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KARIMANAL (MINERAL BEACH-SAND) MINING IN THE ALAPPUZHA COAST OF KERALA – A PEOPLE’S PERSPECTIVE

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Abstract

The coast sand dunes of Kerala are enriched with six prescribed minerals viz. ilmenite, rutile, zircon, monazite, leucoxene (brown ilmenite), sillimanite and garnet. The state government in a much controversial move decided to lease out a 17-km stretch of state owned land from Valiyazhikkal to Thottappilly in Alappuzha district to Kerala Rare Earths and Minerals Limited (KREML), a joint sector company, to conduct mineral sand mining for twenty years. In the present study, the researchers try to comprehend the situation prevailing in the area. The study further tries to assess the seriousness of the social, environmental and health hazards that might result from the indiscriminate mining activity by a profit oriented company. The paper also attempts to compile the history of similar mining projects, their environmental consequences, social implications and mass movements that were successful in checking the negative implications of such hazards.

The government decision met criticism from all corners initially for the unprecedented haste with which the lease was awarded evoked suspicion. No authentic study was done before deciding to lease the land which is the means of livelihood for over 30,000 fishermen, apart from hundreds of coir workers. The coast line of Alappuzha and Kollam is densely populated with fisherman community and is one of the most populated stretches in the country (Census 2001). Sand mining in the area poses grave environmental as well as livelihood problems. Valiyazhikkal-Thottappilly stretch is a highly erosion-prone coastline. The mineral sand coast now acts as a sea wall protecting the area from sea erosion, and preventing sea water from flowing on to the rice fields in Kuttanad, which are close to this area as well as below sea level. Studies have shown that the area has the richest ground water storage in the state (Resource Atlas of Kerala, 1984). Radiation-related diseases have been reported from Chavara and the fear of this replicating in Alappuzha is justifiable.

References:

1. Census of India, 2001, Department of Census, Government of India.
2. Resource Atlas of Kerala, 1984, Center for Earth Science Studies (CESS), Kerala

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“This land belongs to a Public Trust, the Trust of People whose generations had been living here since time immemorial. Neither does it belong to the government nor to any individual. Abandon this callous plan to rampage their milieu. Make it a daily practice to fight against the globalization policies that connive to sell off all what is left for the future generations”.

Justice V.R Krishna Iyer

... so said Justice Iyer, in his key note address to the Anti Beach-sand Mining Convention, held at Thrikunnapuzha, the heartland of peoples movement, addressing thousands of valiant volunteers, who are not the pseudo scientists or the self proclaimed environmentalists, but the local men and women, who decided that their bit of serene land will be protected for their own survival and for the future generations as well, from this atrocious conspiracy to muddle with the nature.

Introduction

Kerala is known for its 570 km long coastline as one of world's most potential fishing-ground with unique biodiversity and also as the abundant source of some of the rarest minerals in the globe, especially its southern coast. It is one of the ten 'Paradises Found' by the National Geographic Traveler, for its diverse geography and overwhelming greenery, in which, fall some of the sandy beaches and back-waters. Sand dunes of the southern Kerala coast are enriched with six "prescribed substances" viz. ilmenite, rutile, zircon, monazite, leucoxene (brown ilmenite), sillimanite and garnet. The most potential source of these mineral deposits is the coastline of the districts of Kollam and Alappuzha that stretches about 150 km.

Mining in the Kollam coast started in 1922 and still continues, undisrupted. As the minerals mined contain potential atomic fuel, Central Government laid strict mining rules and regulations (Atomic Energy Act, 1962), which prohibited individuals or private enterprises from undertaking such mining activity. These rules and regulation were relaxed recently. 'Under the Industrial Policy Statement of 1991 the mining and production of minerals classified as "prescribed substances" is reserved for the public sector. However, the Policy Statement also allows selective entry of the private sector' (DAE. GoI, Oct. 1998). With the legal cover of this statement in the act, Kerala State Government, in a much controversial move decided to lease out a 17-km stretch of state owned land from Valiyazhikkal to Thottappilly in Alappuzha district to Kerala Rare Earths and Minerals Limited (hereafter KREML), a joint venture company, in which a Kochi-based private sector company holds majority stake to conduct mineral sand mining for twenty years.

The government decision met with criticism from many corners. The proposal created much havoc in the society there, which resulted in a mass movement. Corruption and conspiracy are doubted, as ministers, politicians and so called scientists uttered nonsense arguments to support the project implementation. Socio-political leaders, senior scientists and a large section of well meaning people joined the movement to protest against the government's move from genuine concerns for the immediately affected but also understanding the far-reaching consequences and the dangerous portents of the project ([Photo 1](#)). 'The movement demands complete abandonment of the mining project along Alappuzha coast in general and Valiyazhikkal to Thottappilly in particular' [Janakeeya Prathirodha Samithy (People's Resistance Committee) Bulletin, August 2003].

Kerala has a history of environmental social movements, which has won victories many a times against the iron hands of the powers that be. The historic Silent Valley movement, the ongoing Chaliyar River movement, the movement against Coca Cola factory in Palakkad, now the Anti Beach-Sand Mining movement, other environmental movements, smaller but not of lesser importance, all lead by local communities and supported by social activists, are golden pages in the history of people's movements. The authors, as environmental activists had been supporting the anti beach sand mining movement scientifically and intellectually right from the initial stages onwards. In the present study, the researchers try to assess the seriousness of the social, environmental and health hazards that might result from the indiscriminate mining activity by a profit oriented company. A statement validity analysis is also conducted in order to summarize the findings of the study.

Area proposed for mining (Study Area)

The area that is offered for mining is in the Thrikunnapuzha and Arattupuzha panchayath of the Haripad and Muthukulam Blocks of Alappuzha District, respectively. These panchayaths cover about 39.13 km². The area extends from 9°7'24''N to 9°18'36''N and 76°23'5''E to 76°28'44''E ([Map 1](#)). The district, in general, has a pleasant climate with the South West Monsoon season being very wet. Following table (Table 1) has some of the critical parameters of the climatic conditions of the district.

Climatic Parameters of Alappuzha District

Parameter	
Mean annual temperature (c)	27.3
Total annual rainfall (in mm)	3,137
Average number of rainy days	145

Source: RTAC&MRM&PRS, 2003

The coastal deposits which are found along the area proposed for mining are those formed during the Neogene time and are confined to the littoral zone of Kerala, having a maximum width of 16 Km in Kollam District, and a maximum thickness of about 600 m in the Ambalapuzha region. Marine processes control the entire area. Specific origin of the land mass can be related to accretion, erosion and complex processes. Morphological manifestations are coastal plain (sandy and lateritic) and plains with palaeo-strand lines and ridge and runnel topography within coastal plain. [RTAC&MRM&PRS - CRHPA - Kerala, 2003]. A series of dunes/ridges marking the repeated regressional and transgressional events characterize this coastal plain. Soil of the area belongs to the great group of Tropopsamments - Tropofluvents, commonly called Coastal Alluvium (Resource Atlas of Kerala, 1984, Plate 7). This coast is fully exposed to the South West Monsoon winds with the high and rough waves approaching from the southwest.

