IMPACT OF ENVIRONMENTAL DEGRADATION ON MAN

A STUDY OF THE KOLAR GOLD FIELDS

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CERTIFICATE

The research work embodied in this dissertation has been carried out in the School of Environmental Sciences, Jawaharlal Nehru University, New Delhi. This work is original and has not been submitted in part or full for any other degree or diploma of any University

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DEDICATED TO

the Millions of nameless and faceless Workers

who support us and make a study like this feasible:

particularly to

the Memory of many thousands of the Unknown Miners

who have wasted their youth, health and laid down their lives

in digging for - Oh! The Wealth of Gold!!

Miles away from their homes and many a fathoms under the ground

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INTRODUCTION

'Panam yendral Pinamum Vayai thirakum' - is an old Tamil saying that is very popular and apt for KGF. Translated, this means - Mention 'Money' even a corpse will open its mouth!

That important is 'Money' in the lives of the people, even though many traditionally disagreed. And some said that 'Might' is more important in life, while others felt that the place of honour belongs to 'Education' But those who believed in money always felt, that with money they could buy both power and wisdom, or at least subdue or subordinate them to serve their own personal and private interests.

In modern materialistic world, it needs no mention that money and wealth play a very important role. And those with money often would like to flaunt it, exhibit it and show it off. From early times people, the rich, the elite and the rulers and members of the ruling families,like the kings, queens, princes, princesses and other royal members, and,the Nation States believed in Gold and its value. For, Gold symbolised riches, wealth, the state of richness and stood for money. And it provided security to the people and nations, at times of crisis. Thus Gold played a very very important role in the World History and evolution of human societies, and the prosperity of the Nations and Societies.

One could neither create money nor eat it. But one could always make money, see it, feel it, hoard it and make use of it. Gold ideally fulfilled these needs. And what is more important is that, though it was rare, costly and had noble qualities, it was easily available in nature, often in free state and could conveniently be worked upon to produce different articles for use for different purposes. It was the earliest metal known to man right from prehistoric days and also was within the reach of both the poor and the rich. Only the quantity of,the

Gold held and retained varied. In that part of the country, where the Kolar Gold Fields are located, even the poor strive to hold on to a few grams of Gold in the family, not only as a security for the rainy difficult days, but also as part of their cultural tradition. Gold here forms a big part of a woman's life, right from her childhood. And her marriage is not complete without a few grams of Gold for her 'thali' that symbolises her state of marriage. So every married woman keeps some Gold for herself and the marraige of her daughter(s). With this tradition amongst the people, and the richness and wealth which Gold symbolised, it is natural to expect that the Kolar Gold Fields, its workers, and the area would be booming with richness, and the people living in comfort if not rolling in riches.

Rulers and leaders of all varieties always said that they are for working for the good of the people and their welfare. It is for this specific purpose, and in the name of this, that Nation States have come into existance, Governments have been formed, and they have been taking up many developmental schemes to improve the living conditions of the people. At the core of all these, are the schemes that created infrastructures and wealth. Basic to all of them are mining. For mining provides the raw materials, and helpes to create wealth. And if one could mine straight away the wealth like Gold, then there could be nothing like that. As the endings of the fairy tales, that all of us and the children world over are aware, the people then could live happily for ever there after! If not this, the least one could have expected

is, that the people of KGF where Gold is being mined in a massive way, would be living in decent conditions.

Here is a classic case before the nation, the story of Kolar Gold Fields, where Gold is being mined in Scientific and Technologically modern methods since the year 1880. There could have been no better project that could have been visualised, to develop the area, and usher in a better life to the people. A better life for the people need not mean prosperity and wealth, but freedom from economic wants, social deprivations and adverse environmental impacts. It is a wellknown fact that financial mismanagements ruin any profitable or promising preposition, affect the region and the people economically, personnel mismanagements hurt the enterprises and the society around, while the lack of understanding of the environment and the failure to plan any project in an environmentally safe manner depletes the natural wealth of the area, and degrades the environment.

DEVELOPMENT PRODUCES CHANGE IS A FACT. And also, continuous on going changes are the dynamic phenomenon of nature, and the evolution of environment. These changes are caused continuously by the natural forces. In nature, the forces of nature develop the environment in a balanced forward direction with closed cyclic pathways to sustain a great variety of highly evolved forms of life, with a rich diversity. The developments in nature are never linear. But when man is present, in any area, he is only interested in the world around him that could meet his needs. Hence his environment is the one that could benefit him directly, immediately and sustain or help him have a comfortable life. So man is always out in search of a better environment, and in

changing the environment around to benefit him, and exploit it till it yields its wealth and riches. His developmental schemes are mostly exploitative and linear - doing something, taking benefits and dumping the wastes. These wastes though being resources misplaced by man, often suffocates the life around because of the sheer load, concentration, and the rate of dumping of these wastes. Thus man, in his developmental process snaps hundreds and thousands of biological and other chains of nature that sustains the natural environment around him. So he inadvertantly lets loose, forces that set in motion chain of events that hurt the environment and affect it adversely. Thus, man finds that whenever and wherever he had been casreless, negligent, hasty and overexploitative nature had always sprung back at him almost with a revenge, that man has to often leave the area, with deserts as the footsteps behind him. May be, this is natures way of evolution, a safety catch to protect itself and throw out the meddlesome man.

With education and a better understanding of nature, its forces and laws, Scientific and technological progress, and better management, man is expected to perform far better than his predecessors, both ancient and the immediate ones. If on the other hand, man with his science and technology to harness nature's forces, makes use of them to adversely exploit nature, the area and the people, and turns deliberately his surroundings into a desert, he could no more be excused as having brought in the crisis inadvertantly over himself.

> For, science had opened up an immense future, which man can use beneficially, only if he realises this very fact, and does not put to use both his reason and labour, and also his harnessed energy and scientific knowledge in a mutually antago-

nistic collision course with his friends, colleagues, contemporary fellow humans, or for self destruction.

Kolar Gold Fields are unique, in that, here man had gone down into the earth nearly 4 kms below the surface to prospect Gold. That Gold is wealth, much sought after always in the materialistic world. And this Gold is expected to benefit the establishment, the workers, the area, the people and the state. What influence did it then really have on the environment of KGF? Has the environment degraded as many have been fearing? If the environment has degraded, what are the impacts on man - the workers, their families and the people living in the area? These are the issues that have been looked into in this study and for which some answers have been sought. The findings are presented in this dissertation. The findings are by no means complete, for the problems are of immense dimensions and very complex, and hence this study does neither claim to be complete nor perfect, nor to be a final work on the environment of the KGF area. The problems need to be further studied, many times over, by many more scholars and research workers. This study, makes almost the first step in this direction, and it is hoped, may influence many others to take interest in the area and follow this up by their works.

METHODOLOGY

This research work is based on extensive search for materials both published works and unpublished records available in the libraries and with the National and State Archives; informal interviews with a random number of people connected with the Kolar Gold Fields--the people living in the area, workers, their families, union members and leaders, managment personnel, officials who have been posted to the KGF area, research workers and sociologists who had at one time or the other been interested in KGF, and the people of the area--personal observations, photographs, study of the forest/tree/vegetative cover, and the amount of atmospheric dust settling in different parts of the area; collection of effluent, water and soil samples and their analysis to determine the quality of the effluents and water; measurement of the capacity of the soil to sustain life, and also the quantum of life activity within the soil.

The vegetative cover in the area has been studied by line transit and density of the plants in quadrants of 10 meters square in size.

The atmospheric dust settling in the area has been determined through a very simple static test developed for the purpose. Small, oven dried towels after weighment were soaked in water and allowed to dry by hanging them in the open for about 24 hours. Then, they were again dried in

the oven at 30° c and weighed to determine the weight of atmospheric dust that has settled on either side, during the 24 hour period of exposure.

The effluent and water samples collected from mine discharges, wells, hand pumps, open pools and tanks have been analysed for their physical and chemical characteristics in the KGF Water Works laboratory at Bethamangala.

Soil samples have been tested for their capacity to sustain life by germinating seeds in the soil on petri-dishes in the laboratory at JNU.

The quantum of life activity within the soil has been tested in situ, and in the KGF Water Works laboratory by measuring the amount of carbon-di-oxide released from the soil. For this purpose, 30ml of 0.1N NaOH in small beakers have been kept covered in the evening hours with uniform sized and shaped tins of 14 cms diameter. These on collection early in the morning on the next day, were tested for the quantum of CO_2 absorbed by NaOH by titrating them against 0.1N HCL, after addition of 2ml of 50% $BaCL_2$, with phenopthalin used as an indicator.

The methodology adopted for this research is thus a combination of social analysis, field study, analytical laboratory work and library work, with emphasis on the study of actual physical conditions in the area and social realities of the people, than on abstract research of fundamental nature . Thus, the methodology adopted is one of an integrated total systems approach, multi-disciplinary in character as is always the case with any complete study of the Environment by the Environmental Scientistis.

MAN AND ENVIRONMENT

'There is a tide in the affairs of men which, taken at the flood, leads on to fortune; .....' wrote Shakespear in his famous play, Julius Caesar. So it is, in the evolution of Nature. There are times which facilitate certain specific activities, development, growth and evolution. Once missed such opportunities rarely come again and such changes could hardly ever take place. By and large, natural systems make use of the conditions that occur, and bring-in small or great evolutionary changes. Product of nature, man also makes use of most of the opportunities that come in his way, to improve himself and develop. All activities, development and growth cause changes. And all changes feed on the available resources and deplete them. Thus when changes do take place, the very basis of the developments leading to the changes is thus knocked off, and every change invariably brings with it new problems and a new environment.

Improvements, like social benefits have to be paid for, and the costs will be more or less according to the circumstances (Heath KCG 1975). Even if Govts and organisations bear these costs, ultimately in the end, it would have to be paid for by the people. This change if not carefully planned for, monitored and controlled, leads on to environmentally degrading changes that hurt man. The cost then is that the people have to live with the troubles and constraints brought about by the change that has resulted in the degradation to the environment perceived by the people, but unfortunately not foreseen and or taken care of by the planners and the managements.

A change is considered to be environmentally degrading, when it is abruptly sudden and severe, is damaging and or stresses the environment of the people that visible strains appear amongst the people, affecting their normal life style in such a way and to such an exten that they find it increasingly difficult to cope with them. Since all improvements and progress have to be paid for, the problems of change and the costs that had to be paid for were always there with the people throughout their history of evolution. Hence, environmental changes and their impacts are not new. Yet, in many ways, there were no serious or sudden problems of environmental degradation till recent times that caused concern to man and other life in this surroundings. For, in the past, the needs were few, and the wo rld was wide and the resources were plentiful that they appeared to be unlimited. The technology, the pace of development and hence the rate of change was very slow and gradual, that the society could cope with it, though there might have been many instances of individual hardships caused by small limited and localised environmental hardships or degradation.

Agriculture, irrigation, mining, construction and other activities did bring in many changes in the life of the people in the past. But these were always considered to be within the control of the people. Basically so, because the population was small, thinly and widely dispersed and could, when necessary, be dispersed even more widely; and

when crisis situations developed, whole societies could shift to another and even distant places. Humanity was used to migrations, and shifting to new lands and greener pastures. Till recent times, Natural resources were considerd to be unlimited or plenty that sufficcient was hopefully available for any one and every one. Further, the very perspective of environmental degradation was lacking, and the feasibility of nature ' threatening man was not visualised. Man was considered to be all powerful and wise and as having conquered nature. Man thought that he has already become the master of the earth and the universe around him. (BAGGA RS et al 1982 p 339)

ENVIRONMENTAL PROBLEMS: With the earlier understanding of nature and the relationship between nature and man, every new problem was brushed aside, and tackled differently. If whole forests were to be cleared for fuel at home, or use in the mines and the industry, so much the better. There could then be available, more land to the farmer for agriculture, and also for housing and additional settlements. In a similar vein, it was considered that the damages and changes caused by mining on the surface, and at the open shallow depths was always small and insignificant, that they just could be abandoned after use and neglected. It was expected to repair itself and heal naturally by the

passage of time. But, it is now realised that the truth and realities are different. All changes caused by man could not recover by themselves. Though the changes caused by man were small and gradual, they were often steady, linear, unidirectional and hence irrevocable. The environment therefore, could not recover or repair itself to accomodate man once more in those very same areas. Those areas degraded beyond limits, that the whole societies have to desert the areas that were slowly turning themselves to be deserts. Deprived of the natural bases of their very survival, great civilisations collapsed inspite of their power, wealth, comforts, facilities, organisation, knowledge and sophistication. And they, at 1 ast, had to give room to lesser civilisations whom they usually looked down.

