CHAPTER - IV
CLAY MINING STATUS

4.1 Introduction

Absence of very large flood plains and lengthy rivers in Kerala is conditioned by its physiographic setting. This makes the resource availability for brick clays and sand for construction purpose meagre (Soman, 2002). The mining activities are accompanied by a variety of environmental impacts which can lead to the degradation of the environment as a whole. The major cause of environmental pollution is the alteration of the surrounding as a result of man-made actions which causes direct or indirect changes in chemical and physical constituents of the natural surroundings.

Thrissur district is leading in its production of clay bricks and tiles for construction as the paddy fields possess heavy and good quality clay. Mining contributing directly to environmental pollution and soil erosion and could be mapped using IRS-IA, LISS-II data (Dwivedi et al., 1992). As per Kerala State Land Use Board records (1981), 135 out of 294 Tile factories in the state were located in Thrissur district and total clay mining affected area was around 108.47 ha and land left fallow due to mining was around 131.91 ha. The study conducted by Kerala State Remote Sensing and Environment Centre (2007) shows that land use changes due to clay mining includes active clay mining area (2.60 sq.km), waterlogged clay mining area (5.96 sq.km) and fallow land (4.60 sq.km). The Socio-economic survey conducted in 283 tile/brick industries states that around 5,480 labours were working in 283 tile/brick industries from which 1880 were males and remaining 3600 were females. It is estimated that about 159.45 million tonne of tile and brick clay reserves are available in the district (Sreekumar et al., 2005).
4.2 Tile and Brick Clay - Occurrence and Origin

Tile and brick clay in Thrissur district are a part of the Quarternary deposit, which is underlined by 40-55 m thick Tertiary deposit and then by Precambrian crystallines. The surface of the tertiaries is often lateritised at many places (Nair et al., 2007). Tile clay resources are mainly concentrated in the broad paddy fields of the midland and lowlands of the Vadakkancherry, Chalakudy and Karuvannur river basins. The average depth of availability of good quality clay is 0.6 – 4 m below ground level (bgl) and present in yellow to reddish brown colour. Thick grayish black to black, sticky, plastic clays follow it. The black clays are often interlayered by peat beds/laminations at certain levels. The carbon-14 dating of the carbonaceous clay underlying the reddish brown clay yielded age date between 7050 ±140 ybp and 3390 ±110 ybp. The tile/brick clay found above these carbonaceous clays might be slightly younger in age and be of flood plain origin. Therefore, deposition of tile and brick clay in Kerala is related to the evolution of fluvial drainage systems and monsoonal activities coupled with sea level oscillations during Holocene. Tile clay is exogenous in origin i.e., formed due to weathering of parent rock. Analysis of the X-ray diffractogram of the tile and brick clay samples of the Chalakudy basin reveals that the samples are mainly composed of two major types of clay minerals - Kaolinite and Gibbsite. The presence of these minerals continues even to the subsurface layers. The minerals are derived from the weathering of quartzo-feldspathic rocks in the catchment area (Padmalal and Maya, 2004). The total areal extent of tile/brick clay resource in the district is 314.48 sq.km and which comprises 10.38% of the total geographical area of the district (KSREC, 2007).

4.3 Type of Clay Mining

4.3.1 Tile Industry

The fertile paddy fields in the low-midland portion of the district, provides a good resource base to tile and brick kilns. Agriculture is the major activity in the rural sector of the study area. As the social norms keep on
changing, the joint family system is disintegrating leading to a change in economic activities. Since, paddy cultivation seems to be non profitable due to several constraints (shortage of labourers, fertilizer etc.), land owners lease out their good fertile and reproductive land to the tile/brick kilns on a 4 - 5 year contract basis at the rates varying from Rs. 400 - 6000/- depending on the quality of clay and transporting charges. Clay mining is seasonal and open cast mining was carried out in paddy field during summer months (January to April/May). The excavation is carried out by using earthmover. Scrap mining also present in certain places (Plates 1 & 2). During the clay mining, top fertile soil rich in N,P,K and other micro nutrients will be removed. Once the lease is over, the land is left fallow, unlevelled and unproductive land devoid of all top soil and humus. The mining pits will get converted to waterlogged area from next rainy season onwards (Plate 3). Deep excavations done in paddy fields also become a source point for gully erosion in many cases.