In the northern portion beyond Kayamkulam and extending up to Thottappalli in Alapuzha district, the heavy mineral content is estimated at 17 million ton out of a total raw sand reserve of 242 million tonne. The ilmenite content in the heavy minerals is 9 million ton. Arattupuzha panchayath with Kayamkulam kayal as southern boundary exhibits the characteristics of a coastal sandy plain along with narrow beach and elongated dune chains. The sand beach and dunes of this panchayath separates the northern inland spread of Kayamkulam kayal from the sea. Thrikunnapuzha panchayath, further north of Kayamkulam kayal is largely interspersed with a number of inland marshes and elongated incisions of the backwaters and canals. Sandy beach and dunes cover comparatively lesser area in this panchayath. The mining is proposed along this narrow strip of beach, which is critical to the ecological stability of the region.

One of the most significant morphological features in this coastal region is the backwater system generally running parallel to the shoreline, locally known as kayals (backwaters). Their formation is linked with subsidence/lowering of sea level and emergence of sand bars/spits [RTAC&MRM&PRS - SA, India (Kerala) Component, 2003].

Agriculture is the dominant land use type throughout the coastal belt. Settlement (built-up area), mixed tree crops and coconut are found along the sandy ridges. Cultural significance of the area is remarkable. Suffice to mention, here is the birthplace of one of the outstanding reformist leaders of Kerala who made the famous statement 'knowledge is god'. There is also the monument marking the tragic death of the most popular Malayalam poet, Kumaran Ashan. The area that will be immediately affected by the mining has about 50 odd schools. The area is rich with a large number of historic temples and churches. People belonging to various faiths and creeds are living here in harmony for centuries. The area is also known for its architectural variety, with a number of traditional houses and mansions that represent the famous Kerala architecture.

Aim

Aim of the paper is to analyze the scientific facts that underline the relevance of the anti beach-sand mining movement.

Objectives

- To collect all scientific material that is available on the impacts of beach-sand mining.
- To collect all available material on anti beach-sand mining people's movements across the globe and prepare a compendium of the same.
- To identify the negative implications of the proposed project citing available scientific documents and case studies.
- To conduct a qualitative validity analysis of the claims/statements of the proponents of beach sand mining.
- To produce a documentary about the movement and its scientific validity.

Materials and Methods

The study was based on available research works and secondary data on coastal sand mining in Kerala and elsewhere. Internet search was employed to collect the reports of similar movements around the world. Field visits were conducted for video graphing (using Sony TVR 200 DV Camera) the movement and also the area's socio-ecological relevance. Software such as Adobe Premier (for Movie Editing and Compilation), MapInfo5.0 (for Mapping), MS Power Point XP (for Poster Preparations) and MS Word XP (for Documentation) were used.

The study qualitatively analyzes the claims/statements of the proponents of the project and the claims/statements of the people's movement against the project. Scientific validity of these claims is critically assessed citing the words of experts, studies and similar experiences world wide. Other relevant associated issues are dealt separately.

Results

About 30 different websites were visited for collecting the materials required to conduct the study. Few of the most important books related to the topic were also referred. The study has scientifically justified the movement. However, researchers have tried to strike a clear balance between the necessity of resource utilization for people's benefit and blind environmentalism which attempts to restrain any developmental activity. The 8 minute documentary attracted considerable appreciation from the audience. A compendium made with the research reports, news reports, articles and text books collected to conduct the study is an immense source of reference for researchers who are interested in the socio-economic and ecological implications of such projects. The compendium can also act as a source material to build awareness among the scientific community, about the movement.

Discussion

Claims/Statements

For the project

KREML makes a number of claims and statements for the project. Few of the most important ones are listed below. The company has not issued any clear statement of facts on the reasons to support the project or any Environmental Impact Assessment (EIA) Statement to refer to so that one can know their view points. Only when a hue and cry developed that the company undertook a so called EIA in 3 months time, which is also not available for reference. Most of the statements/claims listed here are compiled from press reports and television interviews.

- This is tremendous wealth for us, and all we are trying to do is to channelise the wealth to strengthen our economy and to help sustain the development that we have achieved in the education, health and the social sectors (*Yahoo India News, 2003*).

- The State Industries Minister said a recent study by India Today magazine on states in the country had placed Kerala on top of the list but suggested that if there were no wealth creation, the state might lose its top status. "This is where projects like sand mining are important" he said (*Yahoo India News*, 2003).
- The Industry Minister was quoted as saying that the Government could not conserve the mineral sand forever and, in fact, it was being lost gradually by sea erosion. "Those who oppose sand mining are against any development in the State," he added (*Hindu Business Line*, 2003).
- 'The land is naturally radioactive. Living on it and opposing the mining project is not ethical' said the Industries Minister (*That's Malayalam.com*, 2003).
- The mining will provide direct employment to 400 people. Many more will have indirect employment (*Indiatogether.org*, Aug. 2003).
- Mining pits will be filled with a compound of mining residue and gravel.
- If not mined, the sand will be carried away by the ocean currents to the Sri Lankan coast.
- Mining is required for the greater good of the society. By sacrificing this little strip of land, the whole nation is going to benefit from the foreign currency earned.
- Sand is a renewable resource. Why can't it be mined?
- We should invite private capital for the speedy progress of the state.

Against the project

The researchers came across a number of claims and statements against beach sand mining in general, and the proposed project in particular. Almost all of them have scientific validity. These claims/statements and the associated scientific facts are discussed under three subheadings, namely, sociological implications, ecological implications and health hazards.

Sociological implications

The proposed mining project will have a number of negative impacts. Most important of all is the sociological repercussions. The coastline of Alappuzha is densely populated with fisherman community and is one of the most populated in the country (Census. 2001). Arattupuzha village is the most densely populated piece of land in the whole of Asia ([Map 2](#)). The fishing depended population here involves in activities such as small-scale fish distribution, fish curing, peeling etc. Marine fishing dominates and backwater fishing is relatively less. The area is identified as one of world's most potential and productive fishing grounds ([Photo 2](#)). Thousands of traditional fishermen who operate up to 20 km offshore fear that the sand mining project will deplete the already-dwindling fish stocks. Studies prove that their fears are not based on flimsy sentimental feelings or on any anti-developmental vested interests. Once uprooted from their milieu, these people will not be able to make a living in any other environment.