Thus, with progress of human societies and development of various civilisations, forests slowly lost their hold on the land. They receeded as they were cleared. The agricultural lands slowly gave way to pastures and land for new settlements. Exploited further, to meet the continously expanding population, they lost all their fertility, and productive uses. Today these desert lands remain for all of us to see as mute evidences to remind us of the serious consequences of environmental degradation. Therefore, it won't be far fetched to say that the footssteps of great civilisations of the world are today, the deserts on the face of the earth. Nile and Indus valleys, Indo-Gangetic plains are all some of the few classic examples that have

already become or are becoming to be major deserts, pushing man out from his own craddles of human evolution and nurseries of civilisation. With this realisation and the recognition of the fact that there are now too few a places for us to exploit, or cover by dumping up the wastes and slag heaps, or destroy with harmful wastes; too little living water systems that can bear with toxic effluent loads, too little fresh air to mix with and dilute our smoke and dust, and the growing liberalism and compassion to the sufferings of others, forces upon us the need to recognise our environment and the degradation caused to it by us. Thus only our realisation of the environmental changes are new, but not the environmental problems themselves.

The environmental problems have been in existance right from the days of evolution, and particularly from the days of man's organised, collective social activities. Over the ages, many environmental problem, as a phenomenon had been experienced, complained about, and solved temporarily or set aside as a problem of no consequence and neglected by the society and those in power. Humanity remembers at least some of the classic cases have been reported many centuries ago. One such example of environmental pollution is the case of the English Queen Eleanor, who was forced to leave the town of Nottingham in the year 1257 because of smoke pollution, caused by the burning of coal around the place (Down GG and Stocks J 1977, p 7). Others of notable interest

are the public reaction to the introduction of ho rse drawn public transport carriages causing dust nuisance, and steam cars on the city roads causing traffic hazards. But what is causing concern to the modern world is the fact that science and Technology fuelling industrial growth, which increasingly goes into the hands of aggressive managerial personnel who want to maximise the profits and their personal benefits in a very shorter and shorter span of time, lead o ever rapidly increasing rates at which the environmental problems emerges. Thus they no more remain to be isolated, far distanced local problems. They have a cumulative. Snow-balling effect as the days pass-by.

MINING: Mining that provides various raw-materials required by man and the society, implies selection, exploration and rejection. Exploration means disturbances, and selection implies rejection of the unwanted the dunsuitable and the wastes. And the very processes of exploration and selection may produce smoke, dust, smells, noises and other undesirable effects. Mining in short, while powering the progress of human societies, contains inevitably the seeds of pollution. Unchecked, they will grow and spread widely or sparsely as the case may be (HEA TH KCG 1975).

Industrial revolution has caused the industries to grow uncontrollably hungry for raw-materials, power and human labour. As the standards and income of the people, if not the whole society increases, more demands emerge. Hence, more production, and the need for more raw materials

becomes inevitable. This, logically leads to uneven distribution of wealth, power and control over the resources, whose exploitation, consumption and utility are dictated solely by the market forces of demand and supply.

Mining being one of the important sources for the supply of raw materials to the industries, increased mining becomes inescapable with growth in demand and industrialisation. As a result, distant mining deep in the jungles, deserts and barren hills or overseas or in the colonies in the case of imperial colonising powers, could by themselves alone not be relied upon or be sufficient to meet the needs of the industries. This ever increasing demand, as well as strategic political needs, geo-political international economics, and practical constraints brought in, compulsions on different nation-societies to mine even the otherwise rejected, uneconomic poor grade ores. This obliged the concerned people, and often the whole societies or significant part, to live within the sound, sight and smell of the mines, the mills and the industries that their own demand had brought into being.

MINING AND ENVIRONMENTAL DEGRADATION: Since traditional mining has been carried on in distant places and isolated areas, often dispensable slave labour and condemned men were engaged in mining activities that were even by the old standards considered to be polluting, dirty, unhygenic and risky, it was assumed to be a ridiculous waste of money even to think of vegetating the mine scarred areas, or take environmentally protective measures. Hence, unchecked, uncontrolled and unrestrained mining was practiced. Mine and mill wastes were dumped, effluents were discharged, tailings were scarred and heaped into natural depressions, streams, lakes, valleys, fertile forests and on nearby agricultural lands. Thus mining developed almost as synonymous to environmental degra-

dation of the surroundings.

Ge orgius Agricola in his book, De Re Metalica 1556, says that mining activities in Germany has caused so much problems that, 'there was a strong movement against mining in Germany then. The strongest arguments against were that the fields were being devasted by mining operations; the woods and groves were being cut down to meet the endless demands of wood for timbers, machines and smelting of metals; and beasts and birds were exterminated, very many of which furnished pleasant and agreeable food for the people of Germany. Further when the ores were washed, the water [illegible] used to poison the brooks and streams, and they either destroyed the fishs or drived them away.' Thus he said that it was clear to all that there was a greater detriment from mining than the value of the metals mined. In this respect, he has referred to an early piece of an Italian legislation that forbade mining in fertile fields, vineyards and olive groves, to preserve the surrounding natural environments.

Environmental destructions are also detrimental to mining itself. For example, the earlier practice of cutting down the forests for wood-charcoal, that was the only fuel used for smelting then, effectively extinguished the iron industry in Sussex, England as a consequence of the total destruction of forests and hence lack of fuel. Agricola al so wrote about the need for reclamation of the land devasted by mining, and said that where woods and glades have been cut down, they may be sown with grains to produce rich crops. An early example of reclamation of land under mining is the 1791 lease to Somerset colliery, that stipulated that when the colliery closed, the shaft be filled up and

sown with Rye Grass seeds. This was reported to be so precise that many stipulations of our times are considered to be less st ringent. The ironstone fields of Midlands England, have stipulated from 1850 onwards that mined areas be topsoiled and returned to agriculture. By the 1920s many mines were making spasmodic attempts at reclamation, especially in USA and UK, but seldom did they succeeded. (DOWN CG and STOCKS J 1977, p 8). This does not mean,that all of them were not serious attempts, or were lacking in support, but indicates that the land had been so much degraded.

Now many problems of bigger dimensions and in severe form have arisen as a result of modern technology. Thus, though the detrimental impact of mining upon land, air and water has been a topic of concern for many years and centuries, it is only during the present days that the problems have become so acute that remedial measures have been seriously looked into. The reasons for this intensification of remedial controls appear to be the fact, that the human society has become more humane and concerned as a result of liberal political thoughts, and radical revolutionary ideologies emerging amongst the working classes and the hitherto dormant, indifferent, marginalised poor people. In addition, the sufferings of the world by two great wars have perhaps made the world more compassionate and thoughtful of others. Yet, in developing nations, where even democratic systems get distorted to serve only the interests of traditional systems of authority, even the sufferings, cries of agony and protest movements don't move those in authority and in power. Under such circumstances, all concern for ecology and preservation of the environment, generally tends to be confined to occasional intellectual debates and works like this research. At other times, protests against the technologically induced massive demands for mineral resources break out, since great scientific and technological developments

that are in a position to mine low grade resources move into too close proximity of, and or into our neighbourhoods. The encroachment of the mines within the vicinity of residential areas are inevitable, as the imported or distant rich ores dry out and the existing mines get completely exhausted. Under such situations, attention towards disseminated and hitherto neglected ores of much lower grade is inevitable. Often times it is also true that growing urbanization, and/or the urban settlements, move inescapably to the close proximity of the hitherto distant mines. Then arise the clash between the urban and mining interests. And then emerge the concern for environment that till then remained submerged, or neglected, or not attended to in the distant, far-off rural area.

With the increasing demand for minerals, and increasing exploitation of low grade ores, comes the problem of the need to process larger volumes of ore to win an unit quantity of the minerals. Thus, today in many old areas like the Kolar Gold Fields, mining ores with a gold content of less than 4 gms per tonne, necessitates the need to process more than ten times of the ore when compared to the hay days of the mines when the ore contained more than 40 gms of gold per tonne. Hence the increased need to utilise more and more natural resources like water, the necessity to find newer and larger areas to dump more than t en times the tailings, and load the land, the people and the environment with ten times of polluting wastes for every unit of gold mined. The mines become larger, the workers have to work more, tonnages moved has to be greater and hence the need for more power. And thus the whole process becomes highly energy intensive, till the enterprise collapses, or winds up.

ENVIRONMENTAL AWARENESS: The growing awareness of environmental problem and the impact of pollution on the natural resources, by both the public and the government have brought in many legislations and anti-pollution measures. However, it is a practical reality, the problem becomes inceasingly severe. The problem gets either transfered to a different or distant area, or gets transformed into other forms. As a result we suddenly find many areas that were free from the problems of pollution, have to now live with them. The land, water and air - all the three life sustaining systems get increasingly polluted, untill a catastropy overtakes or some calamity befalls, or a sudden extraordinarily dramatic, disturbing and destabilising incident takes place. Many industsries, particularly many mine-mill complexes have been merrily polluting their surroundings. Only the degree of pollution varies, either they pollute at a rate that are considered to be within limits that their pollutions are tolerable, or at times excessive or are danger ous. But they always do pollute the environment around.

The response of the governments, the press and the public to the daily normal realities of pollution around, or in any parts, depend both on their awareness and on their interests. It is this response, that determines the extent to which the polluting units are made to change their practices and correct themselves. Rarely otherwise, do any self corrective wisdom dawns on the managements of the Industries and mines. Even when the people protest, their status, power and clout over the press and the governments of the day determines the laters' response. If the people are weak, powerless, not organised, and live

in remote parts and/or are marginalised, they and their protests tend to be simply ignored. In all such cases, the protests remain localised, not substantiated with facts and figures, and hence are simply dismissed as being unreasonable and unfair. Hence, they don't have even a marginal influence or impact, since the people could never match the powers, influences, resources and reach of the management (s).

Apart from the question of relative strength of the people, very often the damage being caused is so silent that the people don't even know what is happening to them and their surroundings or as to what is affecting them. Further, the direct relationship of a single known or unknown pollutant, the impact on the environment and the damage caused by it to the society and individuals have not been in most cases quantified, and in many cases not even recognised. Even the laboratory models and equations in known cases, do not fit in the field conditons and fail often in view of the innumerable variables, and interplay of different networks and forces of nature. The only known and frequently adopted measure today to evaluate any scheme or proposal are the extremely narrow economic assessments of profits and loss, investments and recovery. These often neglect, many hidden costs, concessions and subsides, and invariably undervalue human health, well being, individual life , welfare of local groups, and the safety of the surrounding environment as dispensable, or as recoverable in course of time by the natural forces. Else, the need to put up with difficulties, and make sacrifices today, for a better future tomorrow, and the mirage of future well being and comforts of our children and descendents are put forward as justifications for the crude exploitations of today.

Since mining is a basic industry, and has been the cause of pollution in many parts of the world, a close look at it is relevant. Mining affects land, water and air. The worst affected are the immediate surroundings.

