in this evergreen belt particularly in Valpai, Kolem and Keri ranges. Under the Portuguese regime these forests were left intact for the purpose of maintaining the ecological balance of the state.¹³⁰

The moist deciduous forests stud the lower elevations of the hilly tract. These possess a good commercial potential as timber and firewood. Before liberation, while the teak-bearing forests occupying an area of about 400 sq. kms. were thrown open for commercial exploitation, the equally large non-teak deciduous forests were set aside for the benefit of the local villagers. The teak forests are situated chiefly in the Morle, Shigga and Kale localities.¹³¹

The forests of Goa yield products like timber, firewood, poles canes, *shikakai* pods, oil, fibres and grasses. The coastal mangrove forests also serve as breeding grounds for marine fish. This natural vegetation helps in the conservation of the soil resources, regulation of the climate and the surface water flow of this state. The casuarina plantations, for example, help to protect the coast against soil erosion and also serve as a shelter for the agricultural fields located in the interior. In spite of the invaluable nature of this resource, the forest have been subjected to a great deal of denudation. This has been on account of overcutting, mostly of an illegal nature and the outbreak of forest fires. Hence, this natural vegetation cover has been punctuated with either the red scars of mining or patches of denudation resulting from *kumeri* (shifting) cultivation which covers about 30,000 to 40,000 ha. of forest land in the talukas of Sange, Kankon and Sattari¹³² and the abuse of the users' rights granted to the local villagers.¹³³

Grazing lands

The rainy season results in a luxuriant growth of grass which can be used for the purpose of cattle grazing. This easy availability of fodder diminishes considerably with the onset of the summer. Besides, the climatological factor, the moorum soils of the hilly tracts also reduce the cattle grazing value of the territory of Goa. However, on the whole, the equable and humid climate accompanied by heavy rains, though restricted to about one-fourth of the year alone, can be considered to be resources for the development of animal husbandry like cattle, buffaloes, goats, sheep and poultry in Goa. Fodder cultivation can reach the desired level only with a more extensive availability of irrigational facilities. While the equable nature of the climate encourages poultry farming, the natural greenery of Goa's landscape, the stalks of its food crops and the leaves of its tree crops all serve as fodder for cattle and goats. The villages of Nagarshe and Palole in Kankon; Advai, Thane, Salali and Pissurle in Sattari; and Kele, Mole, Sunktoli, Darbandora, Uge, Kirlapal and Kole in Sange have been identified as areas having a good potential for livestock grazing.¹³⁴ Salt and the shells of the molluscs serve as marine contribution to the cattle feed of Goa. In fact, the Techno-Economic Survey of the Union Territory of Goa, Daman and Diu had even declared that "if concentrated attempts are made to increase fodder resources, Goa might even export surplus grass to the neighbouring areas".¹³⁵

Fauna

Besides the above-mentioned domesticated animals, the territory of Goa, especially its forested interiors, is endowed with a magnificent collection of wild faunal and avifaunal species. In order to protect this wildlife and their environment, three wild life sanctuaries have been opened at Molem, (known as the Mahavir wildlife sanctuary) on the eastern border of Goa, Kotigaon in the south and at Bondla which is situated to the east of Fonda. These three sanctuaries cover almost 10% of the territory of Goa and about 33% of the forest area.¹³⁶ A bird sanctuary is also located in this state, on the island of Chodan.

Fisheries

The fisheries industry is an important constituent of Goa economy. The maritime state possesses a rich potential in fisheries, blessed as it is with extensive hydel resources. Its long coastline of more than one hundred kms offers Goa an offshore fishing area of about 5200 sq. kms. up to a depth of about 200 fathoms. The presence of creeks and estuaries along the coast is an added advantage for the fishing industry. The important fishing village of Goa such as those of Betul Siridaon, Colva, Chapora and Banauli are located at places where the coast is free from rocks and possesses a sandy sea floor which permits the easy operation of beach seines or *rampon*.¹³⁷

Besides this ample potential for deep sea fishing, its intricate riverine network of about 250 kms. has provided Goa with an abundant stock of fish. Marshy *khazan* lands are suited for prawns and fish culture after the harvesting of the paddy crop grown there. Thus, 4500 ha. of fallow *khazan* lands can be utilised for brackish water fish farming.¹³⁸ About one hundred ha. of freshwater sources like lakes, ponds and tanks can be exploited for the purpose of fisheries. Fish farming is conducted either on a permanent basis or in the company of salt production or alternating with paddy cultivation. Studies conducted by research organisations like the National Institute of Oceanography, Dona Paula, Goa, have revealed the availability of an area of 15,000 sq. kms. as fishable zones to Goa.¹³⁹

Goa's annual fish catch is in excess of 1.5 lakh kgs. This includes a wide variety of shell-fish and fin-fish like mackerels, sardines, catfish, sharks, seerfish, prawns, pomfrets, Bombay ducks, and butterfish. The sustainable yield of the pelagic as well as demersal fish of this territory is estimated at 70,000 tonnes.¹⁴⁰ Goa's demersal resources like shrimps, prawns, clams, oysters and mussels are located up to a distance of 200 metres from the shore. The annual catch of this type of fish is about 15,000 tonnes, and it is caught almost all the year round. The pelagic fish, in contrast to the demersal stock, is subject to great annual variations. The schools of shoaling fish like sardines are found offshore up to a distance of about fifty kms. The estuarine embouchures, coves and sheltered bays, covering an area of more than 700 ha., are a good source for "suspended culture of mussel and oysters, rope culture of sea-weeds and pen-culture of clams and fin-fish."¹⁴¹

The fisheries industry not only markets fresh fish (about 81% of the total catch) but sun-dried (9%), salted (5%) and canned fish too. It also contributes about 5% of the total catch to the production of manure.¹⁴² Frozen shrimps constitute the eighth important export item of Goa.¹⁴³ Canned fish as well as freshly iced mackerels and sardines are sold in national and the international markets. This industry thus concentrates largely on offshore, inshore and riverine fishing; pisciculture is yet to take firm roots in the state. There is good scope for setting up reservoir culture fisheries in Goa in its estuarine lowlands and mangrove vegetation. The deltaic island of Chodan, Old Goa, Santan, the backwaters of Kurka, the Paingini-Galgibag-Mash in Kankon and those of Morji-Mandre in Pedne have been identified as sites for setting up aquaculture estates.¹⁴⁴

Shellfish, whose annual production potential stands at 5,000 tonnes, and seaweeds like alginates and agar, with a yearly exploitable potential of about 2,000 tonnes (net weight) are some important biotic marine resources which are as yet underdeveloped.¹⁴⁵

These biotic inland and marine resources are being adversely affected by water pollution which results from the discharge of mining rejects, agricultural and industrial effluents, toxic metals and metalloids and the sewerage into the water bodies and also by the spilling of oily ballasts and tar balls.

Water Resources

Goa has been gifted by nature with substantial quantities of both groundwater and surface water resources such as lakes, springs, waterfalls and rivers.

Groundwater Potential

Goa possesses a sound potential of groundwater reservoirs owing largely to valley hills and coastal plains. Folding and faulting have resulted in the creation of narrow, disconnected valleys like those of Kolamle-Kelvan, Dhanoli, Mangesh Mardol-Priol, Old Goa-Karmali. These valleys along with highly fractured and jointed rocks serve as favourable locations for groundwater storage.

The most important water-bearing formations are the laterites

which cover more than 60% of Goa's territory.¹⁴⁶ Springs are a common feature in the laterite region. The rocks of the Precambrian age, like the crystallines, exhibit great variations in their capacity to hold water. On the other hand, the coastal alluvium and sands display considerable porosity and form one of the important aquifers, the coastal aquifer. The water table in the crystalline rock areas varies from 1.5 to 13 metres below ground level whereas its range is from 0.1 to 3 metres for the laterite region. The most important water bearing horizons are located in gravel beds at underground depths varying from 1 to 8 metres.¹⁴⁷

Lacustrine Resources

Another important element in the scenic makeup of Goa is the presence of lakes which are a recurrent theme in the alluvial flats, along plateau ridges and across the valleys of mountain streams. The lakes which lie in the western topographical division of Goa are generally located adjacent to the coast and may have been formed by the interplay of sandbars and alluvial flats on the estuarine water of this region. Maem lake is located amidst rolling green hills and is the most popular lacustrine attraction of this state. Some other well-known lakes of Goa are situated at Kalapur, Kurcholem, Kakoda, Karamboli and Chimbla.¹⁴⁸

Drainage

The rugged terrain of Goa is well served by a fine network of rivers which drain a major part of this territory (See Map 1.7). In keeping with the east-west trending of Goa's topography, these rivers descend from the heights of the Sahayadrian watershed and flow westwards to disembogue into the Arabian Sea. Due to the hilly terrain, the drainage of Goa is high and swift. These rivers are chiefly of a perennial nature and contain a large flow. "The pattern of drainage in different parts has been influenced by the underlying geological formations. Thus in most of the area the pattern of drainage is markedly dendritic which indicates the uniform resistance to erosion by the underlying rocks. However, in the area around Mapusa the pattern of drainage is anastomatic reticulate, being characterised by a network of interlocking channels, layouts and sloughs."¹⁴⁹ The rivers Mandovi and Zuari constitute the two

principal inland waterway systems of Goa (See Map 1.8).