It is strange that the move to lease out the land is going on when some of the notable institutions and experts emphatically point out the detrimental effects of such mining projects. Even the apex governmental agency for advising on coastal resource utilization, namely Center for Earth Science Studies (hereafter CESS) identifies beach-sand mining in Kerala as a threat to the sociological and environmental stability. 'The Kerala coast has the richest deposits of heavy minerals in the country and their mining has generated certain social and environmental issues'. [RTAC&MRM&PRS - SA, India (Kerala) Component, 2003].

Indications of the expected environmental havoc are already visible in the area, which are the results of ongoing sand mining along Chavara coast, south of the proposed mining area. An economically important natural phenomenon that will be seriously affected by the proposed mining is the 'Mud banks' (locally called chakara), which used to be a regular feature on the Alappuzha

coast and is becoming scarce. Each catch during chakara is worth lakhs of rupees. This is the 'bonus' time for fisher folk since most of them save some money to tide over the ensuing lean period.

Mining will affect the coir and coir products depended population of the area. One of the major agricultural products of the area is coconut that grows widely along these coasts. Apart from selling coconuts as an edible good, people are involved in manufacturing coir from the husk of the coconuts. Coir and coir products are exported in a large scale and its local use is also considerable. Modern societies have begun to understand the importance of coir as an incomparable eco-friendly substance. Many of the fishing dependant households consider coir and coir products manufacturing as an additional source of income. Coir extraction process from the husk is complicated and requires brackish water to treat and soften it. The physico-chemical condition of the water is crucial for this process, as its variation might affect the quality of the coir strands. Once mined, the backwaters of the area will get more exposed to the sea, thereby changing the physico-chemical parameters of the water.

Inland fishing is the major source of income to a considerable population that lives away from the coast. It is estimated that the inland fish production of Kayamkulam kayal is about 1.5 million metric tons, annually. Aquaculture is a growing industry here. Elsewhere in the country, the productivity of aquaculture farms are falling, whereas in Alappuzha district, the methods adopted being traditional and eco-friendly, production is scaling, leading to the emergence of these farms all along the district that is widely interspersed by backwaters and inland water bodies. These farms are promising means of livelihood to the local communities. As it is the case with coir and coir products, water quality is an important parameter for health of fishes in the aquaculture farms. Even slight changes in the salinity levels will prove fatal to these fishes.

The beaches and backwaters of the area are famous for their scenic beauty. The State Government has declared beach and backwater tourism as one of the main areas for economic development and tourism is being systematically promoted in this part of the state. There are pockets along the coast with harbours and commercial centers. The southern tip of the area proposed for mining, at the mouth of Kayamkulam kayal, is where a proposed artificial fishing harbour is being constructed.

People of the area live under the constant threat and fury of nature ([Photo 3](#)). Studies show that coastal erosion is prevalent in the coastal strip proposed for mining. As a study indicates 'towards south of Purakkad from Thrikkunnapuzha to Thottapally, a zone of 4.3km is under moderate erosion' (Sreekala. et al, 1997). Relationship between mining and increase in rate of costal erosion is proved through the following words of some of the experts and studies. 'Coastal erosion is reported adjoining the site of beach wash, a regular practice for beach sand mining. Coastal erosion also causes damage to the properties leading to social discontent' [RTAC&MRM&PRS - SA, India (Kerala) Component, 2003]. "Extraction of beach sand which is also an exhaustible resource poses another problem because its depletion exposes coastal areas to the ravages of erosion" says Dr. Baba, Director of CESS (Hindu Online Edition, May 20. 2002). Erosion is already causing a social mayhem. People here lose their land due to nature's fury and now the proposed anthropogenic haphazard will add to the misery of them. The wave height reaches 3.2m with a wave period range from 5 to 7 sec, during monsoon. The normal tidal range varies form 0.9m to 1.0m. Erosion is a natural phenomena and the vulnerability of the coastline to this increases once uncontrolled mining starts. It is clear from these facts that KREML's claim to provide jobs for 400 men and women in the area will be after obliterating the life and livelihood of few tens of thousands or more directly and many more indirectly.

Ecological implications

Water

The immediate result of implementation of this project will be salinisation of the most potential source of ground water in the whole state. The area is identified as suitable for heavy-duty tube wells and open wells that can yield above 20,000 liters per hour (Resource Atlas of Kerala, 1984, Plate 6). Other than a small strip of land that center around this area, no other part of Kerala can yield this much ground water (see [Map 3](#)). Further, if the mined dune area is filled with gravel and silt (as claimed by the KREML) subsequent erosion will not only erode off the coasts but saline water will also infiltrate easily into the ground water storage aquifers. The density of sand that is found along this coast is 0.45 gm/ccm; no other compound known to mankind that can be cost effectively used to fill the mined area, has a density more than 0.25 gm/ccm. Moreover, gravel and silt have about 60% of humus that is easily soluble in seawater.

Water requirements for sand mining are considerable. Yarraman Mine of Australia is an example, which required 550 liters of water per second in the first phase. The requirement of the mine over its life time was calculated as about 300 liters per second (Quandamooka Lands Council, 2003).

Coastal Marine Topography

In the northern portion beyond Kayamkulam pozhi (lake mouth) extending up to Thottapalli in Alappuzha District, the reserve of Total Heavy Mineral (THM) estimated is of the order of 17 million tons with ilmenite content of 9 million metric tons from the raw sand reserve of 242 million tons (Industries Dept. GoK, Oct. 2002). KREML is said to be planning to produce one lakh tone of "beneficiated ilmenite" per annum, which would require mining of five lakh tons of mineral sand. A projection for the period of 20 years of proposed mining accounts for about 100 million metric tons of raw sand to be extracted from the region.

'Coastal areas are so dynamic in its geomorphic nature, that any anthropogenic activities can cause considerable changes to the prevailing process geomorphology. As in other geomorphic environments, coasts are composed of a wide range of land forms, only some of which are in equilibrium, or quasi-equilibrium with prevailing processes' (Summerfield, 1991). Coastal sand is derived from both land and sea. Every coast has a sand budget; they give away and take in sand. Sand brought in and deposited by the waves is dried in sunlight and saltated (jump) land ward by wind, forming a dune over time.