AESTHETICS AND MINING: Waste materials from the mines, especially of recent origin, often stand out glaringly, presenting untidy and unaesthetic picture devoid of vegetational cover, or as carelessly heaped, scattered and spread mounds all around, dumped very indiscriminately. Recent past ones are barren and old ones are eroded and severely scarred.

DANGERS OF MINING: Old deserted mines are very dangerous. They pose grave security and safety risk. The extent of areas affected by old dumpings of waste is more difficult to assess, unless there exists old pre-mining baseline data. The number of water points, natural streams, water bodies, the extent of the valleys dumped with wastes and levelled up are difficult to estimate. Further, more diffuse distribution of waterborne and airborne material may extend several miles from the known source. Often, the very location or siting and sometimes even the existance of ancient, historic workings are not known and have been forgotten. Only geochemical reconnaissance, sampling, detailed soil and vegetational surveys can assess the actual degree and extent of contamination by the old mines, on a field by field basis (Thornton I 1974)

AGRICULTURE AND MINING: Use of contaminated land for agriculture is a controversial topic and must depend on individual factors such as the form and distribution of the pollutants, their degradability, solubility, availability and potential toxicity. Further, the local factors such as the soil type, drainage, pH, farm, management, cropping sequence

planned would all be the determinants. Well established soil-plant-animal relationship, recent investigations, similar experience elsewhere, establishing parallel soil-animal relationship, would be of valuable help and guidance. Animals are often reported to ingest nearly 10% of the dry matter intake, as soil from the farms (Thornton I 1973). In contaminated areas, this would represent an higher intake of the pollutants, nearly 10 times than that conta ined in the plants and herbage. But under certain conditions, plants and animals have reportedly survived in areas of heavy pollution by potentially toxic elements (Thornton I 1974). Hence there is a need to find more about pollution of the living systems at abnormal levels and also at sub-lethal and sub-clinical levels, and the marginal effects of these both individually and in combined form in the presence of other variables, on both the health and production of food, and the health of the consuming public. Similarly the effects of the use of contaminated land for housing and other purposes needs still to be studied, in detail. However, the possible conflicts of interest between mining and farming have been well recognised, for long. In fact extraordinary cases have been reported often. For example in Britain, a condition in cattle - the horses and other livestock - known as 'belland' in Derbyshire and 'mindering' in Mendip was associated with lead poisoning near lead mines and smelters.

Several non-ferrous metals including cadmium copper, lead, zinc and molybdenum may be toxic to plants or animals, and airborne and water borne contamination from mining and smelting may seriously affect both the production and quality of foodstuffs. On the other hand several metals of prime concern to the mining are fundamentally important to

plant and animal nutrition. As trace elements, they play an essential role in tissue metabolism and growth (Underwood E.J. 1971 p 543). These are iron, copper, cobalt, magnese, chromium, nickel, molybdenum and zinc. The list of these appear to be growing with time, and research and improvements in analytical techniques. But, frequently, the optimum range of trace elements in soils and water is so narrow that critical and/or severe deficiencies or excesses may lead to crop failure or animal death. Similarly marginal imbalances, leading to loss of production may be far more widespread and of greater economic significance. Hence, pollution caused by the mining of these elements in areas lacking these may be prove to be beneficial to the farmers and the society. But, unfortunately, this logic in support of the mines and to minimise their pollution impact, by citing possible benefits to the farmer and society in compensating the mineral difficiencies in the soil through their polluting effects, normally don' t hold good, since the soils in nature are generally rich with those very minerals which are there under the surface for exploitation by the mines. Hence, any pollution by the mines would only aggravate the problem and cause adverse effects. In any case, such pollutions could never be selective, and remain within the narrow limits of the optimum range or tolerance limits. Sooner or later, the upper limits would be far, exceeded, causing damages, due to critical or severe excesses. However, death of stock due to ingest ion of mineral-rich wastes, and resultant cotaminated soils or vegetation are only ocassionally reported. But on the otherhand, the possibilities of sub-lethal toxicity, affecting production and health of the cattle and sheep and the quality of foodstuffs such as vegetables and milk have not been adequately evaluated and monitored in most cases.

Apart from the polluting role of the mines, soils do get enriched in industrial towns and cities through pollution caused by process and manufacturing industries, transportation, domestic use, water and airborne contamination with minerals and compounds derived from the ore mines. Similar contaminations in rural areas, affecting farms and fields have been reported. These are apparently caused by repair, plating, tile, brick and matches making rural industries. (Goodman G.T., and Roberts TM 1971 Pp 287-292).

Mineral enrichcment of land, usually of individual field/farm levels are also caused by applicat ion of sewage sludge, animal wastes and fertilisers to the soils. A relative assessment of the intensity of these are difficult to make.

FISHERIES AND MINING: Heavy metal concentration in coastal waters, estuarine sites, bays in the sea, inshore waters enriched by the effluent drainage from mines, industries and municipal sewages have been reported (PRESTON. A 1973 ps 95-97) Hence, the need for monitoring and research - particularly of persistant minerals such as heavy metals, which may accumulate in sediments and in marine organisms and may present a potential hazard to the foodchain, fisheries and man.

WATER QUALITY AND MINING: There is very little published information on the effects of mining on water quality, though authorities are naturally aware of metal contamination of the waters by the mines. Further regular monitoring of water is reported to be costly and time consuming. In addition, the chemical constituents can vary appreciably on both diurnal and seasonal basis in relation to rainfall, runoff etc., though more

detailed research into local climatic, soil and drainage factors affecting the sediment-water relationship and on the form and mode of transport of metals from natural contaminated sources have these days been reported. (THORNTON. I 1974)

HUMAN HEALTH AND MINING: Though an extensive amount of information is available and knowledge gathered on the occupational impact of mining on the health of the workers, very little knowledge has been gathered on the possible relationship between human health and trace elements pollution of the environment by the mines, even to share or make available any information. Even the possible relationship between disease and trace-element distribution in the environment is a topic of some controversy, and actual confirmed casual relationships are probably confined to that between fluorine in water and dental caries, and iodine distribution and the incidence of goitre (Thornton I 1974). Evidence linking a range of trace elements with various types of cancer and atherosclerosis, cadmium with hypertension and molybdenum with dental caries, trace elements in the aitiology of cardiovazcular diseases and such other individual isolated linkages correlations have been coming out. Cases in Japan, USA, and also in other parts have been reported linking disease and physical/birth defects with some industrial pollutants and occupational hazards. In UK, the abnormal distribution of cancer in southwest England has led to a series of st udies of trace element distsribution in mineralised and neighbouring areas. Further, an empirical relationship between stomach disorders and cancer in North Wales with copper and zinc in the garden soils has been reported. In India, cases of Iodine and fluoride deficiencies and excesses on the health of the local population in individual spots and regionwise have been reported. Problems associated with heavy metals and radioactive elements have been reported from time to time in India and elsewhere.

In garden and local grasslands near old mines in the rural areas, abandoned smelting sites and in homes apparently built on or near material derived from mine wastes, higher concentrations of metals could be found. However, no significant report of such concentrations and harm to health, either amongst the people in general or mothers or young children have been reported so far, to cause any alarm in the light of present medical evidence, to be of biological significance, or cause concern to public health. These does not mean that no problem exists. They only show that no such problem have either been recognised or reported so far. The biological pathways of pollutants into human tissue and body in the bones and the blood need to be evaluated, together with bio-availability of their ingesten in the form of soil, dust and normal foodstuffs, before the pollutant contamination from the old and operating mines and other industrial sources on human health can be fully assessed, along with the use and utility of contaminated forest areas for agriculture, recreational, residential, other public amenity and production purposes.

ENVIRONMENTAL CONTROL: The irony of scientific, technological and industrial developments are thus that, while they have enabled the worlds mineral demands to be satisfied from over less accessible and earlier discarded/neglected resources, they have proved to be the causes of environmental damage. The corollary is that, can the same science and technology provide us a means of containing the damages caused and ravages done to the environment? Or, should the extreme remedy of banning all mining and other activities considered to be polluting be seriously thought of? This question is not a far fetched one. Infact, in

the early 1300s the use of coal in London for industrial and domestic purposes caused so great a smoke nuisance, that the nobility of those days backed by their supporters agitated successfully against the use of coal. This resulted in a Royal Proclamation by the King Edward I, banning the burning of coal. But in practice, it proved to be impossible to enforce with any effectiveness, and hence it ultimately failed like any other pollution control laws in many parts of the world. Under these circumstances, the need is not only to increase the research efforts to enable the basic science and applied technology to develop control systems, but there is also a need to orient our outlooks and development thrust in such a way, that a mechanism is developed that progress and even planning for progress is not decided by a select few, but that the public themselves can decide them, and also impose the necessary environmental controls. This needs that the public also be made fully aware of the consequences of the decisions taken, including the longterm effects of the pollutants if any in the wastes and the effluents, and the real effectiveness and efficiencies of the different/ alternative control systems.

ASSESSMENT OF (MINING) ENVIRONMENT

AN APPROACH: Since mining involves the removal of minerals from the earths crust for different uses and services needed by man, it is axiomatic that all mining activities disturb the environment and effect some changes to the surroundings. These are the impacts to the natural environment of the area caused by the mining activities. The extent of this impact can range from scarcely perceptible to highly obtrusive. The nature of the impact similarly can vary widely, depending upon the mineral, type of the mine, process adopted, the characteristics of the area and its surroundings.

In order to assess and consider possible remedies to minimise or reduce the adverse effects of the environmental impact, it would be necessary to -

a) Express the nature and the extent of the impact, with reference to a rational and consistent system of measurement.

b) Define acceptable standards and criteria in a comparable manner.

c) Compare the measured/ predicted impact with the relevant standards.

d) Evolve and implement remedial measures where necessarry, to reduce the impact to conform with the accepted/ safe-limits/ standards.

e) Monitor and periodically evaluate the field conditions, and take corrective measures when necessarry.

But in prctice, there are relatively few occassions on which it is practible to follow these ideal steps for -

i) No accepted techniques are available to quantify the extent of the environmental impact in many cases, especially when the loss of amenities and aesthetic beauty are involved, or health problems develop

very slowly and mildly that the same could not be definitely or specifically, accurately and authoritatively or conclusively attributed to the changes caused by the activities of the mine.

ii) Well defined and generally accepted consistent criteria and techniques exist for only a minority of environmental problems. Some types of impact such as visual, smell and noise are not amenable to measurement as they are inherently debatable while setting up the safe limits and acceptable standards. For, they have different impact on different individuals and on different groups and societies. Hence they are dependent on percieved, subjective reactions and attitudes. Even the cases of quality of drinking water, eminently suited to measurement and objective assessment at regular intervals or continuously, become problems since there exists a confusing plethora of local, national and international standards.

iii) There may be no known remedy capable of reducing a particular problem to generally acceptable levels. In such cases, it seems necessary to accept the environmental disruption that occurs, or prohibit the mining activity causing the particular problem, and putup with the lack of the mineral(s) that could be mined otherwise.

THE PROBLEM: In the last few decades concern has developed to the environmental issues, especially in the sphere of minerals and mining industries. This is very apparent in the developed countries, and appears to be related to increasing affluence of the majority of the people there, and their interest in leisure, amenity and rural areas. Yet, when it comes to the mines, mining and their environmental impact, there is a very peculiar problem. The mines are generally concentrated in some areas, mostly populated by the poor mine workers and their families.