The longest river of Goa is the Zuari which is believed to have been known in the earlier times as the Agnashini. It is about 63 kilometers long from its source in the Diguighat to its estuary in the bay of Mormugaon, adjoining the estuary of the Mandovi to its north. In its upper reaches, the main stream of the Zuari water the southwest portion of the Sange taluka and later it assumes a northwesterly direction, separating Fonda from Sashti. It is fed by the water of a number of tributaries like the Kushavati. It is linked to the Mandovi by the Kumbajuve canal.

The northernmost important river is the Terekhol or Araunde which originates in the Uspa ghats at Patardeve in the Sahayadris and runs along the border of Goa in a southwesterly direction and then assumes a northwesterly flow for about 24 kms before discharging itself into the sea. The Kolval or the Chapora river rises in Ramghat at Maneri and follows a zigzag course, demarcating the border of Pedne, Bardesh and Dicholi for about 21 kms. before debouching into the Arabian Sea near Chapora. Its lower reaches exhibit features of a drowned topography. The short Baga and Siqueri rivers rise in Bardesh. The latter helps to form the peninsula of Aguada before emptying itself into a bay of the same name. In the south, the 24 kms. long Sal river rises near Verna and flowing parallel to the coast meets the sea at Betul. Originating in the Ambaghat in Kankon, the Talpona river runs a 11 kms. long course. The last important river in the south is the Galgibaga which flows for about 8 kms. in Kankon.¹⁵⁰

The surface water system of Goa is intimately linked up to its eco-development since it provides irrigational facilities to agriculture, produces biotic and mineral resources, transports ore from the mining areas to the port, and ferries men and goods to different parts of the state. To permit the fullest utilisation of their inland waterway system, the geometrics of the river courses have to be improved, canals have to be dredged and bottlenecks such as shallow patches have to be corrected.¹⁵¹

The mechanisation of the fishing industry and the use of the rivers as inland waterways especially by the mining industry, has subjected the hydro resources of Goa to oil pollution. In the high seas the oil tankers which head for the Mormugaon port at times create oil ballasts and bilge-washings. Turbulent winds of the monsoon season cause the deposition of these effluents on the

beaches of Goa. The river courses and the sea are being polluted by a great part of the 60,000 to 80,000 litres of liquid industrial wastes which are being daily generated in the state. Even the well water is prone to contamination in certain areas.¹⁵²

Since the rainy season in Goa lasts for only about four months, the irrigation potential of the territory has to be intensively tapped for agricultural development. Goa's gross surface water run off of 8570 million cubic metres is utilisable only to the extent of about 2600 million cubic metres. To this can be added the availability of water in the watershed areas which is around 560 million cubic metres. Hence, the total utilisable surface water available for irrigational and other uses is 3160 million cubic metres.¹⁵³ Thus, although Goa possesses a fine riverine network, a sound groundwater potential and good rainfall, only about 8000 ha. of land, that is about 6.5% of the net sown area is under irrigation. This is much below the national average of about 28%.¹⁵⁴ Since liberation, several attempts have been made to bring additional acreage of rainfed lands under minor and major irrigation projects like those situated at Salauli and Anjune. However these projects must be implemented with respect for other land resources since the setting up of dams results in the submergence of land. For example, under the Salauli and Anjune projects, a forested area of about 32 sq. kms. is adversely affected.¹⁵⁵

Goa does not possess bright prospects for the development of hydro-electricity. This is because it receives heavy rainfall of a restricted nature and its main rivers enter the state at a relatively low elevation. The site of the Dudhsagar falls, which has a storage capacity of 35 million cubic ft. was calculated to generate only 16,000 kilowatts and that too, on a seasonal basis.¹⁵⁶ However, Goa is favourably located in relation to the potential and actual hydel power sites in Maharashtra and Karnataka from which it can benefit through inter-state cooperation.

Concluding Remarks

Based on this natural wealth, Goa can boast of being endowed with a substantial industrial potential. Besides undertaking primary economic activities like agriculture, horticulture, mining, fishing, salt manufacture, Goa manufactures food products like sawn planks, cane and carved wooden furniture, non-metallic mineral products

like rolling shutters, ordinary wick stoves, fabricated structurals transport equipment like barges and dredgers, and livestock-based industries like leather tanning, footwear, leather goods and bone mills (crushed bone is an useful fertilizer).¹⁵⁷

The exploitation of the natural resources for the eco-development of the state has brought in its wake serious environmental problems of land degradation and of both air and water pollution. There has been extensive soil erosion of nearly 1030 sq. kms. in the forest area, coastal belt and in the agricultural tracts.¹⁵⁸ The pace of deforestation has increased and has denuded about 5% of the forest cover of Goa.¹⁵⁹ The water resources have been subjected to industrial and mineral pollution and the siltation of streams is on the increase. This dangerous trend, which affects the conservation of soil and the regulation of the climate and the surface water flow of the state, is gradually undermining the ecological balance in Goa: "The micro and mega climatic pattern, together with the floral and faunal picture is subjected to changes, albeit slowly."¹⁶⁰ Thus, Goa possesses a wealth of mineral resources whose exploitation should be planned within the framework of the state's economic development and its eco-system conservation.

APPENDIX 1**HEAVIEST RAINFALL EVER RECORDED IN 24 HOURS
FOR STATION IN GOA**

Station	Amount of Rainfall (Unit)	Date/Month/Year
Kankon	278.0	22.05.1981
Panji	293.4	04.06.1954
Valpai	281.5	29.06.1959
Sange	267.5	30.06.1956
Fonda	304.6	18.06.1953
Kepe	198.0	22.06.1968
Marmugaon	307.1	22.05.1933
Mapsa	246.8	24.07.1931
Kole	300.0	20.07.1965
Pedne		09.10.1952

Source: Report of the Task Force on the Eco-Development Plan for Goa, New Delhi: Planning Commission, Government of India, 1982, p. 118.

APPENDIX 2

THE STRATIGRAPHIC SUCCESSION OF ROCKS IN GOA:

		Sub-recent to Recent	Sea sand laterite
		Upper Cretaceous to Deccan Trap	Basalt
		Lower Eocene	
		Proterozoic?	Basic Intrusives
			Dolerite
			Gabbro
		Proterozoic	Acid Intrusives
			Pegmatite, vein quartz,
			Porphyritic granite,
			Felspathic gneiss, Granite
			gneiss.
			Metabasalt,
			Metagreywacke
			Banded ferruginous
			quartzite Maganiferous
			chert breccia with
			pink ferruginous phyllite
			Limestone
			Pink ferruginous phyllite
			Quartz-chlorite-amphibole
			schist
			Argillite, Quartzite, Tilloid
			Metagreywacke
			Metagabbro
			Peridotite, Talc-chlorite
			schist
			Variiegated phyllite
			Quartz-chlorite schist
			Quartzite, Quartz-sericite
			schist
			Red phyllite
			Quartz porphyry
			Massive, schistose and
			vesicular metabasalt

ARCHAEOAN TO PROTEROZOIC

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GOA GROUP

VAGERI
FORMATIONBICHOLIM
FORMATIONSANVORDEM
FORMATIONBARCEM
FORMATION

Source Gokul, A.R., Srinivasan, M.D., et al, "Stratigraphy and structure of Goa", *Earth Resources for Goa's Development*, Hyderabad, Geological Survey of India, 1985, pp. 3-4.

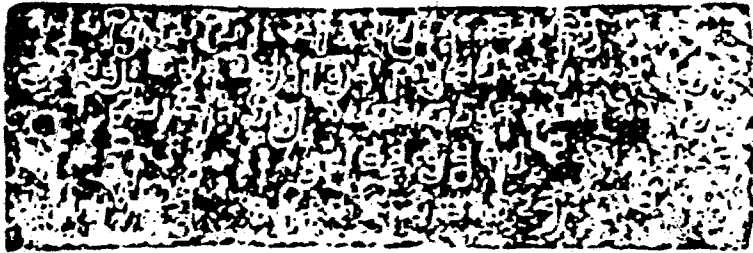
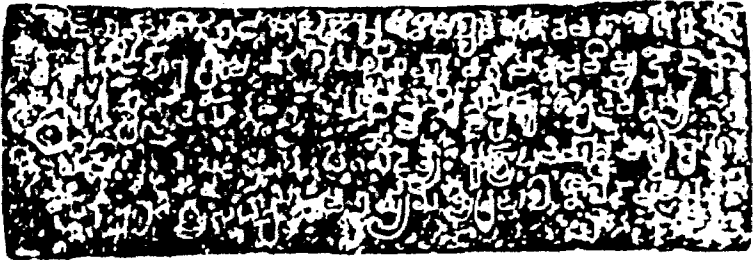
PLATE 1

(a)

हरिवल गडोड

THE HARAVALE INSCRIPTION

(b)



