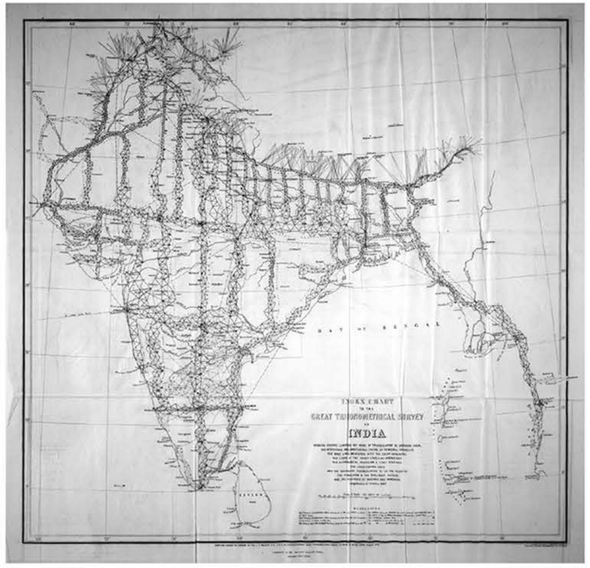
TRIANGULATING

BANGALORE 2

In 1799, William Lambton, a Brigade Major in the English Army that defeated Tipu Sultan at Seringapatam, proposed a trignometrical survey of the southern peninsula of India -- "an uninterrupted series of triangles and of continuing that series to an almost unlimited extent in every direction." Unlike previous surveys a trignometrical survey accounted for the precise curvature of the earth in map-making.

Since Isaac Newton the earth was known not to be a perfect sphere. And since 1735 when the French Academy of Science sponsored expeditions to Lapland (Sweden) and Peru to compare the length of a degree of latitude at the equator with that near the earth's pole, it was known that the earth was flatter at the poles. But its precise form was still open and this form was necessary to place "the great geographical features of a country upon correct mathematical principles." Only a handful of men like Lambton would contribute to this geodesic pursuit with measurements of 'arcs' -- series of triangles along axes of longitude and latitude -- in various parts of the world.



The triangulation begun by Lambton in Bangalore in 1800 extended across India by the end of the 19th century. It determined as Lambton promised, "the exact position of all the great objects that appeared best calculated to become permanent geographical marks, to be hereafter guides for facilitating a general survey of the Peninsular … The surveyors of particular districts will be spared much labour when they know the positions of some leading points to which they can refer because when these points are laid down in the exact situations in which they are upon the globe, all objects of whatever denomination, such as towns, forts, rivers, etc., which have a relation to those points, will also have their situations true in latitude and longitude."

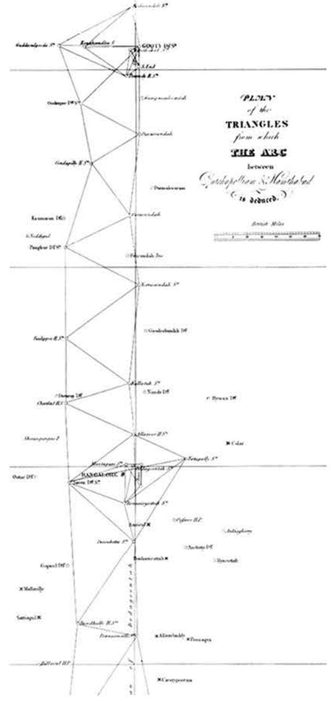
Rock outcrops like Savandurg which a visitor likened to "tea-cups here and there reversed on its surface," made ideal stations for Lambton's survey. They provided sight lines ranging across many miles.

The 'primary station' on top of Savandurg, 400+ meters above the surface of the tableland.

Lambton began the Madras Longitudinal Series with the Bangalore Baseline measured between October and December 1800. He however reworked most of his measurements beginning in Madras in 1804 on a section of coast chosen to be in line with the baseline in Bangalore.

Lambton chose to begin his enterprise in Bangalore in October 1800 because of its "centrical situation" on the peninsula. From here he extended a longitudinal arc across the peninsula (much of which he reworked in 1804-5) and in 1806 he began a meridional arc down to Cape Comorin and up to Himalayas, a distance across 21° 22' of latitude. Completed in the 1840s this Great Arc of the Meridian was said at the time to be "one of the most stupendous works in the whole history of science."