Dunes and beaches give away sand when storm wave impact is experienced on the coast, which in turn is deposited in the adjoining continental shelf by the currents and waves. Over years, this will raise the sea floor thereby changing the Land-Water Line from time to time; new beaches evolve out of this process. Waves shoal and break further offshore minimizing the erosive effect. 'It is a combination of waves, sunlight, tides and wind that enable dunes to repair the storm damage. These forms of energy essentially create a sand pump which pumps sand out of water, effectively protecting the land from the sea' (Seafriends Marine Conservation and Education Centre, 2003). If disturbed through an activity as intensive as mining, their capacity to protect the land from coastal erosion will be reduced resulting in a 'sick beach'. The repair process will completely fail in some cases creating a condition referred to as "the dead beach"; beaches of this kind will recede permanently.

Sand dunes parallel to the coastline offer a chance to study the phenomena of succession. Words of Odum (1971) in his famous book Fundamentals of Ecology describe the importance of coastal dunes; "Indiana Dunes affected by the encroachment of industry has become a subject of concern for the conservationists. These areas not only have a pervious beauty, but also constitute a natural 'teaching laboratory' for the study of succession of communities". Further, destruction of dunes will lead to coastal flooding. 'Sand dunes also provide future supply of sand to maintain the

beach. The wider the band of dunes, the larger the reservoir of sand. The height of natural dunes also provides protection from coastal flooding, storm surge and wave action' (Waiakato Regional Council, 1999). Once mined off, the coast will take millions of years to convalesce from the devastation. Mining will invariably affect the prevailing near coast current patterns, thereby affecting fish population. 'Sand mining on the beach removes sediment from the beach system leading to beach narrowing and deflation' (DLNR Coastal Lands Program, 1999). Reasons for abandoning the mining project along the Ratnagiri coast of Karnataka state is enough an example for understanding the disastrous effects of coastal mining in an Indian context. Mining was extensively and intensively carried out during 1953-54 all along this coast leading to severe erosion. While it might be a fact that sand from the coast may drift off to Sri Lanka during the southwest monsoon period, it may return during the northeast monsoon. If the sand is drifting away to Sri Lankan coast, it is a natural process that is happening for millions of years and by mining the available sand from the beaches, the rate of sand deposition in Kerala coast is not going to increase, but it is for sure that increased erosion will result in severe land loss.

Coastal erosion and beach erosion are different. Coastal lands may experience long term erosions under conditions such as sea level rise, which will lead to the landward migration of the beach or they will drown. This will cause the land behind the beach to erode leading to a condition called coastal erosion, which is a natural process. As there is coastal-erosion there is also the process called accretion happening elsewhere to balance this natural mechanism.

Beach erosion is mostly induced by anthropogenic interferences. As the beaches migrate landward, they draw upon the land and landward dunes for a constant supply of sand, as it does from the sea. Shoreline hardenings due to constructions and sand mining will reduce the constant supply of sand in the required amount interfering with this necessary profile adjustment, resulting in beach erosion. 'Beach erosion leads to narrowing and soon beach loss' (DLNR Coastal Lands Program, 1999).

Climate

In natural conditions, thermo dynamic processes neutralize emissions from radioactive minerals in the coast, thereby reducing effective radiation felt in the surroundings, considerably. Moreover, ilmenite and silica act as a blanket, playing their role in reducing the natural radiation. When the sand is passed through sulphuric acid in a stage of ilmenite extraction process, the emissions from the radioactive monazite is revitalized. This will increase the local atmospheric temperature, altering the micro climatic conditions. This would affect the energy budget of earth and also contribute to the phenomena of global warming in its own way.

Habitat

Fish Habitat – Physical disturbance of this habitat include disturbance to near shore fish spawning grounds and disruption to amphibian species nesting grounds. The most effected will be the unique ecological phenomena called mud banks (chakara) (with considerable economic implications) that occur during the months of May to July, which in turn attracts large schools of fishes. It is the landward accumulation of silt and bio residues drained into the seabed by the rivers. Sea along the coast will be very calm and devoid of waves throughout this period. Residents of the area complain that 'mud banks', which were regular in 70's and 80's and formed the backbone of the fishing community here, have become non-existent now. "Dwindling colloidal wealth will no more entice the fish to come in clusters" explains Dr. B. Madhusudana Kurup (Indiatogether.org, Aug. 2003). South of Kayamkulam kayal along the Chavara coast, where mining has been going on for years, is one of the worst affected. 'Mangroves like *Rhizophora* species and *Avicenna* species which harbour prawns and fishes are affected when coastal sand is mined' (Joseph, 2002).

Bird Habitat – Marine and coastal Birds use the area intensively. Physical disturbance of the habitat caused by dredging activities includes generation of noise, which can interrupt nesting/breeding activities. Other effects include destruction of habitat for foraging and nesting, increased exposure to re-suspended toxicants, human disturbance from mining operations and increased predator use of recently dredged areas.

Marsh Lands, Agricultural Land and Back Waters

The project will affect the adjoining Kuttanad marshlands, which is the rice bowl of the state. These low-lying areas (locally known as Punja), water logged during monsoon and mostly inundated by seawater, are distributed throughout the district. These are mostly mono cropped lands with rice as the main crop. Water bodies, mostly brackish, cover considerable area. Two RAMSAR sites that adjoin the Kayamkulam kayal namely Ashtamudi kayal and Vembanad kayal ([Map 4](#)) are well connected through various channels and canals. Most of this large contiguous marshland is about 1.5 meters below the sea level. Once the small strip of coastline that protects this region from the seawater is mined off, seawater intrusion would inundate the land and saline incursion will affect ground water also. This will see the emergence of a new landscape 25 to 30 km inland. Consequences of the mining project, thus will not restrain itself to the area mined or immediately around it, but will catapult a negative chain reaction all along the districts of Kollam, Alappuzha, Pathanamthitta, Kottayam and Ernakulam.

Health Hazards

Health hazards of the mining activity are of least concern for the authorities, as it seems from their deeds. As Mr. V.T. Padmanabhan (widely acknowledged environmental activist and scientist) puts it, "the establishment does not want to learn what is happening to these people because it will involve multi-million dollars in compensation" (New Internationalist, 1993). Health and health hazards are of the least concern in the mining sites and even in the factory of I.R.E at Chavara and elsewhere. Meticulous research work such as Duranthathinte Noottantileku (Into the Century of Disaster) - A research study on the environmental pollution at I.R.E Alwaye by V.T Padmanabhan (1985) and Manaljeevikal (Sand Creatures) - A Novel by G.R Indugopan (2002), clearly narrates not only the environmental havocs created by the ongoing coastal mining and the related industries in Chavara and elsewhere, but also explicitly talks about the health hazards caused by the industry.