Plate 1: Open cast clay mining in Pazhai area of Nenmanikkara panchayath
Plate 2: Scrap mining area in Annanadu panchayath

Plate 3: Waterlogged clay mining pits in Kadalassery area of Nenmanikkara panchayath

4.3.2 Brick Industry

Flood plains/paddy fields dotted with make-shift brick kilns are a regular feature now, and the finest soil is excavated indiscriminately, leaving behind deep pits that lead to hydrological alteration locally. Estimates suggests that the
Chapter IV

Clay Mining Status

clay brick industry is degrading the fertile top soil to the extent of 20,000 ha every year in India, thereby causing severe land degradation (Hegde et al., 2008). For brick making, average quality clay is required and collect it by removing the top soil (Plate 4). The top soil removal not only lower the yield but also reduces the ability of crops to respond to favourable conditions, whether better landscape position or increased precipitation during the growing seasons. The long term brick kiln industrial activity is reportedly a threat to land and environment that adversely affects human health and vegetation, soils and productivity. The heat from the brick kiln alters the physico-chemical properties and habitats of nearby soils by destroying the top soil nutrient elements and soil biota which are likely to impact species diversity and biomass structure of the neighbouring plant communities (Gupta and Narayan, 2010). Brick-kilns are mainly concentrated in Thottipal-Madapuram padam, Rappal, Nanthikara, Muthrathikara, Parappukkara, Chathanchal and Marathakara.

4.4 Clay/Sand Mining Scenario

The clay mining status is prepared from the Cartosat-1 data (2010), SOI toposheet coupled with field information. Among the 18 blocks in the district,
12 blocks possess the waterlogged clay mining pits and fallow land due to tile/brick clay mining. Total of 124 clay mining affected locations are identified from 39 Panchayaths, one Municipality and one Corporation and shown in Fig. 4.1 and Appendix-1. The block/panchayath-wise details of clay mining locations, type of mining, geographic location, status and depth is given in the table. Most of the clay mining sites are abandoned and waterlogged and a few are fallow land. Current situation faced by the industries are lack of sufficient paddy land for clay mining as it creates enormous environmental problems. Fallow lands are found in Arattupuzha-1 (Vallachira Panchayath) and Parappukkara (Parappukkara panchayath). Floriculture (lotus cultivation) is practicing in Vainthalapadam (Kadukutty panchayath), shown in Plate 5. In Puthukkad-1 and 2 (Puthukkad panchayath), Kallur-1 (Thrikkur panchayath) and Marathakkara-1 (Puthur Panchayath), waterlogged area is utilizing for pisciculture (Plate 6). Land mining is also noticed in Pazhai area (Nenmanikkara panchayath). A few of the waterlogged clay mining pits are found as refilled (Plate 7). Depth of clay mining pit ranges between 1.5 and 8 m.

Fig. 4.1: Clay mining locations
Sand mining, destabilization of hill slopes, filling of wetlands, and marshes for commercial and industrial purposes, conversion of paddy lands for cultivation of other cash crops and non-agricultural purposes are the common human interventions encountered in the state leading to instability of the ecosystem (Premachandran et al., 2012). With the market expansion of sand, the contractors continued sand mining from the waterlogged pits exacerbating the damage caused on the ecosystem. The destruction of thick sand horizon which lies below the clay zone that serves as a potential aquifer of the area. Its removal will lower water storage/holding capacity of wetlands significantly. The excessive sand mining results in lower water table, intrusion of saline water into the river and slumping and caving in river banks, leading to slow death of the river. Sand mining enhances the level of suspended solids, in the overlying water column, which leads to higher turbidity levels in the adjacent wells. According to CESS report 2005, the river banks in the midlands and lowlands are deteriorated drastically due to illicit scooping of sands from prohibited areas of the river environments. In some of the cases, the riverbank itself is being scooped out first for tile/brick clays (overlying layers) and then for construction grade sand (underlying layers). The affected places are under severe soil erosion and land degradation (Plate 8). Air pollution is another environmental problem noticed during transportation of clay dump from the mining sites to Tile industry. Brick kilns are also generated smokes since they are functioning without chimminies. Total number of clay mining sites identified from IRS-P6, LISS-IV satellite data (2005) was 58 locations. Approximately 5,23,775 tonne/year of clay scooped out for tile/brick production by 283 clay industries of the district (KSREC, 2007).