And in addition, majority of the environmental problems caused by the mines diminish with distance, and generally mining has been encouraged in distant areas. As a result, the most severe mining environmental hazards that arise adjacent to the mines are likely to affect only the employees, their families and the local people. And this apparently does not seem to bother the conscience of the very intelligent, well informed, otherwise good conscientious people. For, in a way, the very development and affluence of their life are derived from the costs being payed by the people living in and around the mines, suffering from the problems created by the mines and the environmental impact caused by the mining and other related activities. These are the reasons why, the affluent societies are negligent and indifferent to the environmental problems created by the mines, mining and shipment of valuable and strategic minerals from many parts of Africa, Latin America and Asia. Hence, in any study of the mining environment, it is necessary to first define the environment, when considering the effects of mining. And then, it is necessary to decide as to whether the health and welfare of the mine employees are to be included or considered seperstely from the general well-being of the community in and around the area, even though frequently both are equally affected by the same problems, and cant afford to choose between the two while making a study or while assesing the environment.

Very often the mine workers are exposed to greater risks and pollution problems at their work-spots than the rest of the community and compared to the members of their own families. But many times, the mine workers get many protective equipments, not available or even known to the general community around. Also, very often, they are subjected

to compulsory or regular medical checkups, and recieve prompt or better medical facilities. Some of these may even be mandatory, and hence the help comes in time for the health-care to be effective and bear fruit. The workwers and their families often live in protected, well-maintained and better monitored hygenic areas, unlike others exposed to all the problems of nature and those created by the mines. Hence the problems of the workers and the general community around differs many times, either for the better or the worse, depending upon the situation, the area, the mine, and the specific type and nature of the problem.

The wide variety of mining environmental problems, can arise from and be categorised in a number of ways. Since we are generally concerned about the environment of man, it is relevant to approach this problem based on man's interests and the effect of the mines on man. In this approach, many of the problems can fall into more than one catogory, depending upon the severity with which they occur. The broad classifications are -

i) Direct Hazards to the Safety of Man,

ii) Indirect Hazards to the Well-Being of Man,

iii) Damages to Property, Crops and Livestock, and

iv) Nuisance and Loss of Amenity.

DIRECT HAZARDS TO THE SAFETY OF MAN: Cases of death or serious injury to the general public directly attributable to the mining activity are very few in number. In most mining operations, there exist potential hazards to employees and in almost all places there are adequate or reasonable legislations and control measures to safeguard the workers. It is a different thing to see howfar these are being implemented, followed and or enforced. This legislation normally protects the general

public also, either directly or indirectly from many of the more hazardous aspects of mining. As an example, the transport, storage and usage of the explosives are invariably subject to strict control and safety precautions enacted to prevent the otherwise inevitable dangerous accidental explosions. These not only protect the mine workers, but also the the general public that their interests are safeguarded adequately.

Nevertheless, public safety can be endangered on occassions through carelessness, indifference and negligence, both in practice and in supervision, or because of unusual or unforeseen circumstances, including the acts of God and other natural calamities. The major hazards are:

a) Sudden failure of reservoirs, waste dumps, tailing lagoons, open-pit sidewalls or similar artefacts: Examples of such failures in mine ares around the world have not been infrequent. Classic cases are the Aberfan disaster in South Wales and tailing dams collapse in El Cobre, Chile.

b) Major subsidence associated with underground mining: Subsidence is an inevitable concomitant of certain types of underground mining practices. Engineers normally plan, either to letdown the surface in a controlled manner, or to confine subsidence to areas excluded from public access. The principal risk arises from old, abandoned mines whose stability, or even existence may not be known, while at other times, the exact location of the shafts and other openings might have been lost, or could not be traced, and hence the magnitude of the risks in the area could not be assessed.

c) Shafts, inclines, adits and open pits: Adequate fencing or other security measures are normally required around any mine features, to prevent any accident. But these themselves could be the cause or

scene of accidents. The main risk once again arises from old abandoned mine areas where there is no continuing maintenance or security. Very old workings can cause serious accidents since no safety or adequate safety measures might have been taken at the time of abandonment, and natural revegetation may camouflage potentially dangerous openings, pits, sudden deep depressions and shafts. Open pits also get filledup with water to the level of the surrounding water-tables, as no more pumping of water from the mine-pits are continued in most of the abandoned mine workings. Since the sides are steep, and the exact depths of these open-pits are not known, they are serious security risks to the general public. Sometimes, the water filled deep-pits' steep side-walls pose the risk of sudden colapse and caving-in of the sides.

d) Release of toxic effluents: Many mine wastes, and effluents from the mills, particularly from the mines extracting metals are toxic, if released untreated. When the people are conscious, public pressure is strong, awareness of the locals are high, legal regulations are stiff, and monitoring and prosecution are meticulous and strict. Hence, some precautionary measures are adopted by the mines, either to contain such subsatnces or to dilute them to sub-legislative levels before their release. This spreads the toxicity over larger areas. The only hope is that such diluted toxins would be taken care of by nature, or go unnoticed without public protest, or atleast not attract penal legal actions. The problem of bio-accumulation of these toxins and their concentration to higher toxic levels, or their resistance to natural processes of degradation and hence their physical accumulation in the surroundings, and/ or formation of highly dangerous toxins in the natural process of bio-degradation are some of the risks not foreseen or under-

stood or even investigated manytimes. Such dangers reach man, either directly or through plants or aquatic life or through plant-animal chain and plant/ aquatic life-bird chain. Dangers can also arise from accidental spillage, or from unforeseen events such as exceptionally heavy rainfall which alters the planned pattern of effluent discharge and waste disposal mechanisms.

e) The use of explosives: Accidental initiation of explosives in mine areas are very rare. Inspite of this, the general fear of the destructive potential of modern explosives stocked and being used by the mines prevail amongst the people. Accidents in mishandling, not following safety precautions do cause problems, but these generally affect the mine workers only. Techniques of controlling flyrock from blasting have generally been improved to near perfection to prevent losses to the public. But dangerous accidents with wasteful losses and damages to the public do still occur occasionally.

f) Transport: Mineral and material transport, particularly road traffic,poses the same threat to public safety as other transport activities. This however becomes a major issue, when the mine in rural areas causes a sudden upsurge in the volume of traffic through the area, disturbing the usual calm, peace, tranquillity and safety of the area. Inaddition the mines do pose problems whenever heavy machinery, toxic reagents, chemical effluents, or potentially poisonous outputs like fine heavy-metal powders and dusts are transported.

INDIRECT HAZARDS TO THE WELL-BEING OF MAN: Because of the obvious and immediate nature of the threats, comprehensive measures are normally adopted to eliminate or minimise features of a mining operation which pose a direct danger to man. Much less to detect and remedy are those

aspects, which, if persistent over a period of time can affect the health and safety of the general public. The long-term effects of exposure to some aspects of mining known to be harmful to human welfare are -

a) Air and Water pollution: Gradual and very low levels of release to the natural environment of toxic substances invariably result in air and water pollution. The most important of these are probably the metal ions and chemical reagents. This release mechanism normally continues for long periods even after the mine has ceased to operate. Even though lethal concentrations have not been released from the mine, the long-term effects of exposure to sub-lethal doses are uncertain, especially where a complex combination of metallic ions is concerned. There does seem to be some potential threat to the health, if not to the life of human-beings. Also, there is the possibility that sub-lethal concentrations will be subjected to food chain magnifications with consequent danger to human-beings.

b) Noise and Dust pollution: Long-term exposure to high noise levels can cause permanent hearing damage, and similar exposure to dust can damage lung-tissues, and in extreme cases cause premature death. These are the most important problems in protecting employees.

DAMAGES TO PROPERTY, CROPS AND LIVESTOCK: Many aspects of mining have the potential to cause damage to buildings, animals or crops. Such damage, when it occurs, may be regarded as a direct financial loss to a member, or a section of the community, although it is almost inevitable that at the levels necessary to cause damage, nuisance and loss of amenity will also occur. Problems which affect crops or livestock may also pose an indirect threat to man by reducing or polluting his sources of food.

It is an essential difficulty of this type of problem, that it is frequently impractible to prove unequivocally the source of the damage. For example, vibrations from blasting can cause cracks in buildings, but so also can foundation settlements and many other factors not related to mining. It is thus a common complaint from the general public, that mining companies are unwilling to accept responsibility for the adverse effects of their operations, whilst the companies frequently claim that they are subjected to unreasonable demands for compensation. Even where damage is admitted, the extent of actual compensation justified could often be contentious.

The aspects of mining, which commenly occasion complaints of this nature are -

a) Air pollution; Both airbone and gaseous emissions can cause damage, the extent of which depends upon their composition and concentration. Allegations of dust damage are most common, when the dust has toxic constituents, such as metallic ions. However, even non-toxic dust can contaminate and cause damages if present in sufficient concentrations. And this can be issue of importance if the mine is close to population centres. Stack emissions of sulphur-di-oxide are the most widespread gaseous pollutant, and are normally associated with smelting of base metal concentrates. Their principal effect is to kill, or inhibit growth.

b) Water pollution: The wide range of liquid effluents from mining can pollute sources of water. The effect can range from the dangerous toxicity referred previously, to minor turbidity affecting aquatic plants and animals at the lower end of the food chain. Periodic flooding and everflows, may cause land pollution as a secondary effect.

c) Land-Subsidence: The removal of material from the earth's crust inevitably leads to some stress readjustments, and resulting ground movement. The effect of this may be minimised, by selecting an underground mining method in which the workings are supported by rock left in-situ, or by filling completed workings with waste material. Furthermore, in massive localised ore-bodies, the extent of the surface zone affected is limited. However, in really extensive deposits, such as coal seams or sedimentary ore-bodies, it is difficult to avoid some amount of surface subsidence without leaving a substantial proportion of the mineral unmined. Where deposits of this type underlie surface structures, there exists a potential for subsidence damage. This may range from the appearance of sink-holes, and the complete collapse of buildings, with consequent hazards to life, to minor cracking and architectural damages.

d) Ground-Vibrations and Air-Blast: Blasting operations give rise to ground-vibrations and air-blast waves which can cause structural damages. The potential diminishes rapidly with distance from the site, and commonly is limited to cracking of windows and plaster. Vibrations from static machinery do not normally contain sufficient energy to affect property beyond the boundaries of the mine site, but the heavy mobile plants and vehicles moving on external roads close to buildings can cause vibrational levels similar to blasting.

NUISANCE AND LOSS OF AMENITY: There is little dispute that hazards to the health and safety of man, from whatever source, should be removed as far as is practicable. Similarly, it is generally accepted, that anyone suffering financial loss from the activities of another should recieve compensation.

The types of mining impact dealt with so far have long recieved priority consideration from mining companies and the community in general. Nuisance and loss of amenity do not threaten man's existance, and seldom cause a readily quantifiable pecuniary loss. Consequently, they have so far recieved less attention. It is in these areas that much, though not all of the growing environmental awareness of the last few decades have concentrated.

Nuisance and loss of amenity are concerned with the quality of life and disruption of normal human activity. There is thus a strong element of subjectivity in their assessment, which is inimical to quantification. At very severe levels of impact there is usually unanimity. Thus a continuous noise level sufficient to prevent speech communication would be generally regarded as unacceptable. However, in order to determine whether or not a nuisance exists, it is necessary to define the boundary between the acceptable and the unacceptable. This may depend on a wide ramge of factors including the nature of impact, the location, the time of the day, the duration of the impact, and most important of all, the susceptibility of the individual.

The difficulties of deriving standards and criteria, which receive general acceptance are such, that for some types of impact, such as visual intrusion, there have been few serious attempts, and each individul situation is dealt with in an adhoc manner. Even where standards are common, as in the case of noise, the problems of adequate assessment are well illustrated by the enormous range of regulations in force in different countries.