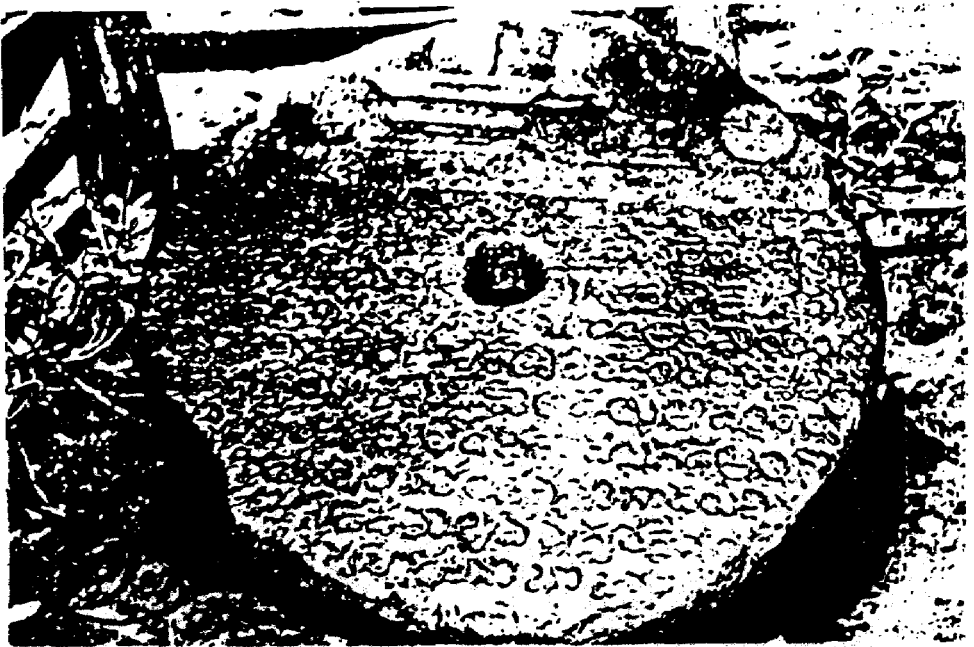
THE BHOJA INSCRIPTIONS

PLATE 2

(a)