The proposed mining is for extracting ilmenite, which is about 70% of the sand that is found on this coast (Mineral Sands of Kerala, p 28). The residue of the extraction process is the radioactive mineral such as monazite and zircon. Even I.R.E like Public Sector Company dumps this residue back in the coast, exposing the local biota to detrimental radioactivity; what a greedy, profit motivated private sector management would not do!

The maximum recommended absorbed dose of radiation is 5.0 mSv a-1* (less for children and expectant moms). It is cited in documents that 'At Kerala Beach, India radioactive sand produces a background of 35 mSv a-1' (FPAS, York University, 2003), which implies that people in the radioactive coast line of Kerala are at risk even when the ilmenite - silica blanket and the process of thermodynamic processes reduce the natural radiation from the radioactive minerals. Yet another document reports that 'the majority of the population of the Kerala region in India receives an annual dose greater than 500 mrem**. A small percentage of the inhabitants receive over 2,000 mrem per year and the highest recorded value has been 5,865 mrem in one year' (CTED. US DoE, 1995). The higher values could invariably be for those regions of Chavara coast and the dumping grounds of the industrial residue.

Somatic, genetic, teratogenic, stochastic and non - stochastic effects of the natural radiation are well studied and documented by researchers. A recent research conducted at the present mining sites along Chavara coast, by the geneticists of University of Cambridge, identified 22 mutations in the mitochondrial DNA sequences of families living in high-radiation area, where as a control population observed for the study, living in the nearby white sand area south of the mining sites, had only one mutation (Foster. et al, 2002). The researchers aptly refer to the areas of high incidence of mutations as "evolutionary hot spots". From the fact that rate of background radiation in the area tends to increase with mining and that mutations of human DNA increase with increase in background radiation, mining in the proposed site will only help to spread the resultant ailments and ill health from the Chavara coast and adjoining areas to a new area, affecting thousands more. The changes that increased radiation rates will cause to the flora and fauna of the area is unknown to even the scientific community as studies are lacking in this regard.

Other Relevant Issues

There are no strategic reasons involved in the proposed mining such that it could be claimed as a reason for undertaking the mining activity. The Atomic Act of 1998 not only divested the exclusive rights of atomic mineral mining from public sector companies but also authenticated the entry of private sector into the field. India already has about 3500 metric tons of Uranium 232 in stock for the use in fast breeder reactors. If extracted, Thorium and other radioactive minerals are too costly to be preserved for long.

Claims of the proponents seem to contradict many a times. KREML says that they are only to mine ilmenite. But those who support them are desperate to execute the project by claiming the necessity to remove radioactive minerals from sand and also citing its strategic relevance! Statements such as 'this is a renewable resource' need not be addressed in a scientific discussion as it is of common knowledge to researchers and scientists that sand is not a renewable resource. Private investment in mining sector will be disastrous as investors will only be profit motivated. For the sake of profit they will exploit Mother Nature as much as technology lets them do, without bothering the least for the social and ecological implications.

Experiences from Far and Wide

The bid to mine the coasts of Kerala cannot be read as an exclusive attempt to lance the nature. Prodigious attempts of this kind are facing severe resentments all across the globe. Some important examples of such attempts are listed below.

Kwale Coast, Kenya – “At least a quarter of the half million people who live in Kenya’s Kwale district, near the Indian Ocean coast, eventually may be evicted to make way for a controversial mining project by the Canadian firm Tiomin Resources Inc. The rest and others, living along the coast, could face significant health risks due to the toxic emissions associated with titanium mining” (*Toward Freedom Magazine, May 2001*).

“The endangered colobus monkey, marlins, tiger sharks, stable antelopes, mangroves and coral reefs will lose their habitat as the company churns out 1,500 tons of ore every hour, for 21 years, environmentalists argue. On the menu of disasters, they add radioactivity and its effects on the health of the locals” [*Nation (Nairobi), July 18, 2002*].

Quandamooka, Moreton and Stradbroke Island, Australia – “A significant proportion of Minjerriba land has or will be affected by CRL’s mining operations... As recently as August 2000 the Queensland Government issued CRL with a notice requiring the company to show-cause why their mining operations should continue at Ibis/Alpha. The notice was issued because of environmental infringements” (*Quandamooka Lands Council, 2003*). The environmental infringements cited by the Government are categorized as infringements on land, water, flora and

fauna and air. The government is concerned about the noise pollution and also the rehabilitation of the local community. Issues cited in the notice are so crucial that it reveals the environmental havocs created by such mining projects.

Waikato Beaches, Newzeland – “Sand mining has occurred in several coastal locations in the past. Most of these operations have now stopped. Sand mining can affect the sand reserves in beaches and dunes. This can reduce the buffering capacity of beach systems to storms. Whiritioa Beach (on the eastern Coromandel Coast) is a good example of how sand dunes can be damaged by vegetation clearance, sand mining and coastal subdivisions” (*Wiakato Regional Council, 1999*).

Trinidad and Tobago, Caribbean Island – “Beaches – besides being such an obvious asset as a tourist draw, they protect the coast line from erosion by the action of sea. Our beaches are of tremendous importance. They need minding. And yet, for the past fifteen years Tobago’s beaches have not been minded - they have been mined ... But large scale mining operations must be stopped immediately” (*Environment TOBAGO, 2003*).

Case of Santa Barbara Beach, São Miguel (Azores, Portugal) – “Constructors therefore used beaches and dunes as principal aggregate sources, exploiting the weaknesses of legal constraints to this type of mining activity as well as the inexistence of proper coastal management plans. This situation was only halted in the middle 1990’s, yet by that time most of the mining sites had already been damaged or destroyed, with the nearby coast showing clear symptoms of sediment starvation... The ability of mankind to transform coastal landscapes is well known and the case of Santa Barbara emphasizes its most prejudicial consequences, due to the absence of a clear policy of sustainable development and any kind of appropriate management plan. This is compounded by a shortsighted perspective on the potential value of the coast as a natural resource (*Borges. et al, 2002*).

Summary

The proposed mining creates concerns for environmentally conscious individuals in terms of the impacts that it will have on land, water, flora and fauna and air. The aspect of mining as a developmental activity and the fact that it is one of the primary activities of human kind from time immemorial was a concern when the study was initiated in this regard. But, facts and scientific findings do not allow the researchers to arrive at a conclusion favouring mining activity in the area even to the smallest extent. Environmental havocs and social disquiet prevailing on the plans of rehabilitation of 20,000 and more directly affected people out weigh the development potential of the project. To list a few of the most important concerns to arrive at a conclusion, against the proposed mining are:

- Livelihood of 20,000 fishing depended population and the rehabilitation for the same.
- Effect of the proposed mining on *Chakara* as a natural phenomenon and as a socio-economic balancing process.
- Socio economic impact on coir and coir products and tourism depended population.
- Socio economic impact on the rice cultivation, inland fishing and aquaculture depended population.
- Increased beach erosion and coastal erosion, resulting in land loss.
- Overall impact of mining on the soil profile that has developed into its present shape over millions of years.
- Land contamination as a result of spillages or improper disposal of mineral residues, sewerage and chemicals. Contamination has occurred along Chavara coast.
- Associated impacts on the RAMSAR sites.
- Microclimatic implications of mining activity.