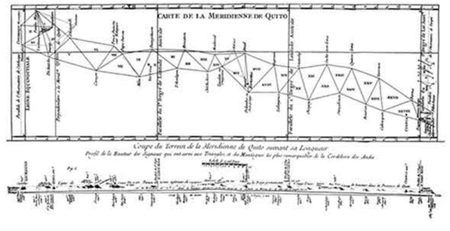
Triangulation would determine the exact position of "great objects" on the Indian peninsula; but it would also reveal a dynamic land. This dynamism would trigger the enterprise of the Survey of India' that improved methods and resurveyed land on a regular basis. But it also draws attention to a world that resisted the fixing desired by Lambton.

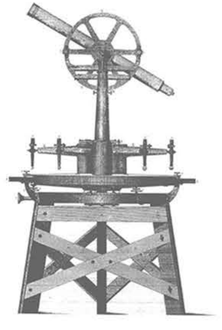


A section of the Great Arc of the Meridian drawn for the Asiatic Researches, 1818.

An 1854 map of Bangalore, the first "reduced from the Grand Trignometrical Survey of India."

Charles-Marie La Condamine and Pierre Bouguer's triangulation across the Andes (1736-39) was the first measurement of the earth's curvature. The computed distance between two points on this arc reduced to sea level was treated as the length of a chord of a circle the radius of which was ascertained through observations at these points of stars moving on a celestial arc. It provided the length of a degree along the meridian, i.e., latitude.



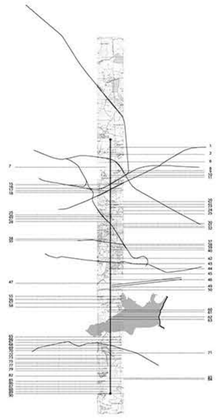


BASELINE

The Mysore tableland was peculiarly suited to a trignometrical survey; rock outcrops made ideal primary stations and "permanent geographic marks." They provided the extended views necessary to connect stations with a theodolite. But the "first operation for obtaining a datum in this mode of surveying," writes Lambton, "is by the measurement of a base line which being reduced to the level [of the sea] becomes a part of a great circle on the surface of the Earth." It was imperative that the length of this line, the only 'material' measure of distance for hundreds of square miles, be accurately determined.

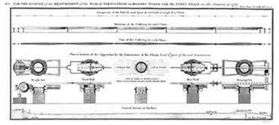
Lambton undertook this critical task in the "neighborhood of Bangalore." Using a 100-foot, 40-link chain of blistered steel, he covered the distance in 90 stages. Five 20-foot coffers of wood held the chain during measurement, each supported by wooden pickets shod with iron or more often tripods "as a very great part of the ground was hard and stony." Twenty 'coolies' moved the chain along "with the greatest care."

From this baseline, measuring 7.437 miles, Lambton triangulated east, west, north and south. Also from this baseline "being nearly half way from sea to sea" Lambton began the Great Arc along the Dodagoontah Meridian named after a settlement north of Ulsoor Tank. It was, he said, "the properest meridian to which all latitudes and relative longitudes should be referred."



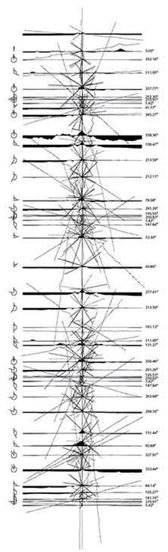
The Bangalore Baseline was measured in 90 stages, each between 100 and 2,000 feet. At each stage Lambton noted the height above or below the preceding stage, the elevation or depression made with the horizon, and the mean of five thermometer readings. When Lambton's survey was reworked in 1867, the line could not be re-measured as a number of obstacles had come in the way -- rail embankments, military and private territory, highways, buildings, nullahs. Today, the obstacles include the runway of the Bangalore airport.

The south end of the baseline called M.E.G. Rock.