The types of impact which can cause nuisance to the society or loss of amenity to the public are -

a) Visual Intrusions: Every aspect of mining, from the excavation to the surface buildings, and waste disposal areas can cause visual disruption. The extent to which the mine site is visible, depends principally upon the size of the operation and the nature of the surrounding topography. Visual intrusion is related mainly to the degree of visiblity and nature of the local landscape, which itself is a matter of personal value judgement. It may in general be thought of advisable to reduce visibility of the mining activity to a minimum, but this could be an over-simplification, since a proportion of the general public finds intterest in viewing major earth-works. For example, we have the massive Bhakra-Nangal Dam; The Bingham Canyon open-pit copper mine in USA is claimed to be the second largest tourist attraction in the State of Utah. So is the case with most of our other small and big dam sites, and the Gold Mines of KGF.

b) Noise and Vibration: Both noise and vibration can readily be measured, and therefore, in contrast to visual impact, are easily quantified. However, the nuisance potential seems to be related to a number of factors - principally intensity, frequency, duration, time of day, type of locality, and ultimately on individual susceptibility. Some standards in use, relate to one factor only, usually intensity. And, probably for this reason, are often regarded as unsatisfactory. More complex standards, incorporating several of the above factors are nonetheless frequently the subject of contention.

c) Air and Water pollution: Even at relatively low levels, air and water pollution can interfere with wildlife and natural vegetation, discolour the atmosphere and water courses, and cause minor contamination to homes, vegetables, fruits and other food items, laundry etc.

d) Dereliction: In certain types of mining, it is difficult to avoid creating land areas of either total dereliction, or very limited land use potential. Surface excavations, solid waste disposal dumps, tailings dams, and subsided areas can sterilise land to the extent that it is seldom possible to find new land uses. Conversely, underground mining may create new space capable of a wide range of after uses. In both cases the importance is directly related to location, at one extreme, in arid, sparsely populated regions, land use are very limited and questions of dereliction or new space may be of low priority. But, close to urban centres, or in other areas of high land demand, shortage and value, they may assume great importance.

FACTORS OF ENVIRONMENTAL IMPACT: The normal factors that generally influence the nature and extent of environmental impacts are, the size of the operation, location, method of mining and the characteristic(s) of the mineral itself. For, bigger the size of the operation, larger and greater are the potential hazards to the environment. But at the same time, larger mines can afford to plan better, and also afford to pay for environmental control, safety and rehabilation measures and equipments and/ or facilities. Geographical and other location factors like topograhy, climate factors of temperature, humidity, wind, distance from sea shore, altitude of the area, hydrology, the total and the rate of precepitation have a large influence on the nature and extent of environmental impact of the mine(s) in the area.

The mining methods adopted such as open-pit, open-cast, underground, dredging and other operations like drilling and blasting, influence the environmental impact of the mine(s). Similarly, the mineral characteristics, such as high-volume heavy tonnage industrial and construction minerals mining and transportation, high-value higher density low-volume metallic minerals by the nature of their demands influence the mining of even low grade ores even in situations that necesitate complete removal of large volumes of overburden, or very deep mining that requires dumping on the surface, large quantities of heavy rocks. And the nature of the low grade metallic ores produces equally large volumes of solid waste tailings, dumped after the extraction of the minerals from the ores, and also large quantities of chemical pollution as a result of the chemical processess adopted to seperate from the low grade ores the useful minerals. Special problems also arise from special mining processes as in the case of coal and oil production, or deep underground mining or mining the sea bed.

ECONOMIC AND SOCIAL FACTORS: The economic and social factors have a very large influence on the extent of environmental impact caused by the mines, or perceived by the people, or the concern the impact causes all around. For, the attitude of the general public to mining and pollution is conditioned in part by the state of the local or national economy, the nature and awareness of the community, their dependence for employment, income and foreign exchange earnings on the mines, and the products of the mines. The society and economy dependent upon the mines raise fewer objections. Even complaints by the mine workers, their families, and sections of the public living around or nearby, affected by the pollution and environmental problems caused by the mines, are not that seriously taken. These are the underlying causes of the developed richer

nations 'exporting' their pollution to the poorer countries, or creating/ producing most of their pollutions in the underdeveloped third world nations, which can not that readily afford to turn down new developments, even if they are known to be environmentally disruptive.

It is also reported that complaints and protests seldom originate from sections of the community with relatively low socio-economic status, such as manual or semi-skilled workers and their families, but spring from conservation and environmental pressure groups dominated by teachers, journalists, intellectuals and others not directly involved or benefitting immediately from the operations of the mines. It is however debatable, as to whether different sections perceive, or are differently affected by the mines and their operations. Or, is it that simply the more better off, the educated, and the better placed members of the society, with an alternative employment, and different sources of income, are naturally and understandably more articulate, and hence are forthcoming or are in a position to influence the different authorities? Perhaps, they are the ones who can, and could afford to raise their voices, and make their protests heard and taken note of by all concerned. More importantly, they can influence the press, that their views are promptly taken note of. Hence they are widely reported and promonently projected. So they attract attention all around, and forces the govts, the local officials and the mine authorities to take adequate or some remedial measures to mitigate the adverse/ serious effects of the environmental impact caused by the mines.

Thus, the existance of a given environmental problem can always be perceived, recognised, accepted, reported upon, and awareness on the same built up, officials made responsive and the authorities forced

upon to act, depending not on the magnitude or intensity or the severity of the problem, but mostly on the type, commitment, standing and influence of the people taking it up and fighting around for it.

TOTAL ASSESSMENT: In the light of the above, any assessment of the environmental impact caused by any human activity, including the mines, should take into consideration all the above factors. And the study should not only be total but also have to be a sincere and honest attempt and not be influenced by the socio-political priorities, economic biases, local prejudices, or just by the volume and intensity of protests. In short, they should not be the outcome of the prevailing paradigms, that mould the thoughts and actions of the intellectuals of the elite sections of the day. And no such assessment can be considered total and complete if it chooses to neglect the aspirations, the life and the problems of the majority sections of the society and especially the last man there in the area.

THE WORLD OF GOLD

GOLD: Gold had always been prized high, and was considered as the Queen, or to be the King of Metals. From time immemorial, and through the ages, Gold has been cherished as a precious metal, and coveted for its beautry, rarity and high value. Its restricted concentration in nature in select areas, brilliant pleasing colour, lustre, untarnishing yellow glitter, extreme malleability and ductility have made it very valuable and precious. Hence right from ancient times, it has been sought after and preserved as wealth, used for ornaments and trading as barter. Thus, in a way, it was the fore-runner of the modern monetary systems. There is then small wonder, that it is still the most sought after metal in the world. Few others could rival Gold in this respect. Thus the lure of the gold had always been there, and prevails till date.

The yellow metal had been used almost the world over, by nearly all civilisations at least for more than 5000 years. Traditionally it had been used for ornaments, ornamentation, jewellary, beautification, art and artifacts of wealth and riches.

Since pure gold is rather soft, it is usually admixed with very small quantities of copper before making jewels and put to other uses. Pure gold is 24 carat in fineness. As copper is added for working it, the resultant gold is only 22 carat or below. In coinage like sovereigns also, the gold used contains at least 2 parts of copper. Apart from ornamentation, gold has its various uses, because of its unique properties.

and of course nothing glitters like gold! Ancient kings used it extensively around them, including for coinage. Even where modern national and international economy has necessitated the removal of gold standard in coinage, gold often plays an important role in many international exchanges at crucial times and in crisis situations.

GOLD IN HISTORY: Gold often had been an important factor in changing the destiny of man. It had challenged his imagination, skills, intellect and also appealed to his greed, that it had mostly caused his demise by countless thousands. Royal courts and the rich have always displayed their wealth by an extravagent use of rich gold displays. Of course, the most important use of gold had been by the religious authorities. Places of worship and idols of gods and goddesses have been gold plated for centuries. The ancient Egyptians displayed two obelisks of solid electrum before their temple in Thebes. The Assyrian king who sacked Thebes during the reign of Tanoutamun, had reportedly taken the obelisks as prizes of war, and listed them as weighing 2500 talents(83 tons). The electrum alloy composed of 75 % gold 22 % silver and 3 % copper.

The church accumulated amongst its large wealth of arts, treasures and other assets, many gold items and icons. The Eastern Orthodox and Byzantine Church, especially the Old Russian Church, had large collections of Gold and Golden artefacts. Close at home, many invaders who had laboriously moved across our northern frontiers from beyond the high forbidding Himalayas, had been motivated by the desire to find among other things, rich gold for which the nation was then known around the world.

In the twentieth century, this wondeful metal has found surprisingly new uses, in gold coated windows, walls and roofs of big rich prestigious

buildings, in jet aircrafts, fighter planes, rockets, in space flights and space walks, as well as for contact points in under-sea cables, computers and telephones. Its use in dentistry and medicine is also not negligible.

GOLD IN TOMBS: Golden treasures of Tut-ankh-amen, the Pharaoh of Egypt who reigned from 1361 to 1352 BC were found in his tomb by the archaeologist Howard Carter in the year 1922. The young kings body was found encased in a coffin of solid gold nearly 3 mm thick, weighing 110kg (242 Ibs); and the hands and toes were sheathed in gold. There was a sheath of gold, embossed with animal scenes. There was a gold throne with a black panel of exquisite worrkmanship, showing the young boy-king being anointed by his queen. This was a rare valuable find, though such uses of gold in the pyramids were common. But specifically for this reason, long before the archaeologists came on to the scene, thiefs and plunderers had broaken into them and plundered the dead Pharaohs of their gold and other wealth.

GOLD MINING: Gold is widely distributed over the earth and is found dissolved in sea water. But its concentration is too low to be of any economic and practical use. However it is found in free state in the sands and gravels of the gold valleys of auriferous regions, in quartz veins and seems in sedidmentary rocks, and frequently in metamorphic rocks. Some gold finds contain small percentage of silver, copper, palladium or bismuth. Gold with a high percentage of silver is known as argentiferious gold or electrum.

The earliest reference to the mining of gold is found in the records of the Fourth Dynasty of Ancient Egypt. That was around 2900 BC. But a more definite information is available about the mine opened in 1500 BC by the Pharaoh Thutmose III. Around that year, he invaded Asia. He and his successors were able to conquer Palestine and Syria. They conquered Nubia, famous for its gold mines. They plundered the conquered countries mercilessly. Caravans of camels, loaded with gold and ivory, travelled to Egypt. The oldest papyrus map in the world, dating around 1100 BC, shows the way to the Egyptian gold mines of Koptos, which were probably situated in the gold district of Ophir, on the Red Sea.

In the second half of the 19th century, excavations were started on one of the fertile plains of Peloponnessus, on the ancient site of Mycenae, in Greece. The excavations showed that the city had existed as early as the 2nd millennium BC. An acropolis rose above the city on a steep hill. The fortress walls surrounding the acropolis were built of enormous boulders. There was a palace in the acro polis, and stone tombs were discovered near it. The entombed people wore gold weapons and gold articles, including a gold cup, made with great artistic skill. During the 11th to 9th centry BC., the Greek cheiftains exchanged extra cattle for copper and bronze items, beautiful fabrics and gold ornaments

In the second century BC the Romans conquered Macedonia and the rest of Greece. Plutarch tells us that they brought back to Rome a great booty. Carts loaded with booty drove through the city. Seventy-seven vessels filled with gold coins were carried. After that came people who lifted above their heads an enormous dipper of pure gold studded with precious stones and other gold vessels.

The value of the Charon coins, which the Greeks and Romans were wont to place in the mouths of their dead, to pay the fee of the fabulous ferryman who piloted the souls across the murky Styx to the land of the

ferryman who piloted the souls across the murky Styx to the Land of the Shades, reckoning the period upto A.D. 300, would be computed at about 30 million Rs. at the current gold price! (Goel B.S. 1987). There was in the 5th century B C in the Athenian acropolis, the Parthenon -a majestic temple in honour of the goddess Athena, Athen's patroness. There were two halls inside the Parthenon. One of them had an 11-metre high statue of Athena by Pheidias. The goddess's clothing was made of gold. In the main temple of Thebes, the columns were 23m high. Golden stars were drawn on the dark blue ceiling. An American investigator, in 1935, instituted systematic excavations at Visby, the chief town of the Baltic island of Gottland. He followed the precedent established in an attempt to salvage the treasures of the Incas. As many as 5,000 Roman coins made of gold were found.