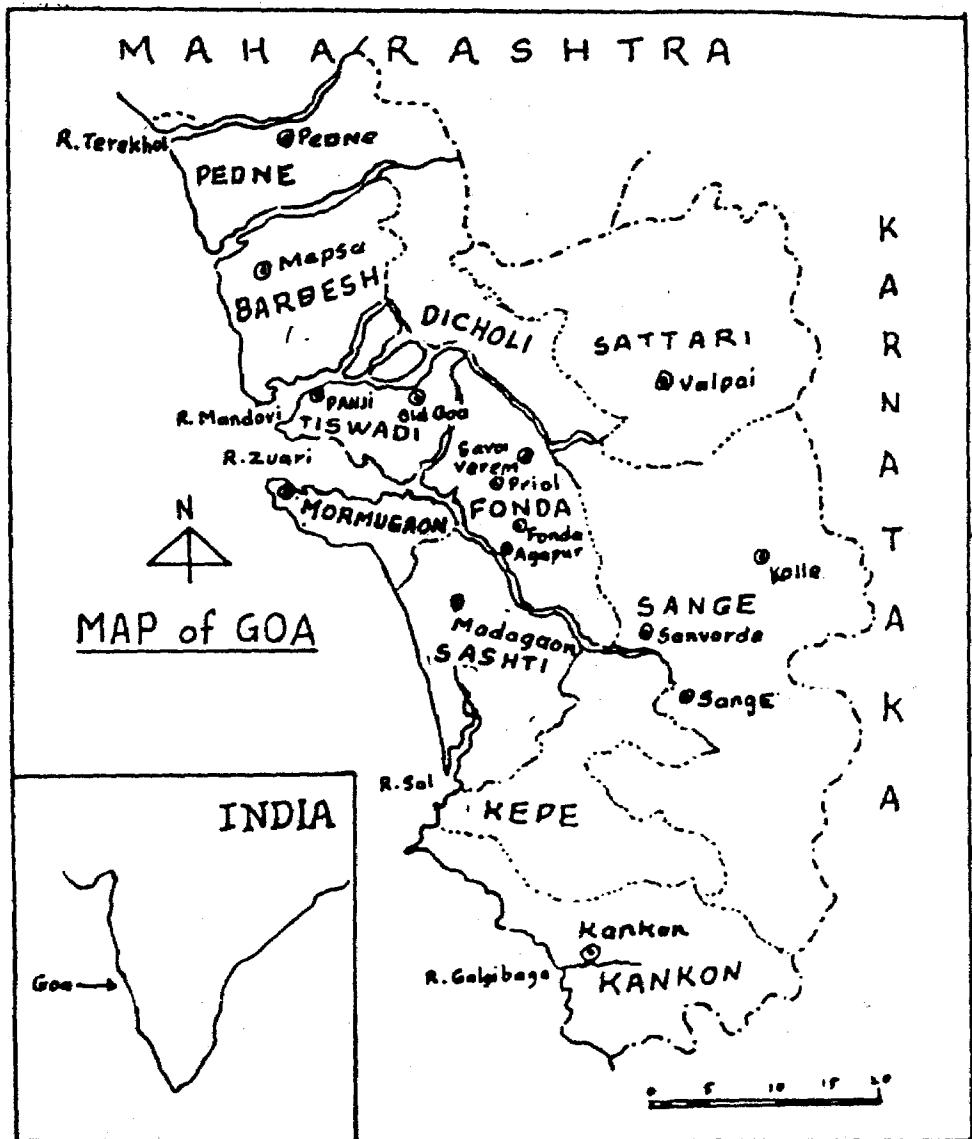


KADAMBA INSCRIPTIONS (C. 1049) INDICATING
THE KADAMBA FAMILY TREE

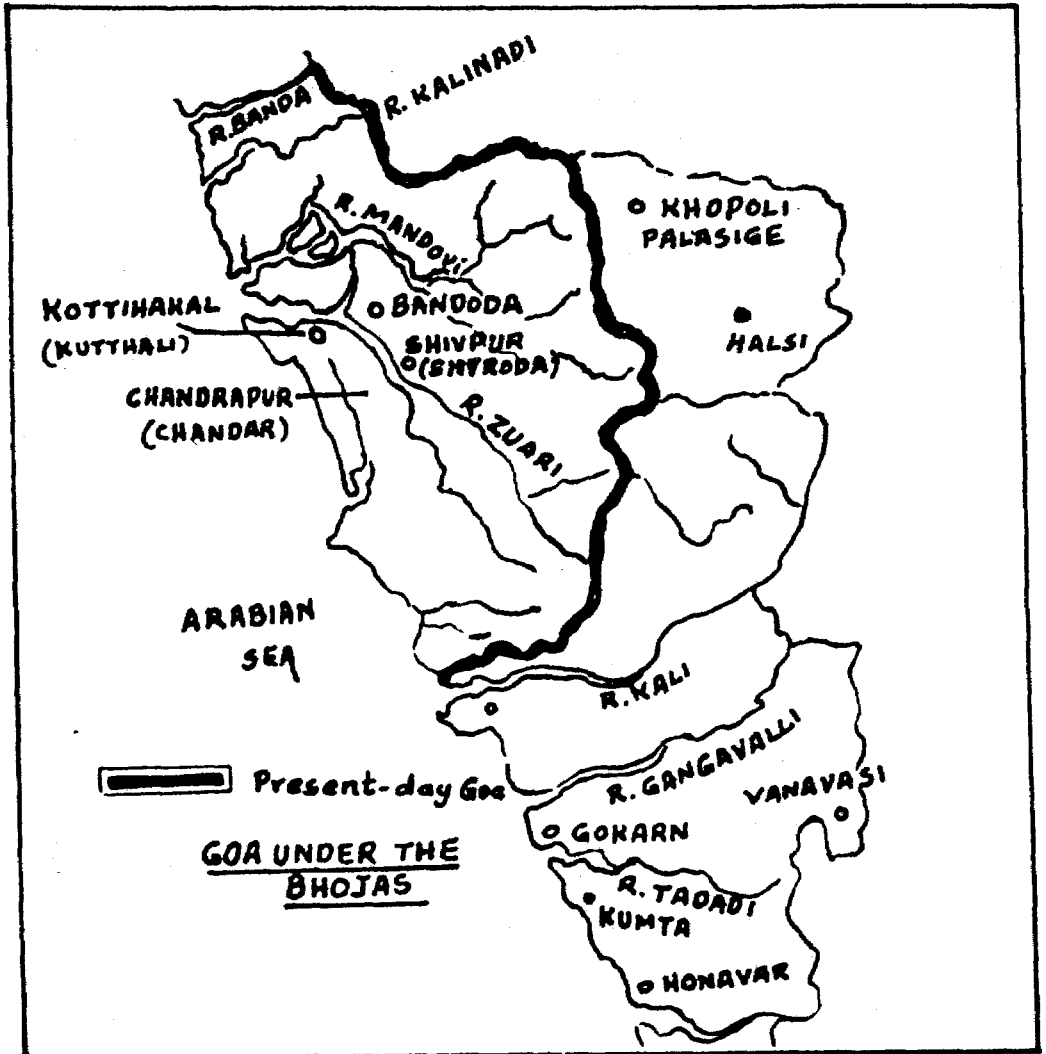


INSCRIPTION OF THE VIJAYANAGAR RULER,
HARIHARA II

MAP 1

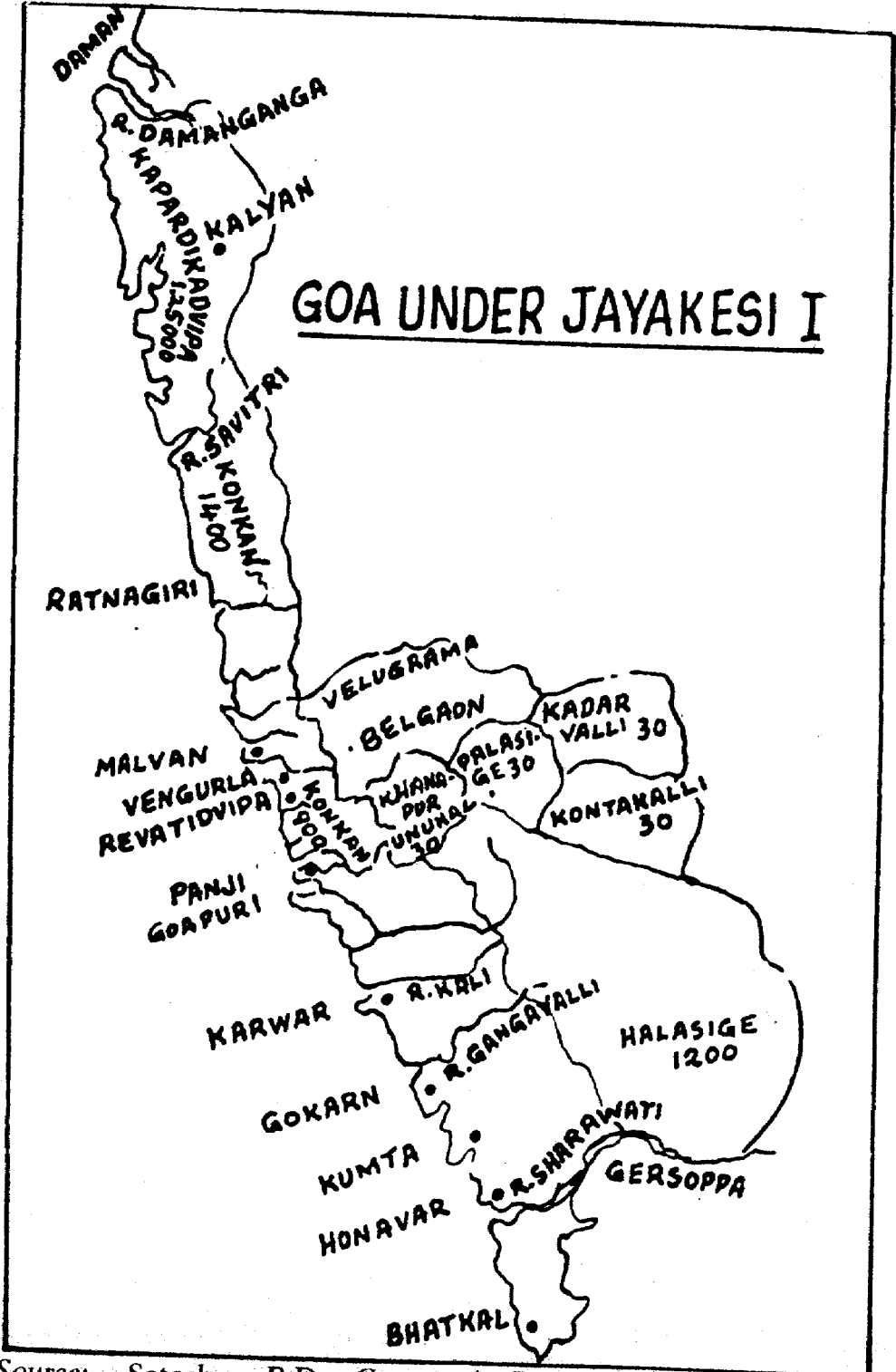


MAP 2



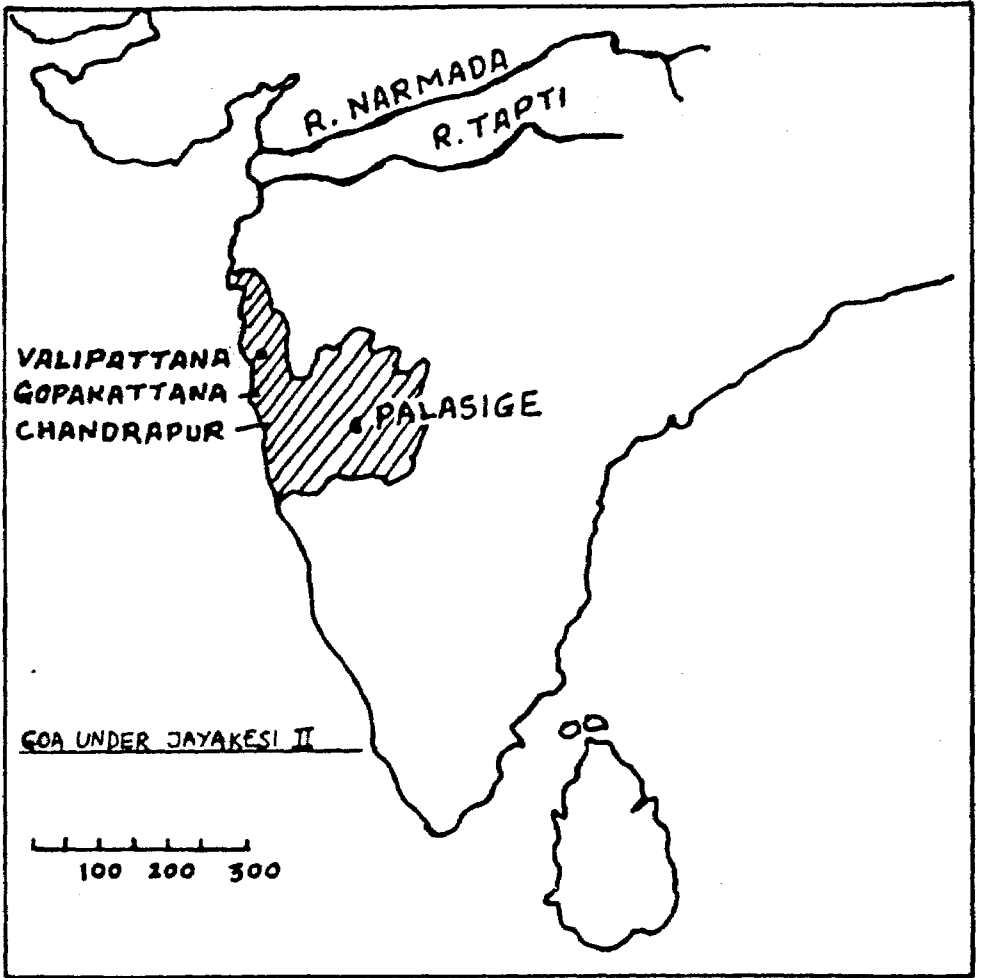
Source: Satoskar B.D., *Gomantak: Prakriti ani Sanskriti*, Pune: Shubhada Publications, 1982, Vol. 2, p. 435.