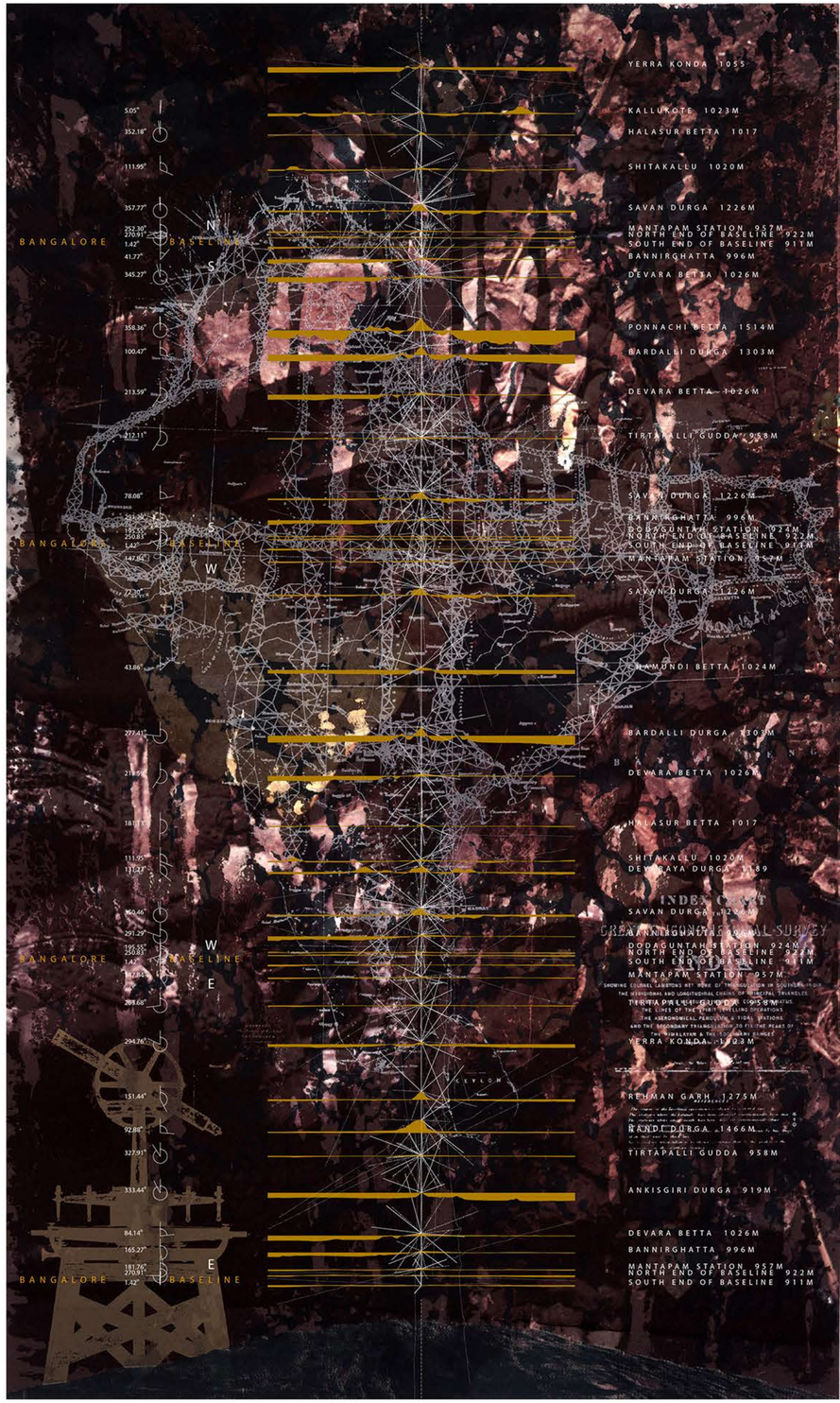


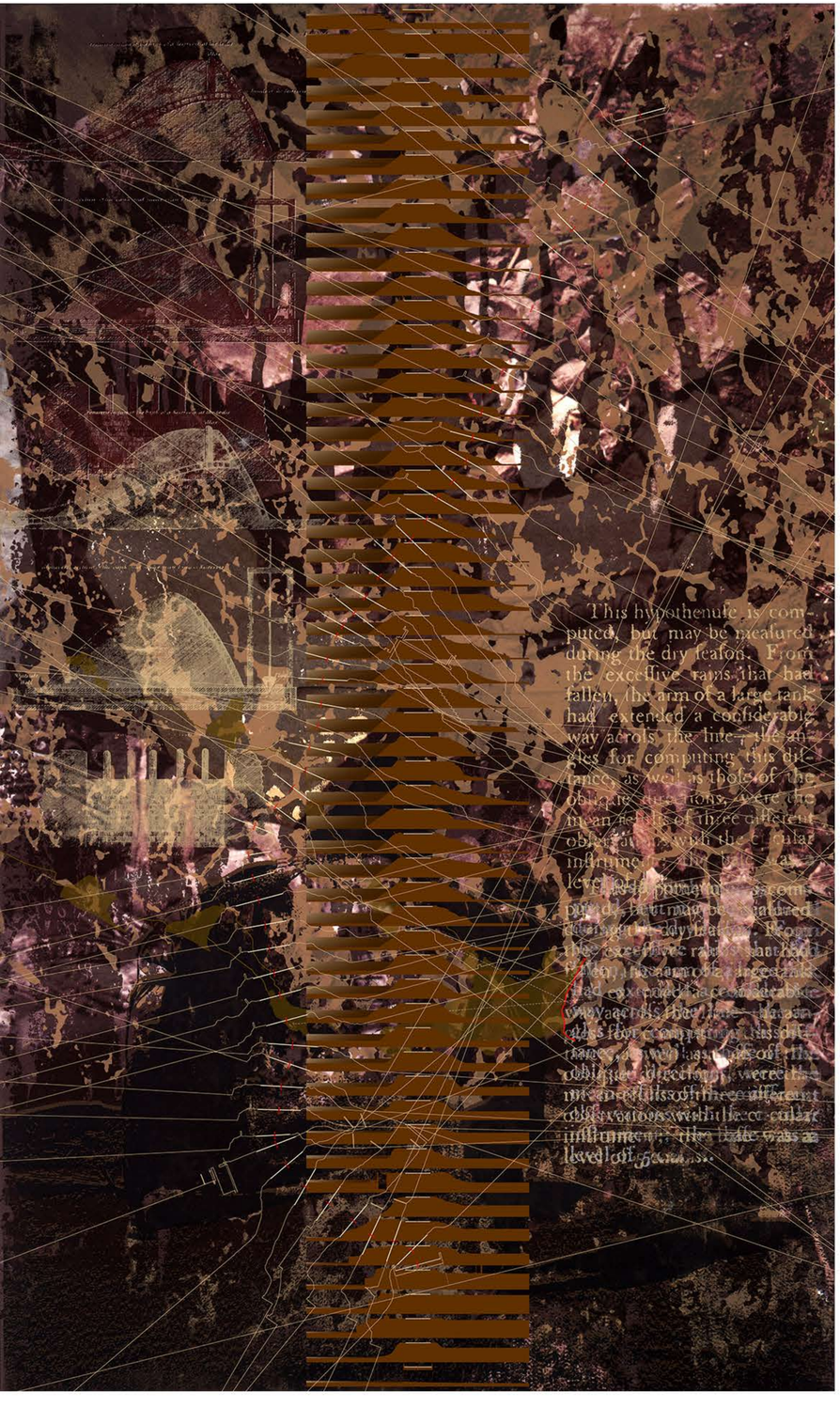
James Colebrooke's "Survey of some of the principal Roads Northward of Bangalore deduced from the Data of Major Lambton's Trignometrical Survey" shows the original baseline measured by Lambton in 1800.

The chain used by Lambton in Bangalore was identical to this one used by Major-General William Roy in his effort to determine the distance between the Paris and Greenwich Meridians in 1787.



From the Bangalore Baseline, Lambton triangulated east, west, north and south, moving from point to point, "fixing" the location of objects that he considered permanent. Each point was related by a 'bearing' with the previous point and one other point, following a convergent path even as it constructed a divergent network of triangles. His points on the tableland were primarily the "lofty eminences" called droogs, kondas or bettas.