As of now, the State government is restricted this activity after the implementation of “The Kerala Conservation of Paddy Land and Wetland Act” during 2008. The seasonal mining activity is allowed in fallow lands after getting the bank guarantee of Rs. 5 lakh from the contractors on a condition that the excavated clay mining pit should be refilled and use for agricultural activity. A committee constituted by the District Collector (Agriculture Officer, Revenue
Chapter IV

Clay Mining Status

Officer, Panchayath President, Panchayath Member and Village Officer) will evaluate the proposed sites. The Mining and Geology Department, Kerala is the sanctioning authority for clay mining in paddy field and only limited area (10 cent area/user) is allowing at a depth of 4 m.

4.4.1 Chalakudy Block

Among the six panchayaths in the Chalakudy block, Kadukutty, Kodassery and Koratty are the clay mining affected Panchayaths (Fig. 4.1). In Kadukutty panchayath, the open cast mines were Kadukutty, Vainthala and Annanadu. The clay mining area is abandoned and waterlogged now (Plate 5). In Vainthalapadam, abandoned mining pits are using for floriculture. The depth of mines ranges between 2 and 4 m in 3 locations and it covers 0.14 sq.km area.

In Kodassery panchayath, Nayirangadi was the open cast mine and abandoned and waterlogged now (Fig. 4.1). The depth of mine is 1 m and it covers 0.005 sq.km area.

Kizhakkemuri was the open cast mine in Koratty panchayath (Fig. 4.1). The location is abandoned and waterlogged and depth of mine is 2 m covers, 0.103 sq.km area.

Plate 5: Lotus cultivation in Vainthalappadam of Kadukutty panchayath
4.4.2 Cherpu Block

Cherpu block consists of 6 panchayaths in which Cherpu, Vallachira, Paralam and Avinissery are the clay mining affected panchayaths. In Cherpu panchayath, 7 mining locations were present. The mines were Ettumunna-1, Ettumunna-2, Ettumunna-3, Ettumunna-4, Urakam-1, Urakam-2 and Chevur (Fig. 4.1). All are abandoned and waterlogged now. The depth of mines ranges between 2 and 3 m and it covers 0.31 sq.km area.

In Vallachira panchayath, Chathankutam, Kadalassery, Arattupuzha-1 and Arattupuzha-2 were the open cast mines (Fig. 4.1). The clay mining area are abandoned and waterlogged except Arattupuzha-1 which is fallow. The depth of mines ranges between 2.5 and 5 m and it covers 0.3 sq.km area. In Paralam panchayath, Pallipuram was the open cast mine (Fig. 4.1). The clay mining area is abandoned and waterlogged now. The depth of mine is 1 m and it covers 0.39 sq.km area. In Avinissery panchayath, Palakkal was the open cast mine (Fig. 4.1). The clay mining area is abandoned and waterlogged now. The depth of mine is 2.5 m and it covers 0.05 sq.km area.

4.4.3 Chowwannur Block

Among the 8 panchayaths in the Chowwannur block, Choondal, Kandanassery, Kattakambal and Porkulam are the clay mining affected panchayaths. In Choondal panchayath, Ayamukku, Kecheri, Cheraparambu and Chiranellur were the open cast mines and all are abandoned and waterlogged now (Fig. 4.1). The depth of mines ranges between 2 and 4 m and it covers 0.2 sq.km area.

In Kandanassery panchayath, Tharakkal Ambalam-1 and Tharakkal Ambalam-2 and Tharakkal Ambalam-3 were the clay mining locations and all are abandoned and waterlogged (Fig. 4.1). The depth of mines ranges between 1.5 and 8 m and it covers 0.24 sq.km area. In Kattakambal panchayath, Pengamukku was the open cast mine. The clay mining area is abandoned and waterlogged now (Fig. 4.1). The depth of mine is 1 m and it covers 0.11 sq.km area.
area. In Porkulam panchayath, Mangad was the open cast mine. The clay mining area is abandoned and waterlogged now (Fig. 4.1). The depth of mine is 2 m and it covers 0.12 sq.km area.