MAP 3



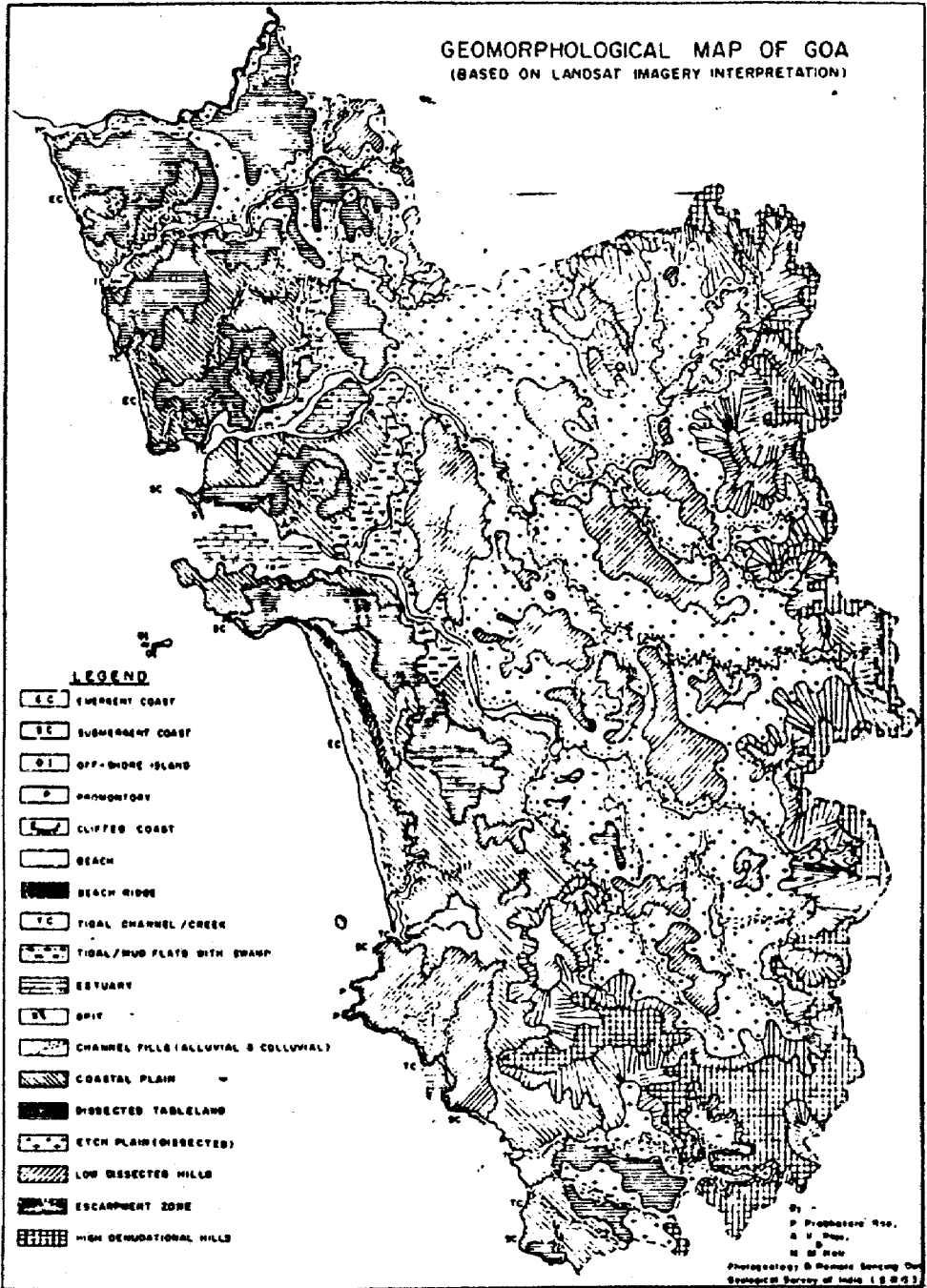
Source: Satoskar, B.D., *Gomantak: Prakriti ani Sanskriti*, Pune: Shubhada Publications, 1982, Vol. 2, p. 438.

MAP 4



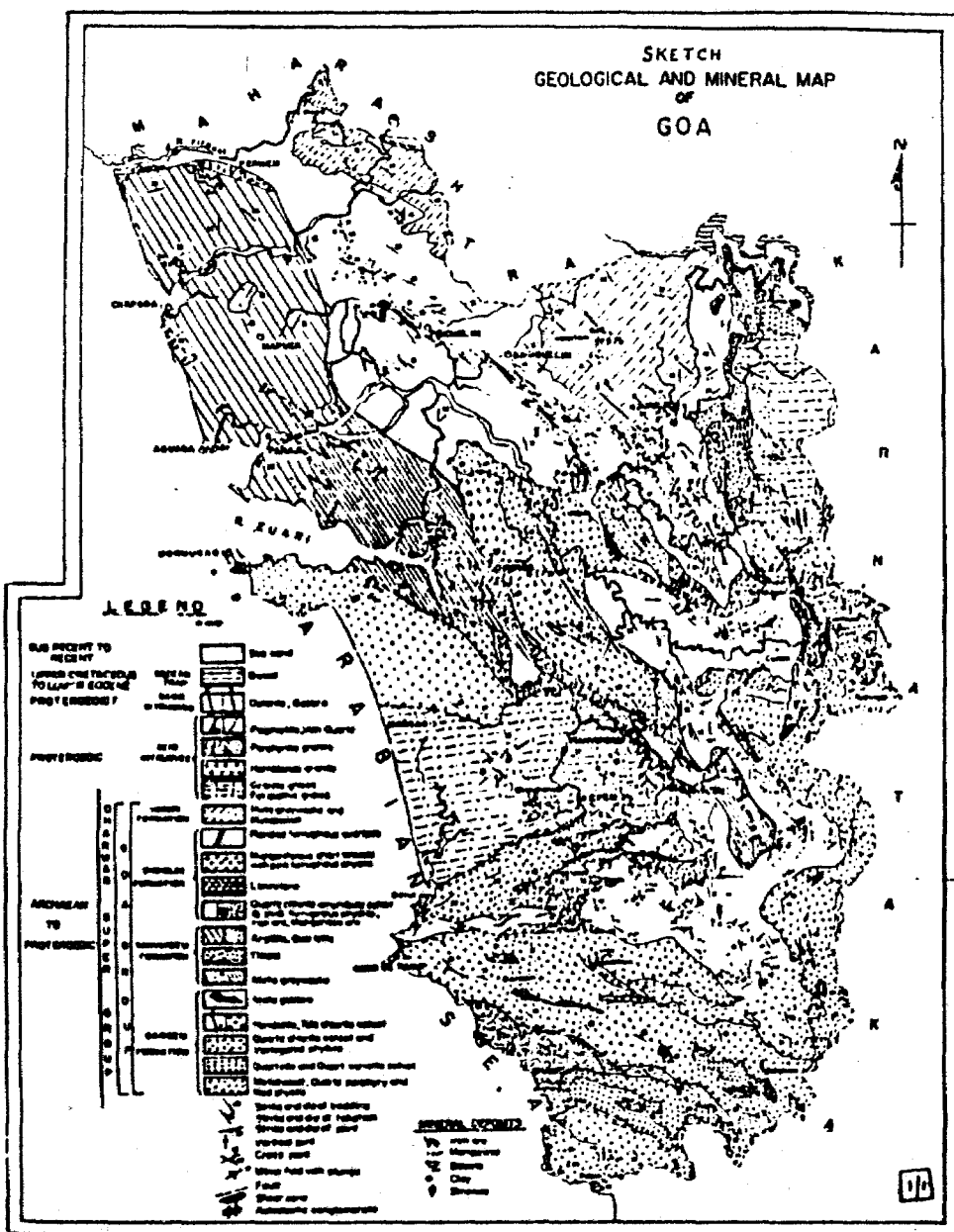
Source: Pereira, Gerald, *An Outline of Pre-Portuguese History of Goa*, Vasco da Gama: Gerald Pereira, 1973, p. 66 a.

MAP 5



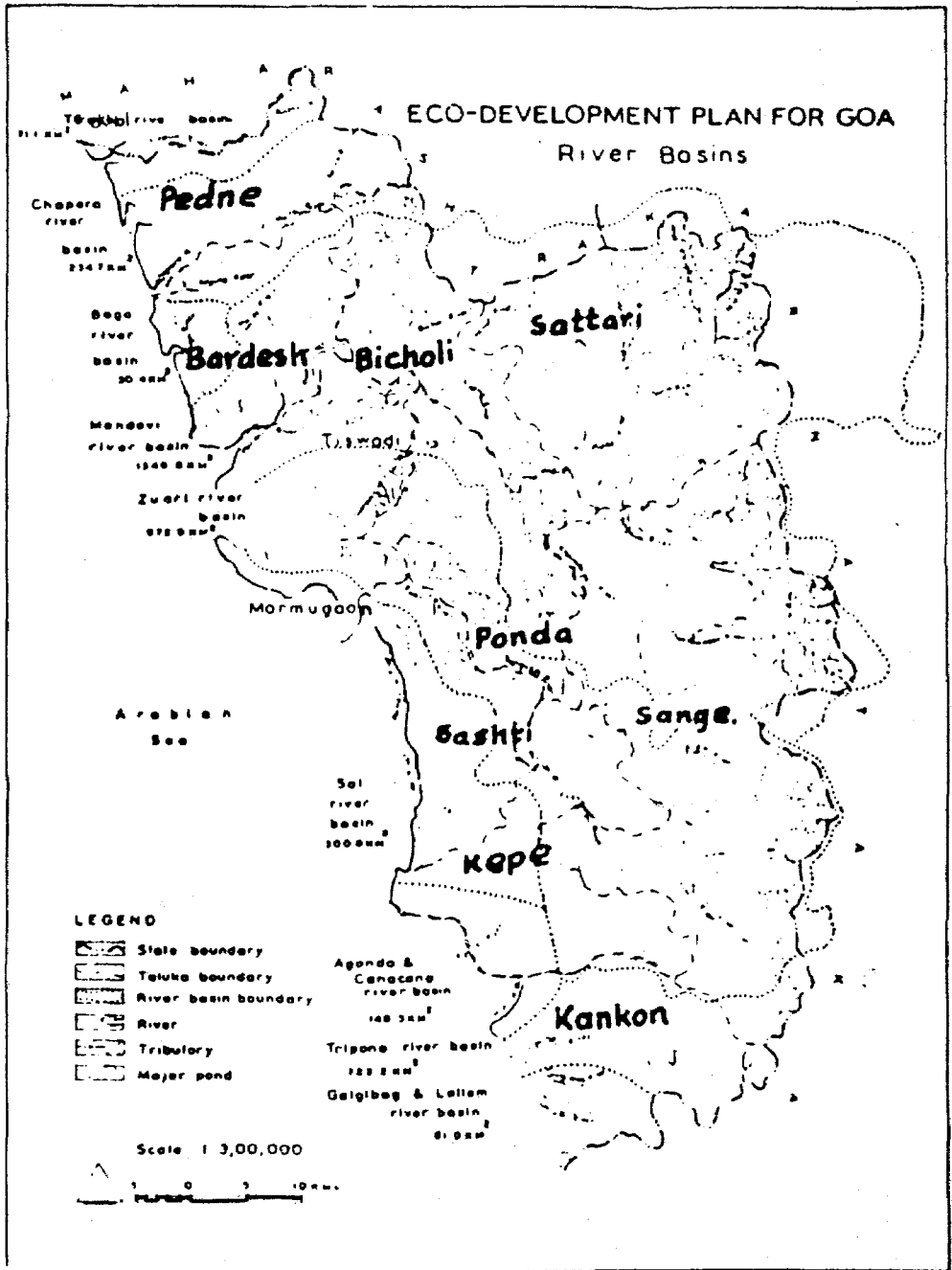
Source: Rao P. Prabhakar, Raju A.V., Nair M.M., "Geomorphology of Goa", *Earth Resources for Goa's Development*, GSI, Hyderabad. 1985, opp. p. 585.