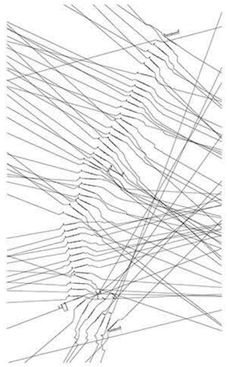
BUND

Six weeks along in the measurement of the Bangalore baseline, Lambton notes, "From the excessive rains that had fallen, the arm of a large tank had extended a considerable way across the line." He was forced to triangulate around the incursion, i.e., compute mathematically rather than measure physically.

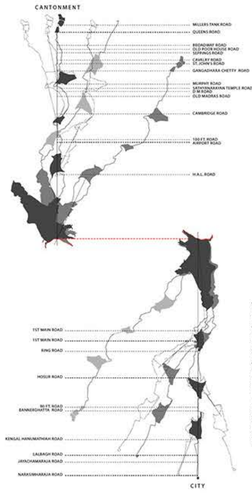
The water was the catchment of the Belandur bund, an embankment linking high-grounds across a land that dips. The tank thus created writes Francis Buchanan in 1800, "has not been formed by digging, like those in Bengal, but by shutting up, with an artificial bank, an opening between two natural ridges of ground." Sluices control the flow through this line of earth faced with stone or vegetation.

Like the baseline the bund is a beginning. While the baseline begins a territory defined by mathematical points, the bund initiates a surface of material flows. Water is a prominent element of this surface in a land where rivers are scarce. But more than water a bund collects settlement. It extends the surface generated by a bund beyond a watershed through roads, rails, pipes, etc.

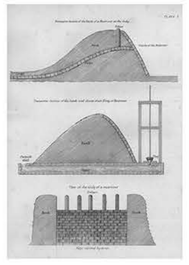
To prevent land falling into enemy hands people did not stop at contaminating the water behind a bund; this merely rendered the water unusable. They rather destroyed the bund and thus destroyed a whole surface of settlement. In this regard, the intersection of bund and baseline in November 1800 was more than just a seasonal interference of a 'large tank'; it was a call to heed a line with a presence more latent and potentially extensive than immediately obvious.



Like the baseline the bund is a leveler in an undulating terrain. If pickets, coffers, angles and mathematical equations leveled the 7-odd mile baseline, earth sloped by repose and faced with stone or vegetation levels the 1-mile bund. The extremities of the baseline are held firm by 'stations' while the trajectory between is a momentary physical presence, there only when the line is measured. The ends of the bund, on the other hand, are fluid, operated by sluices, while the trajectory between is a firm presence of mud and stone, compressed by thoroughfare, deities and temporal occupations.