LAND OF GOLD: The land of Incas was indeed a land of gold. When the Spaniards came, the temples of Pachacamek near Lima were fastened with golden nails that were found to weigh one ton when removed. A beautiful golden lamp in the temple of Minerva which burned through out the year has been described by Pausanias in the 2nd century. The richest temple of the Incas of South America was the Temple of the Sun at Kushko (Cuzco). The historians describing its richness wrote: "In the days when the Incas held away, the temple presented a sight which would have made Aladdin's cave look tawdry by comparison. The walls, outside and inside, were completely covered with plates of burnished gold. The gardens were filled with trees, shrubs and plants of silver and gold. Among the leaves and branches made of the precious metals were birds, animals

and insects of gold and silver, and even the fountains, tools and implements of the gardener's trade were of the same metals... Upon one wall, above where the Christian altar now stands, was an immense sun of massive gold... Opposite this glorious sun, was a hige representation of the moon wrought of polished silver, while about these two chief luminaries were the stars of silver and gold, with an arching rainbow of gold tinted in some remarkable manner to imitate the natural prismatic colours.'

The mummies of the Incan emperors had their false heads adorned with golden crowns and golden masks representing their features. Gold and jewelled ornaments covered their breasts. There were 12 life-size gold statues of the dead Incas. Golden and silver images of deities and mythological being were on every side. A Spanish writer of the 10th century, writing on the Inca treasures had said: "It is a well-authenticated report that there is a secret hall in the fortress of Cuzco, where an immense treasure is concealed consisting of statues of all the Incas, wrought in gold." In order to discover the treasures of the Inca kings, the sacred lake of Guatavia, in Peru, 11,375 ft above sea-level, was drained off, and gold and precious stones worth thousands of pounds were recovered. These had been thrown into the lake as votive gifts to the deified kings. It may be mentioned that the Spanish conquistador, Francisco, and his men ripped 700 plates of pure gold from the Inca Sun Temple at Cuzco. Then came the discoveries of gold deposits in many parts of the world, especially in the newly opened up continents of America, Austrialia and Africa. These resulted in many of the famous gold-rushes across the world. Writing about the early period of the fabled Californian gold-rush, Horace Greeley in his news paper 'the

Tribune,' wrote, 'we are on the brink of an Age of Gold."

EXTRAVAGANZA IN TEMPLES: Coming to more recent times, we have the Golden Temple of Amritsar, with gold-plated domes. Many other gurdwaras and hindu temples have also gold-plated parts in their structures. Many temples have idols of gold or of gold-plated material. The exterior of an Armenian Church in Detroit and a Roman Catholic church in Washington have been covered with gold.

We have the examples of the solid gold cellar of Benevenuto Cellini, designed for Francis I of France. According to Cellini's own description, it was oval in form, standing about two-thirds of a cubit, and wrought of solid gold. It represented Sea and Earth, seated with their legs interlaced. The sea carried a trident in his right hand, and in his left, a ship of delicate workmanship, to hold the salt. The Earth had been portrayed under the form of a very handsome woman, holding the horn of plenty, entirely nude like the male figure. In her left hand was a little temple of lonic architecture, meant to contain the pepper. Many beautiful decoration pieces of gold have served the rich to display their opulence and wealth.

PRESENT USE OF GOLD: The most surprising uses of the yellow metal have been made in the present century. Gold-coated buildings are appearing all across the Americas, Australia and South Africa. The first gold-plated building was the Richfield Oil Building, built in Los Angeles in 1929. Later, gold was used to adorn hotels in California, banks in Los Angeles, Beverley Hills, Dallas, and a chian of Golden Key coffee shops--all with gold roofs.

A very thin film of gold applied to glass can be used for windows to reflect heat and eliminate glare. Gold walls and windows could eliminate the need for airconditioning completely, or reduce it to a great extent. In the case of jet aircrafts or rockets, if normal insulation with asbestos is done, there is much dead weight. A very thin film of gold reflecting intense heat can replace all this dead weight. It is particularly advantageous for fighter aircrafts, as the pilots almost sit right on top of their engines. For the same reason, to provide thermal control and maintain the engines within the safe operational temperatures, gold coatings are being used for the external parts of Varnier rocket engines in the Apollo space fights. The cord that bound astronaut Edward White, the American, to his Gemini spacecraft during his historic walk in space, was gold-plated to reflected away thermal radiation.

To provide electric heating within, to prevent icing of the window-screens of high-speed aircraft, a coating of gold as thin as 1/5th of a millionth of an inch, is being interlaced with laminated glass. It has been suggested that such a glass may find its use also in the wind-screens and rear windows of passenger cars, in very cold climates.

Gold is equally important for electric contact points. It is used for tiny "repeaters" planted at intervals along the cable links, beneath ocean and incommunication satellites. Computers are being improved by replacing w ires with miniature printed circuits, where the electric circuits are "printed" in liquid gold on strips of plastics. The same can be done with many other electric appliances. Gold contact points can serve better in telephones also, instead of platinum or the gold-palladium alloy points.

GOLD IN MEDICINE: Gold has been used in medicine for treating phthisis, tuberculosis of the skin, lupus and leprosy. It is used for the treatment of rheumatoid arthritis in the form of intramuscular injections of a soluble salt of gold. It has also been tried for the treatment of cancer in the form of an injection of a collodial suspension of radio-active gold. During X-ray or radiation treatment, vital organs of the patients can be protected by the use of solid gold barriers. In the Indian system of medicine, gold has been looked upon as an 'Elixir,' which ccould prolong life idefinitely, and is also prescribed as gold-pills for skin diseases, impotence and barrennes. Some, therefore do take specially prepared gold ashes 'Thanga Baspam' in the country.

The unique properties of resistance to tranishing, very high ductility and malleability are responsible for the versatile uses of gold. Even an ordinary goldsmith can hammer it cold, until they are beaten into translucent wafers only five millionth of an inch thick. One ounce of gold can be beaten into a sheet covering 100 sq ft, and can be drawn into 80 kms of thin gold wire, or used to plate a thread of copper or silver wire about 1,600 kms long. An ounce of gold produces, 2,500 gold leaves, three-and-a-quarter inches square. It is because of this extreme malleability that the idea of goldcoating the buildings, etc. has taken root. A few ounces of gold can coat a modest building. One ounce of gold will coat about 150 sq ft of a building.

Liquid gold in the form of an oil solution can be used for providing a metallic brightness to almost everything. The cost is almost negligible, as a film of gold as thin as four-millionth of an inch can be coated. Thus, it can be used for adorning fancy bottles and jars, with gold letterings or designs.

FUTURE OF GOLD: Whether there is any use or not, gold has come to stay with the people. This is an hist oric fact, and gold also helps to a large measure to meet the vanity and the greed of the people. Not only individuals, but also nations of the world go after it, at least to hoard them somewhere safely and securely, if not for any technical, scientific or other immediate use.

Even though we may not today hear any more about mad gold rushes like those of the past, there still exists a heavey demand for gold. In this respect, only very few materrials can compete with Gold. Hence people, the ordinary citizens and nations and states world over continue to dig for gold in their neighbourhood. It is reported that, even peasants in Brazil have got into the act to win some gold that is available there for digging. If not hoard gold, it helps many people of the poorer strata to survive in scarce, poverty conditions in which they live or find themselves in. It is seen that many tribals and other poor pan the waters, sediments and silts of the river 'Swarnarekha' near Ranchi in Bihar for Gold, to sell to the rich and others in order to survive these days. 'Swarnrekha' means 'golden ray or line,' for somewhere along it's course, gold occurs in the soil/river bed, and the same gets washed out free and is carried down by the flowing river. Many women belonging to the families of the poor mine workers in the Kolar Gold Fields, could also be seen panning the drains in the area. For, some of the residual gold in the tailings dumped, by the gold mills, gets washed down as a result of the erosion caused by the rains and the winnowing action of the wind. Hence, at times the women get a few traces of gold by

panning the drain running out into the valleys formed between the innumerable tailing dumps.

GOLD RUSH: This rush for gold today, could well turn into tomorrow's gold glut. With all and sundry, trying to elbow into the diggings and panning, gold production by the end of the century could be running as high as 2000 tonnes per year. This compares with a record gold production prised from the bowels of the earth at 1375 tonnes in 1986, and 700 tonnes in 1943. In few years, improved mining technology will make it possible, and even at current prices profitable, to extract gold from places that the mining equipment now in use cannot reach. Therefore, the risk for the market according to 'Economist' may not be one of sacrcity, but of so much more of the stuff being mined that the yellow metal would begin to loss its rarity value and that could perhaps bring about a crash in prices.

GOLD IN ECONOMY: Banks and private investors today hold gold mainly because, its scacrcity and deamd persuades them to believe that it would not only keep its value but also appreciate considerably. This assumption helps to sustain the price of the metal, at between twice and four times the production cost of most of the worlds gold mines.

Investors, who still rate bullion a good buy say that the new gold finds will simply help compensate for a tailing off in the gold output from South Africa, which produces more than half of the gold mined outside the Communist world. The evidence, however suggests otherwise. South Africa's mining houses are searching as hard as anybody else for gold, and are still finding it. New mines in that distrubed country

are opening regularly. South Africa, will in all probability not find it hard to maintain its annual output at round it's current 650 tonnes, well beyond the turn of the century, whatever may be the political disturbancies occuring there.

Papua New Guinea may be set for the maximum expansion amongest all the established gold producers. Indian Express has reported that the total output of this much soughafter metal there, has already reached 43 tonnes from 17 tonnes in 1981. Besides, this country has yet to exploit those mines which are reported to contain 40 grams of gold per tonne. The richness of this mother lode can be appreciated when compared with the Gold rich South Africa's ores, which yield today in comparison a meagre four to five grammes per tonne of ore mined.

Peasants digging their own tiny claims, have helped Brazil double its gold production, to nearly 75 tonnes a year, since 1981. The dangerous honeycombs of mines they create in Bolivia and Peru as well, recover on an average only about 30 percent of the gold available. Scope therefore, still remains for the big mining companies to extract the remaining 70 percent.

Of the other major gold producers in the non-communist sector, Canada expects to produce around 120 tonnes of gold in 1987, against 52 tonnes in 1981. Australia is likely to mine around 90 tonnes of gold in 1987, up from 18 tonnes in 1981. The United States could be producing around 200 tonnes of gold a year within a decade. This projected figure comparers with 144 tonnes in 1986 and 43 tonnes in 1981.

TRADING IN GOLD: Gold Mines today are worried as to what they can do with so much of gold, and to stop a glut and the consequent slackening in gold prices? Some experts think, that they should sell gold, as hard as De-Beer of South Africa does with diamonds. In 1986, De Beers spent $100 million to promote sales worth $2.6 billion. Even though annual sales of gold are put at around $ 1.8 billion, at a gold price of around $410 an ounce, precious little is spent on sales promotion. De Bears has another big advantage over gold producers. It has spent years successfully persuading buyers that diamonds are forever. If the company sells a diamond, it can expect with a reasonable amount of certainty to never see the gem again. On the other hand, most of today's gold bugs have no such attachment to the metal, since they buy only to sell for profit, in an inflationary market.

Twenty years ago, the floor of the Bank of England collapsed under the weight of gold st ored on it. The bottom could well fall out of the market again, if todays gold rush continues. Though it is unpalatable to say so, what the industry really needs fo r prosperity is a less peaceful world or a less stable or a less prosperous economy, for crisis appear to be good for gold.