MAP 6



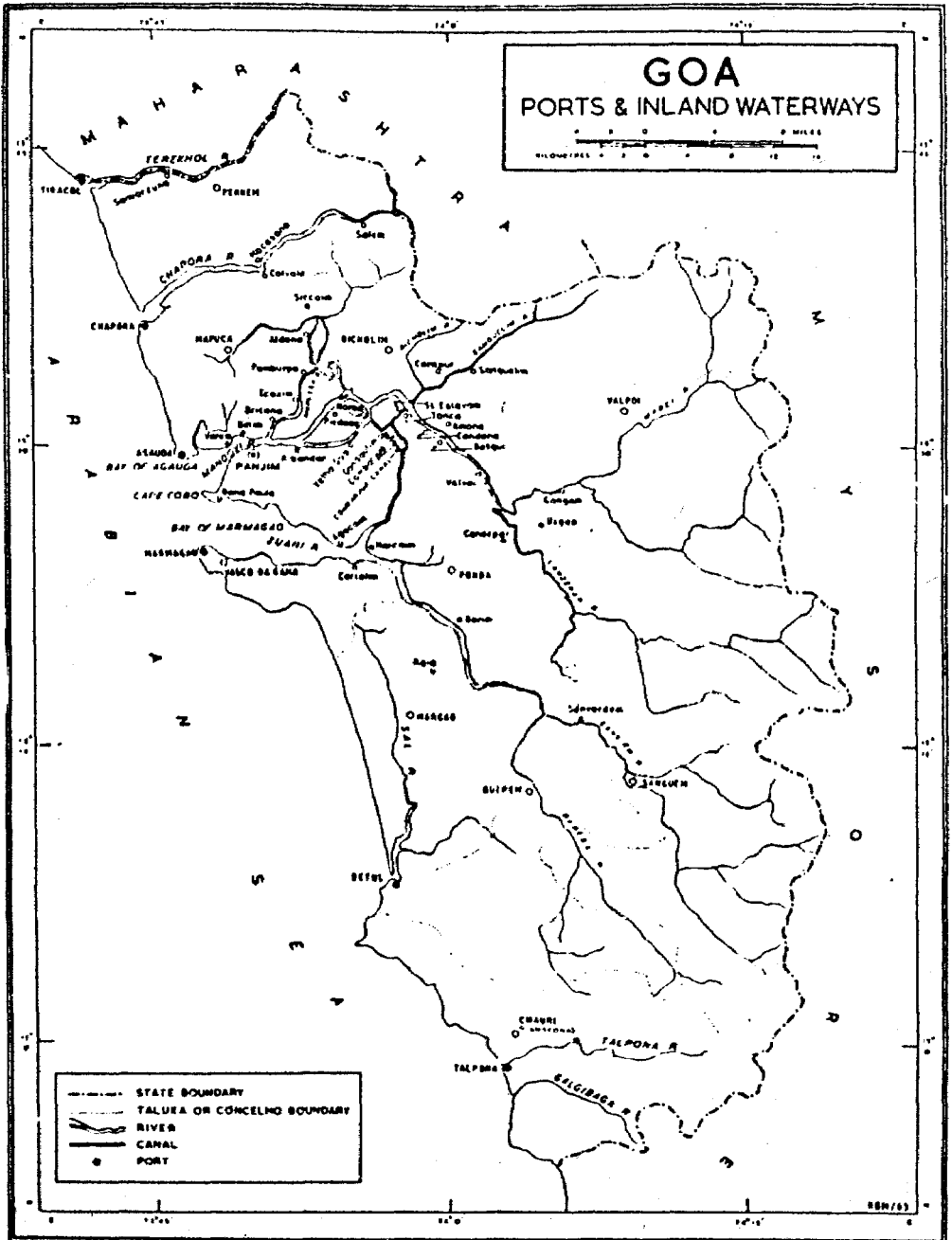
Source: Gokul A.R., Srinivasan M.D., Gopalakrishnan K. Viswanathan, L.S., "Stratigraphy & Structure of Goa". ERGD, GSI, Hyderabad, 1985. opp. p. 4.

MAP 7



Source: Report of the Task Force on Eco-Development Plan for Goa, New Delhi: Planning Commission, Government of India, 1982, p. 37.

MAP. 8



Source: *Techno-Economic Survey of Goa, Daman & Diu*, New Delhi: NCAER, 1964, p. 128.

REFERENCES

1. *Statistical Year Book for the Year 1977-78 and 1978-79*, Panaji: Directorate of Planning, Statistics and Evaluation, Government of Goa, Daman and Diu, 1982, p.3. *India Today and Tomorrow, Goa Special*, vol.9, no.1, 1981, pp.7, 9.
2. Saldanha, C.F., *A Short History of Goa*, Bombay: Anglo-Lusitano, 1952, p.1.
3. "Goa at a Glance—1988" (Chart), Panaji: Directorate of Planning, Statistics and Evaluation, Government of Goa, 1988.
4. Dhume, A.R.S., *The Cultural History of Goa from 10,000 B.C.—1352 A.D.* (= *TCHG*), Panaji: R.A.S. Dhume, 1985, pp.118, 306.
5. M.D'Anville (*Antiquite Geographique de L'Inde*, Paris, 1750, p.83) identifies it with Nelkinda. Dr. W. Vincent (ed.) (*The Periplus of the Erythrean Sea*, London, 1800, vol. II, pp.391 f.) equates it with Aigidii which other antiquarians like D' Anville and Fr. Paulino have identified with the island of Anjediva because of the similarity in names. Also see, Schoff, W.H. (trans.), *The Periplus of the Erythrean Sea—Travel and Trade in the Indian Ocean by a Merchant of the First Century*, London: Longmans, Green and Co., 1912, p.202. Lassen (*Indischer Alterthums Kunde*, Bonn, 85, vol. III, p.187) and C. Müller (*Geographi Graeci Minores*, vol I. p.296, and *Geographic Ptolomei*. 1608, lib. VIII, cap. I, tab .X) associate Goa with Chersonesus of the *Periplus*. Quoted partially from Fonseca, J.N. da, *An Historical and Archaeological Sketch of the City of Goa* (= *HASCG*), New Delhi: Asian Educational Services, 1986 reprint, p.117.
6. D'Anville, *Ibid.* Associates Goa with Melinda and P.F.J. Gosseleini (*Recherches sur la Geographie Systematique et Positive des Anciens*, Paris, 1790, tom. 3me, p. 208) with Tricadiba. Quoted from *HASCG*, p. 117. For the 'Kouba' identification see, *TCHG*, p. 306.
7. D'Anville, *Ibid.*
8. Rennel, Major, *Memoir*, London, 1798, p. xxxviii, as quoted in *HASCG*, p. 117.
9. Shirodkar, P.P., "Survey of the Ancient Kadamba Port of Gopakapattam". Paper presented at the seminar on "Ocean, Religion and Archaeology" held at the National Institute of Oceanography, Dona Paula, Goa, on 5-8-1989.
10. Dr. Lee (ed.) in *Travels of Ibn Batuta*, London, 1829, p. 164; Gildemeister's *Scriptorium Arabum de rebus Indicis*, Bonn, 1838, p. 48; Reinaud's *Geographie de Abulfeda*, Paris, 1848, p. cdxxvi, Badger's *Travels of Ludovico de Varthema*, London, 1868, p. 271, and others. Quoted from *HASCG*, p. 118. Colonel Yule, however, disagrees with the above point of view. To him, Kuwa is synonymous with Conva, located to the south of the estuary of Mahi.
11. Yule's *Cathay and the Way Thither*, London, 1866, vol. II, p. 444. Some scholars dispute this identification for they opine that Sindabur is a corruption of 'Sidan' ('Sanjan') which is today called St. John's Point of Rennel, located between Bombay and Daman. As quoted in *HASCG*, pp. 118-119.
12. Yule, H., and Burnell, A.C. (eds.), *Hobson-Jobson*, London, John Murray, 1903, p. 379.
13. *HASCG*, p. 119. B.D Satoskar raises a doubt about this identification and suggests that Chintabor could be Chintakulem, near Sadashivgad, on the banks of the Kalinadi: Satoskar, B.D, *Gomantak: Prakriti ani Sanskriti* (=