### 4.4.4 Irinjalakuda Block

Porathissery, Parappukkara, Muriyad and Karalam are the clay mining affected panchayaths in this block. Total number of panchayaths present in Irinjalakuda block is 5. In Porathissery panchayath, Murkkanad, Karuvannur-1, Karuvannur-2, Kundukuzhi and Pichampallikonam were the open cast mines. All are abandoned and waterlogged now (Fig. 4.1). The depth of mines ranges between 2 and 3 m and it covers 1.25 sq.km area.

In Parappukkara panchayath, Muthrathikkara, Rappal, Kurumali-1, Kurumali-2, Nellai, Nedumbal and Parappukkara are the clay mining affected places. All are abandoned and waterlogged except in Parappukkara where the location is fallow due to clay mining (Fig. 4.1). In Rappal, Kurumali-1 and Nedumbal, sand mining is found in the waterlogged clay mining pit after pumping out water (Plate 6). The depth of mines ranges between 2 and 5 m and it covers 1.09 sq.km area.

![Plate 6: Sand mining in Rappal of Parappukkara panchayath](image)
In Muriyad panchayath, Ananthapuram and Tiruvangad are the clay mining locations identified, which are abandoned and waterlogged now (Fig. 4.1). The depth of mine is 2 m and it covers 0.83 sq.km area.

In Karalam panchayath, Karalam itself was the clay mining location identified and abandoned and waterlogged now (Fig. 4.1). The depth of mine is 3 m and it covers 0.11 sq.km area.

4.4.5 Kodakara Block

Among the 6 panchayaths in the Kodakara Block, Puthukkad, Alagappa Nagar, Nenmanikkara, Trikkur, Mattathur and Varandarappilly are the clay mining affected panchayaths. In Puthukkad panchayath, Puthukkad-1, Puthukkad-2, Puthukkad-3 and Chengalur were the open cast mines (Fig. 4.1). In Puthukkad-1 and Puthukkad-2, pisciculture is practiced in the mining pits, whereas other locations are waterlogged. The depth of mines ranges between 2 and 3 m and it covers 0.28 sq.km area.

In Alagappa Nagar panchayath, Pukod, Amballur and Alagappa Nagar belongs to open cast category which are abandoned and waterlogged now (Fig. 4.1). Depth of mines ranges between 1.5 and 3 m and it covers 0.25 sq.km area.

Nenmanikkara is the most clay mining affected panchayath in Thrissur district (Fig. 4.1). Around 96% of the paddy fields of the Panchayath is scooped out for clay and remain as abandoned and waterlogged. Cheruval, Konnikarapadam, Thalore-1, Thalore-2, Madavakkara-1, Madavakkara-2, Pazhai, Paliyakkara and Nenmanikkara were found as open cast clay mines. In Konikarapadam, clay mining pits are refilled (Plate 7). Land mining also is noticed in Pazhai and the depth of mining pit varies between 1.5 and 6 m. Other locations are abandoned and waterlogged. The total area of mines in the panchayath is 3.12 sq.km.
Plate 7: Refilling of waterlogged clay mining pit in Konikkara padam

In Trikkur panchayath, Kallur-1 and Kallur-2 were the open cast mines. In Kallur-1, the pits are being used for pisciculture (Plate 8) and the Kallur-2 is abandoned and waterlogged (Fig. 4.1). The depth of mines ranges between 3 and 4 m and it covers 0.27 sq.km area.

Plate 8: Pisciculture in Kallur of Trikkur panchayath
In Mattathur panchayath, Panthallur and Vasipuram were the open cast mines (Fig. 4.1), both were abandoned and waterlogged now. The depth of pits ranges between 2 and 3 m and it covers 0.18 sq.km area.

In Varandarappilly panchayath, Mandipulam-1, Mandipulam-2, Mandipulam-3 and Varandarappilly were the open cast mines (Fig. 4.1). All were abandoned and waterlogged now. The depth of pits ranges between 1 and 2 m and it covers 0.21 sq.km area.