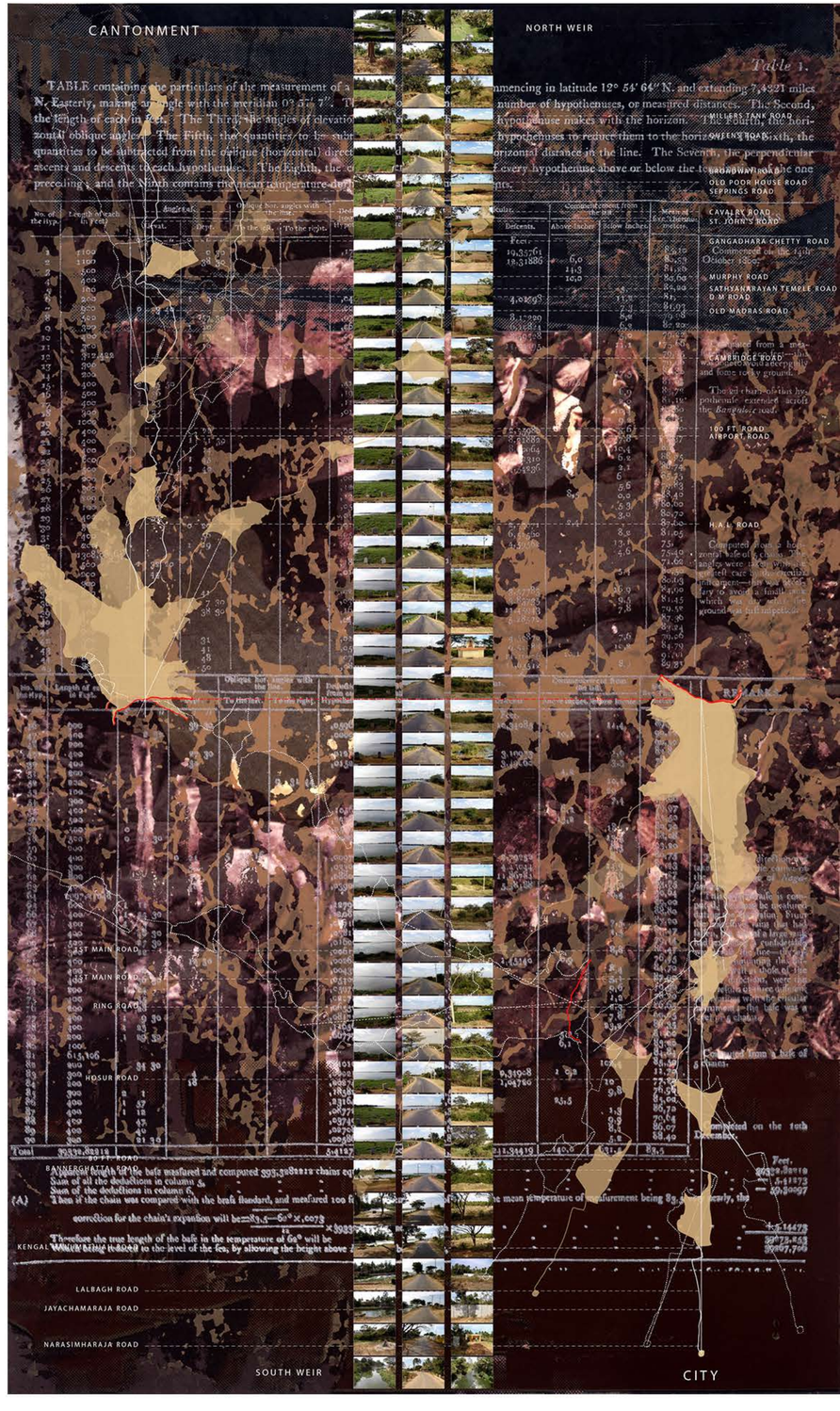


The Great Trignometrical Survey begun with the Bangalore Baseline would 'fix' the boundaries of the pettah and new cantonment, settlements that observers would articulate as vastly different -- "a native town almost exclusively Kanarese in origin" and "a heterogeneous assemblage of people of various nationalities and speaking several languages." Belandur bund however, would unite them in the soil that it gathered.



Francis Buchanan's 1800 sections through two kinds of sluices of a bund - an overflow sluice marked by stone pillars and an underflow sluice manned by a 'plug'

Belandur bund today is a meeting ground of urban and rural worlds, urban soil and agricultural fields.

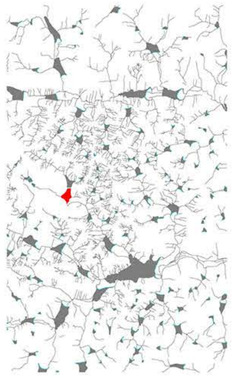


TANK

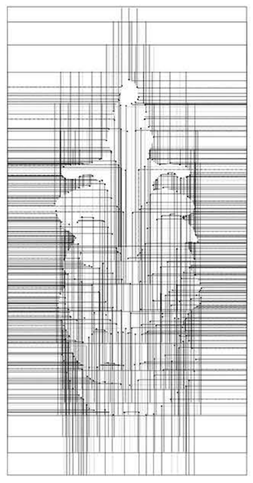
On a carriage ride on the tableland in November 1868, Mrs. Bowring marvels at the many sheets of water. "The sugar-cane and rice crops looked most flourishing in the low wet land under the great tanks, which have all the appearance of natural lakes. Many of these have been most skillfully constructed . . . long before English rule and public works were thought of." Benjamin Heyne had noted this in 1800, "Lakes, in the right sense of the word have nowhere been observed by me in this country but tanks or water reservoirs with artificial embankments are in great abundance."