THE GOLD MINES OF KOLAR GOLD FIELDS

KOLAR GOLD FIELDS: The Kolar Gold Fields is the world famous KGF gold mining complex, in the south-eastern part of the Bowringpet taluk, in the south-eastern district of Kolar in the State of Karnataka, located in the Deccan Plateau of Southern Peninsular India. KGF lies at an altitude of 877 meters (2878 ft) above the MSL of Madras. It covers an area of 65.73 sq kms of which 52.78 sq kms is the mine area, and the remaining 12.95 sq kms is the civil area known as Robertsonpet and seperated from the mine area from the year 1971. It nestles on the eastern part of a low ridge of hills of which Betarayanhill, which is 975 meters (3199 ft) tall, is the most conspicious point.(Refer drawings No 1 & 2).

KGF lies 87 kms east of Bangalore the state capital, 24 kms south-east of Kolar district head quarters, and 16 kms soth-south east of Bangarpet(Bowringpet) the taluk headquarters. It lies at the extreme south-eastern edge, very near the junction of the Andhra-Karnataka-Tamil Nadu borders, on the Southern Railway broad-gauge spur that loops north into the area from the Bangarpet junction on the main Madras-Bangalore railway line.(Refer the Map Section). Gold occurs in the area in an auriferous land of schists running in a north-south alignment. The southern parts of these schists are productive areas, where the gold mines have sunk their deep shafts.

Gold was mined in this area from ancient times, right from the days of Indus Valley Civilisation. Mining by modern methods began during the last decades of the 19 th century by the British companies.

The first deep shaft was sunk in the Oorgaum village in the year 1875, and effective extraction of gold commenced only in the year 1881. But gold of value only ₤ 38 was produced in the year 1882. Four main gold-reef veins, the Champion, Oorgaum, Nandydroog and Mysore mines became operational in 1883, and they were then struggling to remain alive. In 1885 the rich Champion lode was discovered, and really there after the present extreme levels of deep mining of gold started. There after came many a number of mines in the area. KGF was then the biggest and the richest gold mines, yielding as much as 40 gms of gold and some silver in every ton of ore mined. The total gold production till date has been about 800 tonnes, recovered from nearly 50 million tonnes of gold bearing rocks mined from the depths of KGF and brought to the surface mills, averaging till date about 16.48 gms of gold per ton of ore mined. The average gold to rock ratio of the ores mined so far is 1 : 60 676 by weight. Today the yield has fallen by more than 10 times, and the yield is now less than 4 gms per tonne of ore mined, and is reported to be steadily going down. Only 3.77 gms per tonne of ore has been reported since the year 1982 - 83. Yet, as on date the mines compare very well with the famous and biggest gold mines of the world in South Africa, where the yield is of the order of 4 gms per tonne of ore mined. The biggest factor tilting the fortunes in favour of the South African mines are the scale and magnitude of the operations, for there gold occurs extensively in a large area almost from coast to coast. Today all KGF mines stand nationalised and operate as a Govt of India Public Sector Enterprise.(Refer Annexure I).

THE GOLD OF KGF: The gold in the Kolar Gold Fields occurs in the crystal-line schists of Dharwar age, the principal occurance being in the Kolar

schist belt, which is composed of a series of dark hornnblendic rocks stretching along north-south for about 64 kms, with a maximum width of 6 kms, and bounded on the east and the west by younger granitic rocks. The gold field itself, however, is limited to a length of just about 6 to 8 kms towards the southern end.

Numerous old workings along the strike of the schists in the auriferous locality indicates gold mining operations from the remote past. Kolar had reportedly supplied gold to Harappa, Mohenjadaro and other settlements of the Indus Valley Civilisation. The history of Kolar, is full of discoveries of rich treasures by the local chieftains. During the middle ages, Tippu Sultan had caused the mines to be worked through the agency of one Raja Ramachandra for some time, but abandoned the enterprise as the produce of gold just balanced the expenses.

THE BRITISH IN KGF: One Lieut John Warren of HM 33 rd Regiment, while surveying the eastern boundary of Mysore, immediately after the fall of Seringapatnam, heard vague reports of gold finds near Oorgaum and Marikuppam villages in the present day KGF, and in 1802 he seems to have noticed gold in these places. But nobody appears to have paid any serious attention to this till 1873, when one Mr MF Lavelle came forward and applied to the Government of Mysore for the exclusive privilege of mining in the Kolar district. Thereafter, the Wynad gold boom of 1878 bought in its wake several companies, which started vigorously to purchase and to work the mines of the KGF. But not having fully grasped the mode of occurance of gold, much money was wasted in the beginning. Only the dying effort of the Mysore Company in 1885 that discovered the rich 'Champion' lode, saved the situation. The adjacent companies which were on the verge of extinction, resumed mining operations

at deeper levels and succeeded in coming upon rich lodes. Ever since, the Kolar Gold Fields operations have been successful, though considerable anxiety had been caused from time to time by the intermittent character of the richer shoots of ore.

The depths of the main shafts vary from 4,000 ft (1220 meters) to 9700 ft (2960 meters). The deepest workings are now over 12,000 feet (3656 meters), vertically down below the surface. Owing to the operations at great depths, the rock temperatures in the mines are very high. They are over 62°C (143°F) in the lowest working spots. Deep mine ventilation methods have been adopted to provide an adequate supply of fresh and cool air in the mines. Air-conditioning plants have also been put into commission. However, the temperatures at the deeper working areas are very high, and hence the environment at the working levels inside the mines are very very uncomfortable.

The mines in the Kolar Gold Fields frequently suffer from 'air-blasts' or 'rock-bursts' or 'mini-quakes' of varying intensities, which cause considerable amounts of dislocations to work, and damages to the underground workings. These, not infrequently also result in deplorable loss of many lives. It is possible, that forces which caused pitching folds and faults in these rock formations are responsible for the strains in rocks in particular areas. Owing to their frequency,some portions in the Champion Reef Mine have been completely shut down, many times. Now all possible methods of sup porting the workings, to prevent or minimise the effects of the rock-bursts are adopted. Compressible timber supports such as stulls and sets have now been replaced by brickwworks, granite masonry-packs or concrete pillars in stopes, and steel arches in levels. However, the number of fatal accidents due to rock-bursts,

is on an average in the order of one in 20 or 30% of the rock-bursts, and numbers about 50 per year.

POWER FOR THE MINES: The mines originally started work with steam power. In 1894, Mr Edmund Carrington, an electrical engineer, applied for a concession of the water power at the Cauvery falls situated on the Cauvery River in latitude 12-16' -47" to latitude 12-17' -36" and longitude 77-12' -30" to longitude 77-13' -33". He was connected with Mr Holmes of Madras, one of the pioneers of electric lighting in India. The then British Resident in Mysore Colnel Henderson, took a keen interest in this, and Mr Holmes suggested supply of Power to the Kolar Gold Mines. Then the Mysore Govt come in, and after studying the account of the installation at the Niagara Falls, decided to produce electricity at the falls for supplying power to KGF and other domestic and industrial needs on the way. In 1900, with the sanction of the Govt of India, concession from the Govt of Madras, agreement with Messrs John Taylor and Sons and the individual mines, a contract with GEC of USA, and Messrs Escher, Wyss & Co of Zurich was signed for the Electrical and Hydraulic Plants. On 30th June 1902, 30,000 volts of 6,000 hp electric supply to KGF commenced. This subsequently went up in stages to 48,000 hp in seven installations by the year 1925. Then the transmission lines 147 kms long from the falls to KGF were the longest in the world, and the power plant was the first of its type in Asia.

Supply of electric power reduced the working expenses of the mines. Later, completion of the Kannambadi (Krishnarajasagara) Dam, ensured the steady supply of more power to the mines. The supply of electricity

to the mines from then till today is interestingly of 25 cycles AC

GOLD MINING IN KGF TODAY: The number of gold mining companies in the then Mysore State was 10 in 1918 of which 4 paid dividends, 1 produced gold but paid no dividends, and the rest were non-producers. The four dividend payers were the Mysore, Champion Reef, Ooregaum and Nandydrug Companies. In 1922-23, the number of companies which produced gold was only five, voiz., Mysore, Ooregaum, Champion Reef, Nandydrug and Balaghat, which amongst themselves shared about twenty leases from the State Govt to exploit different gold bearing blocks in the area. During the twenties, there were 22 mining leases current in the Kolar Gold Fields and no leases or licenses current for gold outside it. Now again, there are only three mines in the area. Mysore Mines in the Southern end, Champion Reef in the center, and Nandydroog at the Northern end. They are all under one Govt of India Public Undertaking, namely Bharat Gold Mines Limited (BGML), Oorgaum, KGF. Though, located adjacent to one another, they operate as different mines for historic reasons that resulted in separate technical/managerial styles and evolution of their own operational culture. Amongst themselves, they own, share and utilise all the old mine-shafts - both the operating and non-operating service shafts - mills and blocks, and hold exclusive rights to exploit gold in the area.

THE MINES BELOW THE SURFACE: No one who has not been deep down the gold mines or for that matter any underground mines, can imagine the incredible labyrinthine wonderland that lies hidden beneath the road and the traffic, the shops and offices, the bungalows, gardens and extensive housing colonies, the hillocks of mine tailings, the shafts and towers

crowned by huge rotating pulleys that meet the eye on the Fields. As one observes more closely, one notices gaping tell-tale cracks, plastered up, on office buildings and residences; and hears of rockbursts and mini-earthquakes that caused them, the tragic casualties, that give a grim hint of the eerie, ceaseless adventure that goes on beneath their feet. Visitors are usually taken to the mining Companies' few show-piece like the Edgar shaft of the Mysore mine or the Nandydroog Mine upto a depth of only 2000ft for a visit underground. And a show-piece they certainly are! This has been the reaction of those who had seen other shafts (SRINIVASAN Report 1930).

At the minehead all visitors have to sign an indemnity bond absolving the Companies from responsibsility for any injury or damage one may sustain underground. The visitors are then given a fibre-glass helmet (earlier it used to be a wicker basket hat) for protection of the head, a flask of water to slake thirst in the hot depths/to those going to deeper levels and a carbide lamp to light the way in the dark tunnels (earlier Acetylene lamps were used, and they have since been replaced by electric caplamps). One then enters a lift, or cage as it is not inappropriately called. The shaft is crowned by a gaint wheel with a helical axle--a masterpiece of engineering work--which operates the lift smoothly, with not a jerk or jar at a speed that reaches 30 miles per hour. Lights flash by, as the cage goes down, revealing glimpses at every 100 feet of the stages as they are called, opening into brightly lit tunnels. Then the cage glides down and down. The ears start aching with the growing air pressure, until the cage gently slows down and stops at the stages of its call. Thus they go down to depths of hundreds and thousands of meters. As one gets out into a well-lit tunnel, one could see rail tracks, trolleys and small tunnels branching out in various directions, massively supported

by concrete, bricks/stone work and timber; after walking miles one could meet sweating helmeted workers drilling and blasting away with compressed air drills the white gold-bearing quartz sandwhiched amidst black rocks. The air is humid and the rock floor, walls and roof are too hot to touch. Chilled 72°F (22°C) dehumidified air blown down by two-stage air-conditioning stations even at 150,000 cft (45,000 cm) per minute seem to be powerless to cool the environment any lower than 60°C (140°F). One learns with astonishment, that there are over 600 miles of tunnels and tracks underground in all the mines put together and the mining goes on to further depths of over 12,000 feet (3656 meters) making Champion Reefs the deepest or the second deepestin the world. The mining authorities are reluctant to allow visitors deep inside, a reluctance understandably based on their knowledge of the hazards of KGF's deep mines. Apart from this risk, one has to go down to reach these levels in cages, and then ladders, further down in cradles, buckets and crawl through narrow passages and connecti ons, wallowing in warm wa ter at the lowest depths. Only those who had been to the deeper levels can understand the hard conditions under which the men work, and also the risks to which they are being exposed.