4.4.6 Mala Block

Mala Block consists of 5 panchayaths in which Annamanda, Kuzhur, Alur and Mala are the clay mining affected panchayaths. In Annamanda panchayath, Erayamkudi-1, Erayamkudi-2, Alathur, Edayathur and Padinjaremuri were the open cast mines which are abandoned and waterlogged now (Fig. 4.1). The depth of mines ranges between 1 and 2 m and it covers 0.50 sq.km area.

In Kuzhur Panchayath, Thiruthu-1, Thiruthu-2, Thirumukkukulam and Eravattur were the open cast clay mines and presently waterlogged (Fig. 4.1). The depth of mines ranges between 1.5 and 3 m and it covers 0.46 sq.km area. In Alur Panchayath, Thiruthuparambu was the open cast mine identified, abandoned and are waterlogged now (Fig. 4.1). The depth of mine is 2.5 m and it covers 0.12 sq.km area. In Mala Panchayath, Mala was the open cast mine identified, abandoned and are waterlogged now (Fig. 4.1). The depth of mine is 1.5 m and it covers 0.12 sq.km area.

4.4.7 Ollukkara Block

Among the 7 panchayaths in the Ollukkara block, Nadathara, Puthur, Pananchery, Kolazhy and Madakkathara are the clay mining affected Panchayaths. In Nadathara Panchayath, Murkinikkura-1, Murkinikkara-2, Nadathara, Mulayam, Eravimangalam-1 and Eravimangalam-2 were the clay mining locations. All were open cast mines and abandoned, now it is waterlogged (Fig. 4.1). The depth of mines ranges between 1.5 and 3 m and it covers 0.46 sq.km area.
Chapter IV

Clay Mining Status

In Puthur Panchayath, Marathakkra-1, Marathakkra-2, Kainur-1, Kainur-2, Trikur, Puthur-1, Puthur-2, Anakuzhi and Chilanka are the open cast mines. All are abandoned and waterlogged now (Fig. 4.1). In Marathakkra-1, the clay mining pits are using for pisciculture. The depth of mines varies between 2 and 5.5 m and it covers 0.97 sq.km area.

In Pananchery panchayath, Pananchery-1 and Pananchery-2 are the clay mining locations identified (Fig. 4.1). Both were open cast mines and depth of mine is 2 m. The total mine area is 0.2 sq.km and it is presently waterlogged.

In Kolazhy panchayath, Kuttur is mining location, it has an open cast mine, it was abandoned and waterlogged now (Fig. 4.1). The depth of mine is 2 m and it covers 0.05 sq.km area.

In Madakkathara panchayath, the clay mining location has identified in Nettisseri. It was an open cast mine and abandoned and waterlogged now (Fig. 4.1). The depth of mine is 1 m and it covers an area of 0.05 sq.km.

4.4.8 Anthikkad Block

Anthikkad block consists of 4 panchayaths in which Chazhoor and Manalur are the clay mining affected panchayath area. Chirakkal, Inchamudi, Puthenpidika-1 and Puthenpidika-2 were the clay mining locations identified in Chazhoor Panchayath (Fig. 4.1). All are abandoned and waterlogged now. The depth of mine varies between 1 and 2 m and it covers 0.24 sq.km area.

In Manalur panchayath, Kanjani, Manalur-1 and Manalur-2 are the clay mining locations identified (Fig. 4.1). All were open cast mines and abandoned and waterlogged now. The depth of mine is 1 m and it covers 0.014 sq.km area.

4.4.9 Mullassery Block

Among the 4 panchayaths in the block, Mullassery, Elavally and Pavaratty are the clay mining affected panchayaths. Tirunellur and Annakara are the clay mining locations identified in Mullassery panchayath (Fig. 4.1). Both
were open cast mines which are waterlogged now as it is kept as such after mining. The depth of mines varies between 1.5 and 2 m and it covers an area of 0.06 sq.km.

Elavally-1, Elavally-2, Peruvallur and Vaga are the clay mining locations identified in Elavally panchayath (Fig. 4.1). All were open cast mines which are abandoned and waterlogged now. The depth of mines varies between 1 and 3 m and it covers 0.21 sq.km area.