Yet tanks cannot be reduced to reservoirs. Unlike reservoirs which collect water, tanks collect earth -- dry to wet to very wet earth. This earth is largely clay, a substance that is never without water just as water on the tableland is never without clay. To see the dry bed of a tank is not to see the absence of water but the presence of clay; to see a full tank is not to see water alone but clay in suspension.

But if tanks are sources of more than water, they are destinations of more than the clay coming off the higher reaches of the tableland. They take in Ganapathis on the final day of Ganesha Chaturthi, a festival which takes place in a time of the year when tanks "have all the appearance of natural lakes." The 'deity of the good harvest', molded from clay, is immersed in the tank and asked to return next year from a 'bigger' tank. Before the next immersion however the waters must recede sufficiently to provide for the momentary consolidation of clay.



Tanks, Mrs. Bowring observed, "have all the appearance of natural lakes," but only in a particular time of the year. One tank however is forced to maintain this appearance throughout the year, Ulsoor. It was a tank when Cornwallis' army camped on its 'higher reaches' in March 1791 and when Lt. Blakiston built the Cantonment in the same place in 1807. It was a tank when Major Bevan witnessed the "melancholy fate of three fine young officers who were drowned in the Ulsore tank," And it was a tank when the artist and "nonsense poet," Edward Lear went "in search of the Ulsor tank, and found it" on August 16, 1874. Today it is held as a lake. This however does not stop the consolidation of its bed; it merely forces a massive dredging operation in place of a clay economy.



"The benevolent disposition of the Hindoo people," writes Captain Charles Gold in the 1790s "is most deeply engraven over the face of their country, in the reservoirs, or Tanks of water. . . Was it not for these generous and patriotic works of art, a great part of the peninsula of India . . . would probably exist only in [a] rude and uncultivated state." Today, in a city driven to make these tanks into sites for buildings, recreational spaces, or ecological wetlands, the annual immersion of Ganapathis is a powerful reminder of their 'art'

Rather than operating on a scale between full and empty, tanks operate between two ends of a clay economy -- a bed that provides clay and a surface for a range of activities including bazaars, sports, games, fairs, etc. and a reservoir that provides water.

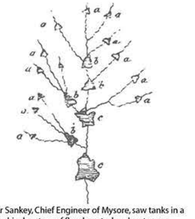
In 2002 Ulsoor Tank popularly known as Ulsoor Lake was drained to reveal its tank bed. Unsightly for a 'scenic' lake, a tank bed is a common seasonal sight.

THOUSAND TANKS

In the 1840s, a traveler observed that the red clay in Bangalore was only a beginning. "A similar formation continues to Kolar" in the east. Indeed, in this direction streams are increasingly suspended in favor of tanks and for much of the year water is suspended in favor of earth, culminating in the 'land of a thousand tanks.'

This land is largely the upper basin of the Palar, a river with a mysterious source. It is popularly believed to originate on the summit of Nandidurg. But the hill is separated from the Palar watershed by its 'sister' river, the South Pinakini into which the waters coming off the east side of the hill flow. These waters empty into the Bay of Bengal many miles south of the Palar. If Nandidroog "be accepted as the source," Lewis Rice writes in 1897, "it follows that the stream must at some point cross the S. Pinakini - a difficulty which the natives easily set aside by the hypothesis, for which there is no evidence, that it runs underground at that place."

Perhaps the notion of an underground link between Nandidurg and the Palar basin is less suggestive of a material connection between a source and a flow and more an acknowledgement of a terrain of no-flows and overflows. Water here moves not continuously and 'naturally' but through a series of bunds by the will of people or for most of the year not at all. Furthermore on this gently undulating surface tanks are as easily cross connected as connected, bunds inserted, overflows diverted, and no-flows maintained. Far from a hierarchy of flows that British engineers sought to see and maintain this is a terrain of ubiquitous and imminent sources.

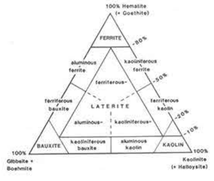


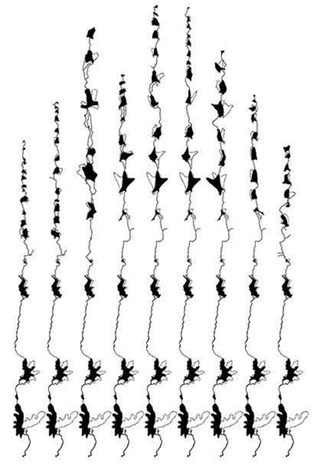
Major Sankey, Chief Engineer of Mysore, saw tanks in a hierarchical system of flood control and water use.