- Radioactive residue dumped back into the mined pits resulting in increased natural radiation in the area. Health hazards as result of this process.
- Proposed mining can have effects such as contamination and salinisation of ground water, altering drainage patterns, changing the water balance and drawing down the water table.
- Large areas of vegetation, especially vegetation and coconut plantations along the sea coast and backwater coast will be affected due to change in TDS levels and salinisation levels in the subsurface water and surface water.
- Impacts on a number of rare species of birds, fishes, crabs, frogs, snakes etc. are unexplored.
- Dust generated by mining will be cancerous.
- Noise pollution caused by the mining machinery, trucks and cranes.

Validity Analysis

Sl. No	Statements of the project proponents	Valid / Not valid	Why is it not valid
1.	Statement 1	Not Valid	Sociological and environmental implications will be felt in atleast 5 districts of the state.
2.	Statement 2	Not Valid	The wealth created by mining cannot supplement the amount that is destroyed.
3.	Statement 3	Not Valid	No one is against the development of the state. Government need not conserve the sand; rather they need to simply leave it for the nature to take care.
4.	Statement 4	Not Valid	Natural radiation is considerable, however radiation is increased when sand is disturbed, ilmenite blanket is removed and the radioactive residue is dumped back.
5.	Statement 5	Not Valid	More than 20,000 will lose their livelihood, when there are only 400 job opportunities created by the project.
6.	Statement 6	Not Valid	Gravel residue compound will increase rate of erosion and result in salinisation of the ground water due to increased permeability of the resultant landscape.
7.	Statement 7	Not Valid	No evidence is available on sand being drifted by ocean currents from Kerala coast to Sri Lanka. Even if it is being drifted off, mining will in no way help increase accretion but will boost erosion.
8.	Statement 8	Not Valid	Removal of radioactive sand is not the project intention of KREML. It is far more dangerous to mine radioactive monazite from the beach than to leave it undisturbed.
9.	Statement 9	Not Valid	No greater good of the nation is served by the proposed project as almost 5 districts and the economic balance of a whole state is jeopardized.
10.	Statement 10	Not Valid	Sand is not a renewable resource. It requires millions of years to be grinded and sorted into the fine grained beach sands of Kerala coast.

Conclusion

Mining is one of the primary livelihood activities, the others being agriculture, hunting and gathering. Not all mining is as disastrous as the proposed beach sand mining along Kayamkulam coast. Studies and reports emphatically prove that the proposed mining will negatively affect all spans of human livelihood and environment, not only around the mining sites, but also all across

the state. The researches based on their findings categorically demand the complete abandonment of the Proposed Mining of Mineral Sand from Alappuzha Coast.

The necessity to clearly understand the far-reaching effects of such projects is the responsibility of every conscious and sensible individual of this country. Capitalism nearing its doom is cunning and brutal; it will seek all possible means to continue in control. As crisis in the manufacturing industry is casting long shadows on the global market, capitalists are in a desperate spree to claim their stake on the natural resources of earth. Every responsible human being has to carry the slogans of the local community where from it emanates "Abandon the beach sand mining project, long live people's movements, down with anti people projects".