In Pavaratty panchayath, Peringad is the clay mining location identified (Fig. 4.1). It has an open cast mine and abandoned and waterlogged now. The depth of mine is 3 m and it covers 0.03 sq.km area.

4.4.10 Puzhakkal Block

Adatt and Arimboor are the clay mining affected panchayaths in this block. Total number of panchayaths present in this block is 6, amongst which Chittilapilli is the mining location identified in Adatt panchayath (Fig. 4.1). It was an open cast mine which is waterlogged now as it is kept as such after mining, the depth of mine is 1.5 m and it covers 0.79 sq.km area.

In Arimboor panchayath, Vadakkumpuram is the clay mining location identified (Fig. 4.1). It was an open cast mine and abandoned and waterlogged now. The depth of mine is 2 m and it covers an area of 0.02 sq.km.

4.4.11 Vellangallur Block

Among the 5 panchayaths in the block, Velukkara is the clay mining affected panchayath (Fig. 4.1). Avittathur-1 and Avittathur-2 are the mining locations identified and are waterlogged now. The depth of mines varies between 1 and 2 m and it covers 0.114 sq.km area.

4.4.12 Vadakkanchery Block

Out of the 9 panchayaths in the block, Velur is the clay mining affected panchayath (Fig. 4.1). Velur is the mining location identified and is waterlogged now, the depth of mine is 2.5 m and it covers an area of 0.01 sq.km.
Chapter IV

4.4.13 Thrissur Corporation

Kurukkancheri-1, Kurukkancheri-2, Panamukku, Chittissery, Pullazhi, Nettisery, Vilvattom-1 and Vilvattom-2 are the clay mining locations identified in Thrissur Corporation (Fig. 4.1). All were open cast mines and abandoned and waterlogged now, the depth of mines ranges between 1 and 2 m and it covers 1.05 sq.km area.

4.4.14 Chalakudy Municipality

Padinjare chalakudy is the clay mining location identified in Chalakudy Municipality (Fig. 4.1). It was an open cast mine and the mining area is abandoned and waterlogged now. The depth of mine is 2.5 m and it covers 0.50 sq.km area.

4.5 Summary

Tile/brick clay is mainly concentrated in the paddy fields of the mid land and low lands of the Vadakkancherry, Chalakudy and Karuvannur river basins. The average depth of availability of good quality clay is between 0.60 and 4 m Below Ground Level (BGL) and is present in yellow to reddish brown colour.

The tile/brick clay found is younger in age and be of flood plain origin. Therefore, deposition of tile and brick clay in Kerala is related to the evolution of fluvial drainage systems and monsoonal activities coupled with sea level oscillations during Holocene.

Kaolinite and Gibbsite are the major clay minerals present in the paddy fields. The total areal extent of tile/brick clay resource in the district is 314.48 sq.km and which comprises 10.38% of the total geographical area of the district. Approximately 5,23,775 tonne of clay scooped out for tile/brick production by 283 clay industries of the district during 2006-07.

Clay mining is a seasonal work and carried out during summer season in the paddy fields. For brick making, average quality clay is required but for the
Clay mining top fertile soil richer in N, P, K and other micro nutrients will be removed. The mining affected places are under severe threat of soil erosion and land degradation.

Among the 18 blocks in the district, 12 blocks are affected by tile/brick clay mining. Total of 124 clay mining affected locations are identified in 39 Panchayaths, Thrissur corporation and Chalakudy municipality and most of them are abandoned and waterlogged now. Depth of mines ranges between 1.5 and 8 m. The total clay mining affected area is 15.26 sq.km and it was 13.16 sq.km during 2005. The waterlogged clay mining pits are used for pisciculture in Puthukkad-1&2, Kallur-1 and Muthrathikara-1 (Plate 7). Floriculture (Lotus cultivation) is present in Vainthalapadam (Plate 5). The waterlogged clay mining pits are being used for sand mining after pumping out the water. Sand mining enhances the level of suspended solids, in the overlying water column, which leads to higher turbidity levels in the adjacent wells. A severe ecological implication of sand mining is the destruction of sand layer lying below the clay bed that serves as a potential aquifer of the area.