In the land of a Thousand Tanks, streams are overflows rather than flows and tanks are a way of life. Overflows point to bunds and sluices rather than to water bodies.

The rock-sculpted Nagas, prevalent across the shifting surface of the land of thousand tanks are both marks of firm ground and reminders of the source of red soil in the crystalline rocks of the 'higher reaches'.

Red soil is largely residual rock. In this land, however, there is an intermediate material that is neither rock nor soil. It is the result, geologists say, of "a disease" that transforms crystalline rock into a material that Francis Buchanan in 1801 described as "full of cavities and pores, and contains a very large quantity of iron in the form of red and yellow ochres." While excluded from air it is soft; but "soon after becomes as hard as brick." He called it laterite, 'later' being brick in Latin.





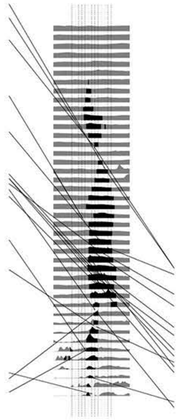
In the land of thousand tanks, a land of overflows and diversions, there is no dominant water course. Instead there are many possible series reaching back from the 'last' tank on the tableland. This tank is Ramsagar, the Thousandth Tank.

EARTH

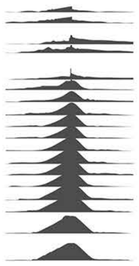
In the land of a thousand tanks there is occasionally more than clay and water; there is gold. as Lt. John Warren was told in 1802 that "in the prosperous years when the gods favoured the Zillah of Cargoory with an ample harvest, grains of gold were now and then found in the ears of paddy, which grows under the tank lying north of that village." He figured that prosperous years translated into abundant water, flooded fields in the lower reaches, and depositions on young plants which "carry up now and then a grain of gold in its growth." Investigating the 'higher reaches' where flows begin, he found traces of gold.

Geologists would in time identify these higher reaches as the surfacing of the Kolar Schist Belt, an 80 km long "patchwork of different terrane elements" within the vastness of the 'peninsula gneiss' that dominates the tableland. Maps reveal this 2.5 billion year old belt by the absence of tanks. But a more contentious indicator today is the Kolar Gold Fields, an amalgam of corporate entities that grew into a settlement on this ridge beginning eight decades after Warren came through. Over the next century these entities would construct one of the deepest penetrations into the earth - three miles.

The mines are closed today, largely flooded by water that was kept out of active mines but allowed to collect in abandoned shafts to supply the town and the processes of mining. It is as if the land of a thousand tanks turned down into the earth along shafts and pockets left by excavated lodes.

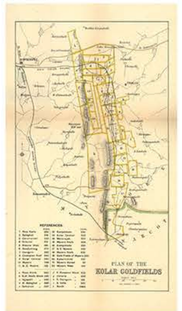


The Kolar schist belt is a ridge that divides the Palar and Ponnaiyar basins. It is also a 'suture zone' between two terranes of gneiss. These terranes, geologists say, came together 2.5 billion years ago "causing compression and eventual shearing of the rocks in the belt and the surrounding gneisses." As if to manifest this suture a number of dolerite dykes and quartz veins run through the belt and into the terranes on either side. These 'stitches' are the youngest elements in this island of complexity. Until, that is, mining brought together its own conflicting terranes of colonial capital and native labor, Kanarese and Tamils, Presidency and Native State.



The Ramsagar bund is a mile-long line with two sluices and a plug. The tanks above it number 999; the tanks below it number 0. It makes the water and red soil that collect against its 40 feet high, 40° slope embankment the Thousandth Tank.

An 1897 map of Kolar Gold Fields, an amalgam of corporate entities.



Attempts to capitalize on the gold of KGF proved futile until Captain Plummer discovered the 'Champion lode' in 1883. This lode, shown in its longitudinal section, runs at an angle of 45° and in widths upto 5 feet, to a depth of more than three miles.