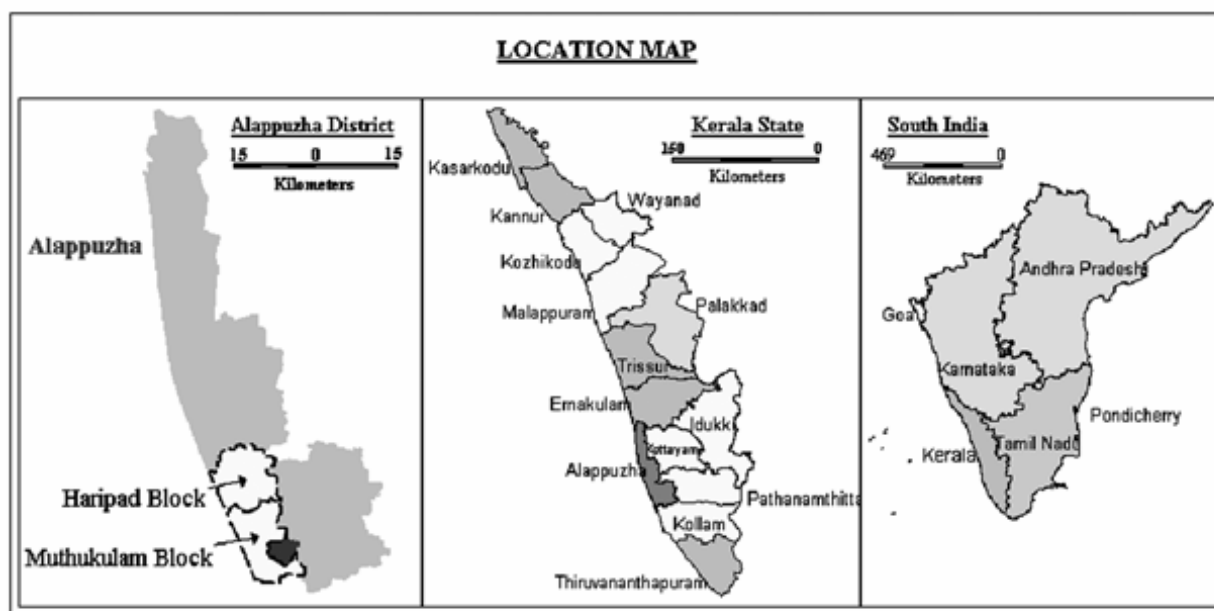
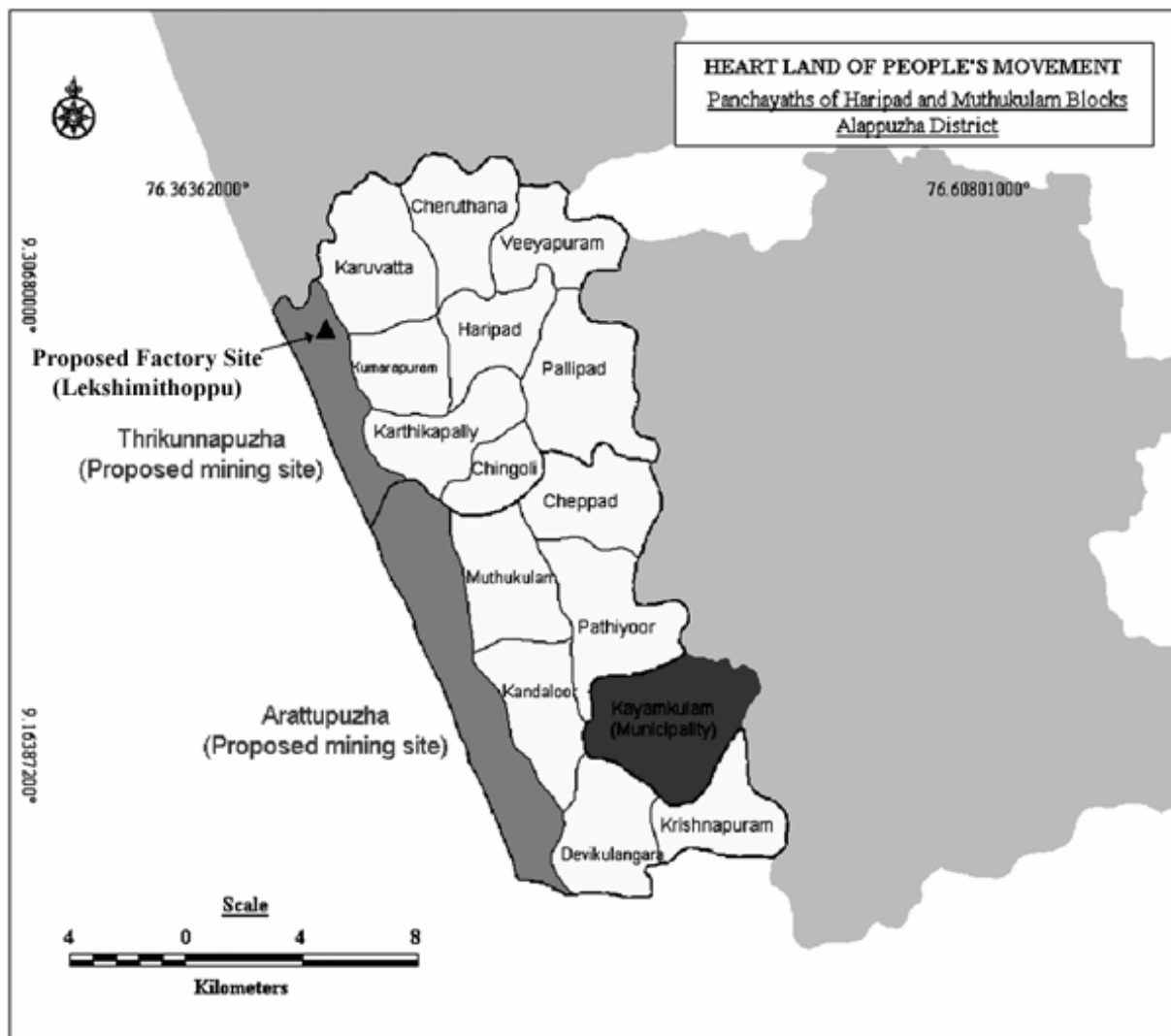
Sub Text: To a temporary relief of the local community, Central Government returned the proposal for the beach sand mining citing serious procedural flaws, thereby shelving the project temporarily. But the fight for ultimate victory is not over. Once the bureaucratic red tapes are systematically outstripped, KREML will resume its attempts to conduct the mining.

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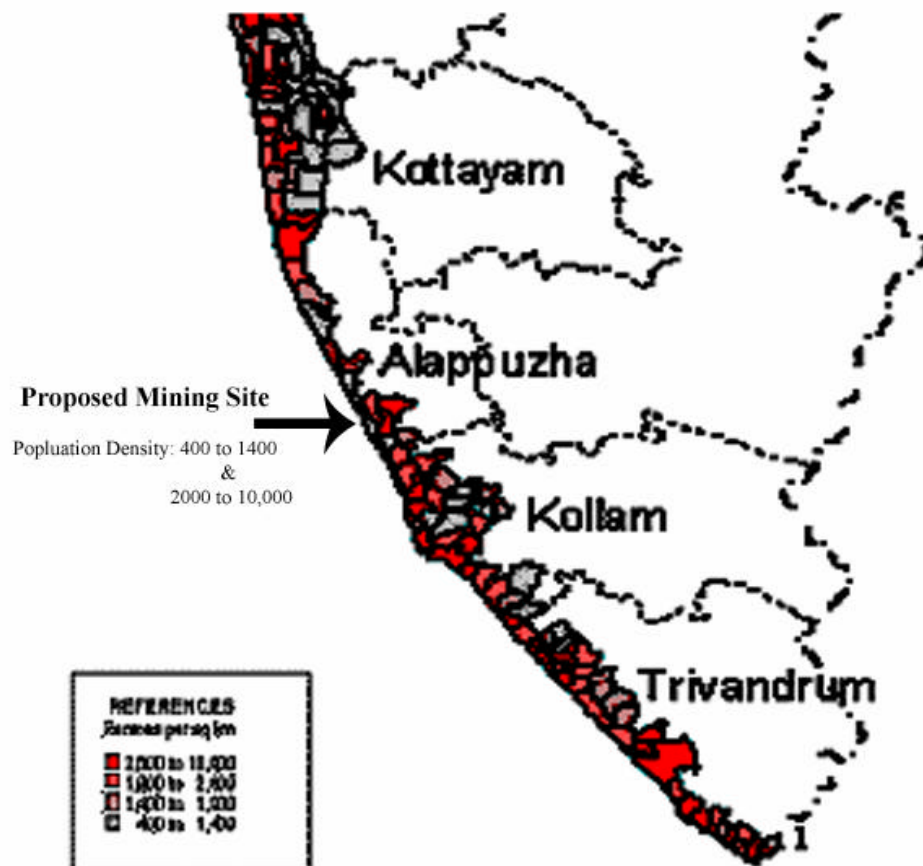
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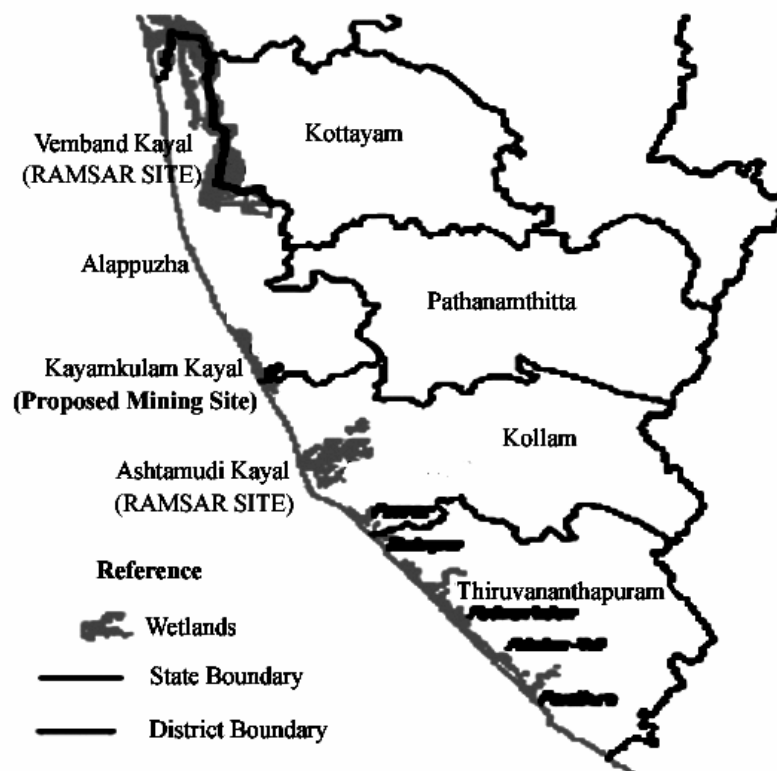
33. **Milli Sievert (mSv)** - The sievert is a unit used to derive a quantity called equivalent dose. This relates the absorbed dose in human tissue to the effective biological damage of the radiation. Not all radiation has the same biological effect, even for the same amount of absorbed dose. Equivalent dose is often expressed in terms of millionths of a sievert, or micro-sievert. To determine equivalent dose (Sv), you multiply absorbed dose (Gy) by a quality factor (Q) that is unique to the type of incident radiation. One sievert is equivalent to 100 rem.
34. **** Millie Roentgen Equivalent Man (mrem)** - The rem is a unit used to derive a quantity called equivalent dose. This relates the absorbed dose in human tissue to the effective biological damage of the radiation. Not all radiation has the same biological effect, even for the same amount of absorbed dose. Equivalent dose is often expressed in terms of thousandths of a rem, or mrem. To determine equivalent dose (rem), you multiply absorbed dose (rad) by a quality factor (Q) that is unique to the type of incident radiation.