- GPS) Pune : Shubhada Publications, 1982, vol. II, pp. 24-25.
14. Arunachalam, B., "Socotra in Indian Navigational Traditions". Paper presented at the inter-disciplinary seminar on "Islands of the North Indian Ocean", co-sponsored by the Department of Geography, University of Bombay at Vidyanagari, Bombay, on 22-23 July 1989, pp. 10-11.
 15. *Hobson-Jobson*, p. 379.
 16. *HASCG*, pp. 115-116.
 17. Esteves, Sarto, *Goa and its Future*, Bombay: Manaktalas, 1966, p. 8.
 18. *Ibid.*, p. 116. Also see, *Hobson-Jobson*, p. 37 and Pereira, Gerald, *An Outline of Pre-Portuguese History of Goa (=OPPHG)*, Vasco da Gama : Gerald Pereira, 1973, p. 52.
 19. *HASCG*, p. 114.
 20. *GPS II*, p. 18.
 21. The former is more of a regional term as has been discussed later on in this chapter, while the latter is believed to have been derived from the village of Sonawali (golden village) located in the vicinity of the battle field where Lord Krishna and Jarasandha were engaged in a fierce combat. *Vide*, Varde Valaulekar, V.R., *Goenkaranchi Goanbhayli Vasruk*, Bombay: Gomantak Printing Press, 1928, p. 5.
 22. *Ibid.* Gomant has been variously identified with the Sahya mountain, or with the hills lying to the south or the southeast of Nasik or with those located in the Mysore region. *Vide* Law, B.C., *Historical Geography of Ancient India (=HGAI)*, Delhi: Ess Ess Publications, 1976, p. 22.
 23. *GPS*, pp. 28-31., *TCHG*, p. 306.
 24. Couto, Diogo do, *Decada IV*, liv. V, Cap. iv.
 25. Braganza, Alfred, *The Discovery of Goa*, Bombay: Brooks Publications, 1964, p. 8.
 26. Paes, Leonardo, *Promptuario das Definições Indicas*, II, cap. 3. and Souza, Francisco de. *O Oriente Conquistado*, vol. I, p. 154.
 27. *HASCG*, p. 115.
 28. *Aajcha Va Kalcha Gomantak*, Bombay: The Goa Hindu Association, 1954, p. 7.
 29. *TCHG*, p. 2.
 30. *Mahabharat*, xii, 49, 67, quoted in Yazdani, G. (ed.), *The Early History of the Deccan (=EHD)*, London : Oxford University Press, 1960, parts I-VI, p. 33.
 31. *HASCG*, p. 114.
 32. *TCHG*, p. 9.
 33. *OPPHG*, p. 12.
 34. *GPS-II*, p. 32.
 35. Upadhyaya, B.S., *op. cit.*, pp. 54, 73. Sir R.G. Bhandarkar refers to it as northern Konkan with Shurparadesh or modern Sopara as its capital.
 36. *Mahabharata: Bhismaparva*, IX, p. 335; *Vanaparva*, ccxvii, pp. 7885-6; *Santiparva*, XLIX, pp. 1780-82. *EHD*, p. 33. Also see Law, B.C. *Geographical Essays Relating to Ancient Geography of India*, Delhi: Bharatiya Publishing House, 1976, pp. 69, 136-138; and *HGAI*, pp. 12-14.
 37. *EHD*, p. 34.
 38. Upadhyaya, B.S., *India in Kalidasa*, Delhi: S. Chand and Co., 1968, pp. 54, 73.
 39. *GPS-II*, p. 39.
 40. *EHD*, p. 35. Konkan has been identified with Concondae to whom Pliny refers to as a people who lived in the territory lying in the middle of the route connecting south India to the mouth of the Indus: Cummingham, A., *The Ancient Geography of India*, Varanasi: Indological Book House, 1963, p.

- 466.
41. *GPS-II*, p. 39. Also see, Varde Valaulekar, V.R., *op.cit.*, p. 163.
 42. *OHPPG*, pp. 13-14; Pissurlencar, P.S.S., "Goa ha 1500 Anos", *O Oriente Portugues*, Nova Goa: Imprensa Goncalves, no. 6, 1934, p. 397.
 43. Pissurlencar, *op.cit.*, pp. 391-2.
 44. *Ibid.*, pp. 392-397.
 45. Report in *The Navhind Times*, Panaji, 8-4-1974.
 46. Pissurlencar, *op.cit.*, p. 397; *TCHG*, p. 187; and *GGDD-I*, p.66.
 47. Report in *The Navhind Times*, 8-4-1974.
 48. *PPHG*, p. 16; *TCHG*, p. 186.
 49. Girnar Inscription of Mahakshatrapa Rudradaman, *EHD*, p. 97.
 50. Surat plates of Vyaghrasena (c. 489 A.D.) indicate that the Traikutakas exercised their sway over *Aparanadi-adesa*, *GAIL*, p. 45; *GGDD-I*, p. 71.
 51. *Epigraphia Indica*, XXXIII, p. 295; *GAIL*, p. 178. Dhume, however, identified Kumaradvipa with the island of Ranneache Juve in Bardesh, *TCHG*, p. 212.
 52. *TCHG*, pp. 79, 197-8.
 53. Cunnigham, A., *op.cit.*, pp. 465-6, 477.
 54. Aihole inscription of Kirtivarman's son, Pulakesi II, of c. 634 A.D. *GAIL*, p. 46.
 55. *EI*, XXXI, p. 232; *EI*, III, p. 51. Goa plate, *Journal of the Bombay Branch of the Royal Asiatic Society (=JBBRAS)*, X, p. 348; *Indian Antiquary (=IA)*, XIX, pp. 11, 12.
 56. *GGDD-I*, pp. 82-3.
 57. *Ibid.*, p. 85. There were three families of the Silaharas: The South Konkan or the Goan Silaharas, the North Konkan Silaharas and the Southern Maratha Silaharas. For further details *vide OPPHG*, pp. 28-31.
 58. *GPS-II*, pp.43-53: for identification of Valipattana. *GGDD-I*, p. 85.
 59. *TCHG*, p. 237 and *GGDD-I*, p. 86.
 60. *OPPHG*, p. 31.
 61. *Ibid.*, p. 45. For details of the original kingdom of the Goa Kadambas *vide*, Mishra, P., *The Kadambas (=TK)*, Allahabad: Mithila Prakashan, 1979, p.52. *The Kadamba Kula (=KK)* by George Moraes (Bombay: B.X. Furtado and Sons, 1931) is a monumental work on the history of the Kadambas.
 62. *EI*, XIII, p. 310; *OPPHG*, pp. 47-48.
 63. Pissurlencar, P.S.S., "Inscrições Pre-Portuguesas de Goa", (= "IPPG") *O Oriente Portugues*, no. 22. 1938. pp.386-400; *KK*, pp. 259-86; *GPS - II*, pp. 204-67.
 64. Shirodkar, P.P., *op.cit.*. In the Kadarole inscription of Guhalladeva II, Gopakapattana is referred to as "the best of cities", *KK*, pp.465-7. For the commercial contacts of Gopakapattana *vide* "IPPG", pp. 395-7.
 65. *OPPHG*, p. 51; *TK*, p. 59.
 66. *EI*, XIII, pp. 316-26; *TK*, p. 45.
 67. *OPPHG*, p. 54; *TCHG*, p. 241; *IBBRAS*, XI, p. 244; Bhandarkar, R.G., *Early History of the Deccan and Miscellaneous Historical Essays*, Poona: Bhandarkar Oriental Research Institute, 1983, p. 120.
 68. The Khedarpur and Kolhapur inscriptions dated c. 1213 and 1218-19 A.D., respectively, of the Yadava emperor Singhana II (1209-1247 A.D.) , *GGDD-I*, pp. 11-2.
 69. Gibb, H.A.R. (trans.) *Ibn Batuta's Travels in Asia and Africa (1325-1345)*, London: George Routledge and Sons Ltd., 1929, p. 230.
 70. *TCHG*, pp. 240-1. *Newsletter*, Panaji: Directorate of the Archives, Archaeology and Museum, Government of Goa, Daman and Diu, vol. I, 1, pp. 49-54. *GGDD -I*, p. 125.