Population Density



Wetlands



GROUNDWATER PROVINCES OF KERALA - 1975

(Reproduced from Plate 6, Resource Atlas of Kerala, 1984)

Not to scale and projection

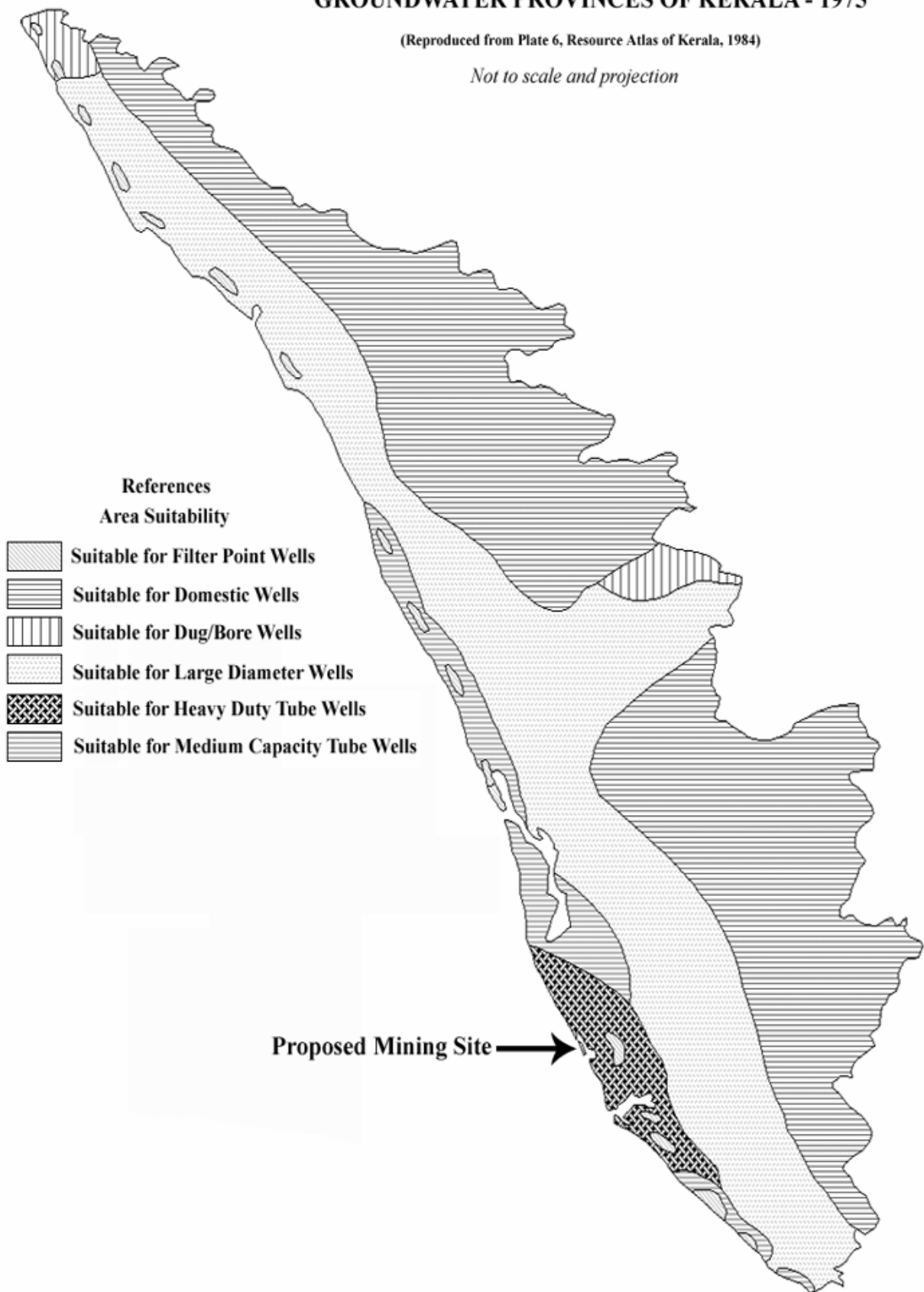




Photo 1.



Photo 2.



Photo 3.