71. "IPPG", p. 422; OPPHG, p. 74.
72. Correa, Gaspar, *Lendas da India*, II, p. 55; Albuquerque, Braz da, *Commentarios do Grande Afonso Dalbuquerque*, Lisbon: Imprensa Nacional, vol. II p. 92. Barros, João de *Decadas da Asia*, Lisbon: 1777, vol. II, liv. V, cap. I.
73. GGDD-I pp. 134-135. It has also been opined that the coastal boundaries of Adilshahi Goa were Banda in the north and Sadashivgad in the south ; Shastry, B.S., *Studies in Indo-Portuguese History*, Bangalore: IBH Prakashan, 1981, p. 129.
74. There is a controversy regarding the first conquest of Goa. For details vide Shastry, B.S., *op.cit.*, pp. 127-9; and Fragoso, J.J., "Conquista de Goa", *O Oriente Portugues*, vol. VIII, 1911, pp. 212-7.
75. GGDD- I, p. 144.
76. Ball, V., (trans.), *Travels in India* by Jean-Baptiste Tavernier, New Delhi: Oriental Books Reprint Corporation, 1977, vol. I, p. 150; Sen, S.N., (ed.), *Indian Travels of Thevenot and Careri*, New Delhi: National Archives of India, 1949, p. 191 (Careri), p. 129 (Thevenot); Fryer, J., *Travels*, London: Hakluyt Society, 1912, vol.II, p.10.
77. Cunha Rivara, J.H. da, *Arquivo Portugues Oriental*, Nova Goa: Imprensa Nacional, 1865, Fasc. 5, Pt. I, doc. 153, p. 268.
78. Cf. Mhamai, S. K., *The Sawants of Wadi*, New Delhi: Concept Publ. Co., 1984; Pissurlencar, P.S.S., *Portuguez-Marathe Sambandha*, Pune: University of Poona, 1967.
79. *Ibid.* GGDD-I, pp. 183-6.
80. Shrivastava, P.P., *Conservation of Cultural Heritage, Environment and Pollution Control in Goa: A Status Report* April, 1987, Panaji: Government of Goa, Daman and Diu, 1987, p. 1.
81. GGDD-I, pp. 24-25. Also see, *Techno-Economic Survey of Goa, Daman and Diu (=TES)*, New Delhi : National Council of Applied Economic Research, 1964, p. 4.
82. *Report of the Task Force on Eco-Development Plan for Goa (=RTF)*, New Delhi: Government of India, Planning Commission, 1982, p. 6.
83. GGDD-I, p. 24.
84. *Ibid.* Also see, *RTF*, p. 24 and Annexure 3.1, p. 116.
85. *RTF*, p. 116.
86. *Statistical Pocket Book of the Union Territory of Goa, Daman and Diu (=SPB)*, Panaji: Directorate of Planning, Statistics and Evaluation, Government of Goa, Daman and Diu, 1986, p. 1. This is the latest edition of the *SPB* as on 1-8-1989.
87. GGDD-I, p. 25.
88. *RTF*, Annexure 3.4, p. 119.
89. Rao, P. P., Raju, A.V. and Nair, M.M., "Geomorphology of Goa" in *Earth Resources for Goa's Development (=ERGD)*, Hyderabad: Geological Survey of India, 1985, p. 583.
90. *Loc. cit.*
91. *Western Ghats Region—Goa Sub-Regional Plan (=WGR)*, (Draft), New Delhi: Town and Country Planning Organisation, Ministry of Works and Housing, Government of India, 1983, p. 10.
92. *RTF*, p. 1.
93. GGDD-I, p. 4.
94. *SYB*, p. 5.
95. Ghosh, T.K., "Groundwater Potential Evaluation of an Area in Goa by Remote Sensing Methods". *ERGD*. p. 419.

96. *RTF*, p. 1.
97. *GGDD-I*, pp. 4, 15.
98. *Ibid.*, p. 4.
99. *RTF*, p. 1.
100. *Ibid.*, p. 6.
101. *OPPHG*, pp. 9-10.
102. *GGDD-I*, p. 5.
103. Gokul, A.R., "Structure and Tectonics of Goa", *ERGD*, p. 15.
104. Gokul, A.R. *et al.*, "Stratigraphy and Structure of Goa", *ERGD*, pp. 4-11.
105. *GGDD-I*, p. 3. Also see, *ERGD*, p.1. and Oertel, G., *A Geologia do distrito de Goa*, Lisbon: Comunicações dos serviços geológicos de Portugal, 1958, tomo 40.
106. Gokul, A.R. *et al.*, *op. cit.*, *ERGD*, p. 4. Also see, Fernandes, A.T. and D'Souza, A.T, " On the Occurrence of Landslips at Altinho, Panaji, Goa", *ERGD*, pp. 512-513.
107. Discussion with Dr A.G. Desai, Head, Department of Geology, Goa University.
108. *RTF*, p. 53.
109. *Ibid.*, pp. 53-54.
110. D'Souza, A.T., "The Growth of Iron Ore Industry in Goa", *ERGD*, pp. 339-343.
111. *WGR*, pp. 70, 72.
112. *RTF*, p. 54.
113. *Ibid.*
114. *WGR*, p.73.
115. *Industrial and Commercial Directory of Goa, Daman and Diu, 1985* (= *Directory*), Panaji:Goa Chamber of Commerce and Industry, 1985, p. 48.
116. *RTF*, p. 54.
117. "Production of Value-Added Products from Iron Ore". Paper presented at seminar on "Exchange of Ideas with Trade Representatives on Investment Opportunity in Goa", organised by the Directorate of Industries and Mines, Government of Goa, held at Kala Academy on 9-11 March, 1988 (= *Seminar' 88*).
118. *RTF*, p. 52.
119. *RTF*, p. 41.
120. Shrivastav, P.P., *op.cit.*, p. 11.
121. *TES*, p. 94.
122. Discussion with Dr. A.G. Desai, Head, Department of Geology, Goa University.
123. *RTF*, p. 7.
124. For a description of the soil types found in Goa *vide RTF*, pp. 7-8; Ghosh, T.K., *op. cit.*; *ERGD*, p. 419; and Desai, C.G., "Surface Water Resources for Goa's Development, *ERGD*, p.425.
125. *SPB*, pp. 20-21.
126. *RTF*, p.18; *TES*, pp. 25-32; *Directory*, pp. 23-26.
127. *GGDD-I*, pp. 37-39.
128. *Ibid.*, p. 41.
129. *RTF*, p. 39; *WGR*, p. 65; *SPB*, p. 20.
130. *TES*, p. 69; *WGR*, pp. 65-66.
131. *WRG*, pp. 65-66; *TES*, p. 71.
132. *RTF*, p. 42.
133. These include "unrestricted lopping, unlimited grazing, free use of firewood, free use of timber for agricultural implements and 'hutting' and the removal

- of leaf manure": *TES*, p. 72.
134. *WGR*, pp. 62-63.
135. *TES*, p. 56.
136. *RTF*, p. 40; *Directory*, p. 30.
137. *TES*, p. 60.
138. *RTF*, p. 71.
139. Dhawan, R.M., "Scope for Development of Fisheries in Goa". Paper presented at *Seminar'88*, p. 1.
140. *RTF*, p. 72.
141. *Ibid.*, p. 71; *WGR*, p. 82.
142. *RTF*, p. 72.
143. *SPB*, p. 127.
144. *RTF*, pp. 71-72.
145. *RTF*, p. 71.
146. Pathak, B.D., "Groundwater Resources and Development Prospects in the Union Territory of Goa", *ERGD*, pp.408-11.
147. *RTF*, p. 25.
148. *GGDD-I*, p. 6.
149. Subramanian, A. " Surface and Groundwater Resources in the Northern Part of Goa Districts, Union Territory of Goa, Daman and Diu", *ERGD*, p. 475.
150. *GGDD-I*, pp. 6-8; *OPPHG*, p. 9.; Costa, B.C. da, "Geografia, fisica e politica", *A India Portuguesa*, Nova Goa: Imprensa Nacional, 1923, vol. I, pp. 11 ff; *ERGD*, p. 475; *WRG*, pp. 119-121; Rebello, A., "Inland Water Transport in Goa", *Seminar '88*, pp. 1-3; and *SYB*, p. 4 for the details of the navigability of inland waterways in Goa.
151. *RTF*, p. 67.
152. Shrivastav, *op. cit.*, pp. 9-10.
153. *Directory*, p. 27.
154. *SPB*, p. L. The figure quoted is for Goa, Daman and Diu.
155. *RTF*, p. 42.
156. *TES*, p. 142.
157. *SPB*, pp. 47-58.
158. *RTF*, p. 43.
159. Shrivastav, P. P., *op.cit.*, p. 15.
160. Pant, A. *et al.*, "The Changing Landscape of Goa—Need for Environmental Planning and Management" (Abstract), *ERGD*, p. 614.

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