OCCUPATIONAL DISEASES: The occupational disease associated with gold mining - like silocosis or pneumonokoniosis- is caused by fine quartz and other rock dusts inhaled into the lungs. Available reports and literature on gold mining in other countries, notably the Rand show that silicosis is a well-recognised occupational disease related to gold mining. Steps had been taken for a long time in those countries to prevent or reduce the risks, and to treat as well as compensate those affected. But the Workmen's Compensation A ct in force in the Kolar Gold Fields for many decades made no mention at all of silicosis, or

pneumonokoniosis even though the records of Government hospitals in the nieghbourhood, the case sheets and x-ray films always showed a clear evidence of workmen from the mines having been examined and treated for acute pulmonary complaints like coughing blood and difficulty in breathing. But the Chief Medical Officer of the mines used to report that there was no case of silicosis or pneumonokonisis in the Kolar Gold Fields. This was brought up only by the SREENIVASAN COMMITTEE IN 1930. But the Gold Mines expressed grave concern to make silicosis compensatable, and hinted that if this were to be done, the financial implications would be so serious that the Companies might think of "Shutting shop and go." When the State Govt stood firm, saying that they would rather like the Companies to shut shop and leave, than tolerate the sight of their workmen coughing blood at neighbouring hospitals, railway station and in rail coaches all the way to their homes, and asked as to whether they would not agree to take some action if this sort of thing happened in their own country, they reluctantly agreed to take some remedial action. But they suggested to the State Government that the Report, if published, might lead to a big labour unrest, and hence some of the sensitive portions of the findings may be omitted from the published Report. The Government accpeted the suggestion. The findings and recommendations in regard to silicosis were omitted from the expurgated publication. And later silicosis/pneumonokoniosis as an occupational disease was made compensatable.

THE LURE OF GOLD: The nature and problems of gold mining, its hazards, economics, unique features, the lure of gold, its sovereign sway over international monetary dealings, the risks not only in winning it from

bowels of the earth but also in the adventure of smuggling it around the earth and over the oceans, its twilight commerce in places like Kuwait, Dubai and Muscot, are all strange and exciting unreasonably. They reflect the depths of human vanaity and wastefulness. The sovereignty of gold continues unassailed amidst all the fiscal devices and strategies of international finance. Even though Gold has been delinked from the monetary system, gold is still the backbone of international credit or barter, and is the one commodity whose value has appreciated steadily, often steeply, through the decades. The price of gold has been going up and up, and continues to do so almost relentlessly. Gold apparently commands a market that is ready and waiting, inspite of the doubts and fears expressed by many in different quarters from time to time. Yet KGF, the Gold Miners and their families all remain poor, underdeveloped and very backward. Dug from depths, Gold is again hoarded underground, as in Fort Knox in the USA and in heavy guarded crypts and vaults of other nations. It is said that the biggest cell containing gold bars in the vaults of the Federal Reserve Bank, 80 feet under Wall Street, New York, belongs to the Soviet Union!

India has been famed for gold down the ages. She is one of the few countries in the world in which gold is found. For centuries, the precious metal has been mined in various places in the land. The present headquarters of the Kolar Gold Fields, Oorgaum, where the first shaft was sunk in 1875, was itself the site of old workings. The place name itself, as often is the case, reveals the clue. 'Oorgaum' comes from Tamil word 'Urukkanam' that means 'to melt!' Gold was mined there by the ancients. But the old workings were limited to a few hundred feet below the surface, and could not go lower for lack of massive technical equipments and energy needed to carry on mining at great depths. KGF

had such a long history. But now, long past are the halcyon days of the KGF mines. Since they are now working at great and dangerous depths, the cost of raising the ore, supporting, cooling and dewatering the workings had escalated steeply. But still there is 'Gold' and there are the 'Gold Mines.' And KGF would go in the memory of the people for it's Gold, the European mine managers and other officials, even after the 'little England' had vanished from the area, and the Tamil mine-coolies are erased out of the face of KGF perhaps as some say, 'as a result of their sins in digging the mother earth to help the British to steal the wealth of the golden eggs from her bowels.'

NATIONALISATION OF KGF: Gold always conjures up dazzling visions of fabulous wealth in the imagination oif the people. It spares none, including the Govts. So was the case with KGF. It blinded the eyes of the officials to the actual realities. After independence, the state levied heavy taxes on the companies, in addition to the royalties, gold duties, income tax and other taxies. Further, KGF became the centre of bitter union jealousies and political rivalries. These made the gold fields the centre of political intrigue and an active cockpit of politics. With the changing times, many labour leaders of KGF went up as MLAs, MLCs, MPs, Ministers, and one even as the State's Chief MInister. With so many leaders, aspirations and political activity, coupled with the uncertainity about the future of the mines, KGF became an issue over which even an elected Govt was toppled. Ultimately, since KGF had become a big political problem, the State Govt had to announce its determination to nationalise the mines. Pressurised by the State, due to political compulsions and electoral exigencies, the Govt of India appointed the eminent economist and the then Finance Minister at the

Centre Dr John Mathai, to study the problem of KGF mines. The working of this committee itself became a highly politicised controversy. All the interested parties tried to influence the committee. But, faced with the State's determination to nationalise the mines, and its demand on the Govt. of India to approve the states proposals, Govt rejected the findings of the Mathai committee report. Thus under unavoidable circumstances of public demand and overwhelming political pressures, soon the mines were nationalised by the then state government of Mysore on 29th November 1956, and a new company named the Kolar Gold Mines Undertaking was formed. And some considered that willy-nilly, the state had become the'undertakers' for the dying Gold Mines.

A huge compensation was paid by the State to the British owners of the mining companies on taking over the mines with their assets including built up ore reserves, hundreds of miles of rail and trolley tracks, the shaft lifts, power and water supply installations, other equipments and machineries, residential quarters, worksmen's colonies, the hospital and other institutions, as also all the liabilities payable to the sick and retiring old employees. The new masters of the mines and their managerial agents, after the natinalisation, were in extreme haste and hurry in rapid indianisation of the companies and of their higher paid officers and staff, bridging the gaps and vestiges of distinctions between the terms and conditions of employment of Indians and the few remaining Europeans, of shifting the company's headquarters from London to Oorgaum, KGF. Thus, it is understandable that the gaps between the mine workers and the Indian officials widened. Also, the housing, working conditions, amenities of the mine workers, and the quality and commitment of the management towards work visibly detoriated. In the process, the new

masters also forgot about the need to modernise the mines, to make them economical, and face the growing technical problems of mining and extracting gold from low grade ores and ever increasing depths. They also forgot to think about the problems of unemployment of the workers and the future of their families and dependents. As a result a unique combination of very unfortunate political and administrative repotism prevailed in the area.

The State Govt. which was crying for the nationalisation of the mines earlier soon found the mines to be a burden. Unable to cope up with their management, even though they had reportedly mined twenty crore rupees worth of gold during a period of six years, the state entreated the centre to take over the responsibility of running the mines. Thus after about six years, these mines were renationalised, by the Central Govt on 1st December 1962. The State Govt claimed Rs 6 crore as compensation for the mines and the assets the re-in, including the estates and the land, and received over three crores of rupees compensation.

DECAY OF KGF: The tales of woe of neither the workers, nor the mines ended after the Govt of India took over the mines. And the Gold mines have been incurring very heavy losses since nationalisation. But in all fairness, it is not denied by the authorities that much of the losses are the result of some accounting phenomenon. Hence a good part of the losses are book-losses. These accounting looses occur as a result of, or are based on the government's philosophy and attitude towards the mines and their workers. For example in the year 1977, the Govt of India pegged the prices of Gold produced by the mines at a ridiculous level of Rs. 8.66 per gram of gold, far below the market prices whole it was publicly making it's gold available to the goldsmiths across

the country through the Reserve Bank of India at Rs 60 per gram. And even this was considered to be a concessional favour shown to only some interested powerful parties at far below the market prices, that it became a political controversy and the sale had to be stopped as being an uneconomic sale at throw away prices, causing avoidable losses to the public exchequ er. This clearly shows that the Govt works-out and determines the profit and loss of it's own gold mines at one seventh of the price at which it sold large quantities of its gold reserves to domestic buyers, which sale itself was considered to be an undue favour shown by the Govt to some interested parties whom it wanted to favour. If only the real market prices of Gold could be taken as the prices for the gold produced, all the losses of the mines would instantly vanish into the thin air.

Today, the world gold orices have hit the cealings, and still are soaring high. The price of gold today is $ 410 an ounce. Still it is feared that the Kolar Gold Mines may soon become just a memory in the not too distant future. But the bustling townships that had grown in and around the mines, have been saved from their otherwise imminent collapse with the mines. The setting up of the huge, multi-crore Govt of India, Ministry of Defence controlled public sector undertaking known as the Bharath Earth Movers Limited (BEML) could sustain these townships, the neighbouring villages, and other settlements with their market areas and commercial business establishments. Thus it has been assured that the KGF townships will continue to live and grow. The sentimental fears of many, of lizards and jackals keeping court, where bright homes and busy installations shone, and people and townships flourished has been

dispelled. And it won't go the way of the Bellara Gold Mines of the Tumkur District, in Karnataka where the abandoned Bellara mine site remained to be a sad stretch of mounds, hollows, ruins and rubble, overgrown with scrub and jungle, known and dreaded for tigers, till the State Government reopened the mines. Yet, the KGF mine workers and their future have been causally, very conveiniently and easily forgotten, as if with a vengence. KGF and the mine workers who were once a force, and caused even the fall of the State Govt are today dispensable, and could be forgotten easily and ignored lightly.

THE ENVIRONMENT OF KGF

At present, the three mines in KGF - the Nandydroog, Champion, and Mysore mines - produce in addition to gold, some silver and sheelite from the old tailing dumps. After the gold bearing ore is recieved from the mines, the mills process the same by seperation, classification, crushing, grinding, blanketing, concentration, cyanidation, precipitation, and acid treatment to finally recover all the gold and little silver that also is found to occur in the ores in small quantities. Earlier, some mills used to extract the gold from the ores by the old amalgamation process. But at present the amalgamation process is reported to have been given up, as this involves extensive usage of mercury. Now cyanidation process is used by which the gold in ore is dissolved in cyanide solutions to seperate the tailings through special filters. Special plants for the slimes treatment installed makes it possible to even retreat considerable portions of the old tailing dumps which have been through the amalgamation process in the early years. Thus almost all the residual gold contents of both the old and new tailings could be recovered. Such reprocessing of the old tailing dumps is popularly referred to as the double extraction of gold or re-extraction of the tailings.

OPERATIONS IN KGF: The main activity of the KGF mines under the Government of India's Public Sector Corporation, the Bharat Gold Mines Limited is Gold Mining. They also recover a little quantity of silver that occurs along with the gold. In addition, old tailings of sand dumps are treated to recover any residual gold left, and scheelite of +65% WO_3 to manufacture TCT rods, retipped rods and drills. They also manufac-

ture mine electric winders upto 400 hp, shaft head gears, mine electric locomotives, mine signalling systems, automatic contrivances, and manufacture and maintain mine operating machineries. They also undertake and proof test load suspension cables, chains, humble hooks; non-destructive tests on drum-shafts, head sheave axles, suspension gears; provide assistance in dust investigation and ground control problems; carry-out R&D work of micro-seismic study on Rock Bursts underground; training of personnel; project works on high-speed shaft-sinking and tunneling; and special high-technolgy heavy machinery repair and rectification job-works from outside.

The mines process on an average about 1000 tonnes of pyritic ore per month in their mills. Stamping or tube mills are used by the mines to crush their ores in the mills, for extraction of gold. Gold and some silver are recovered from the finely crushed pyritic ores. Nearly 4000 gms of gold and about 300 gms of silver are recovered from the ores mined in a day by all the three mines.

GOLD EXTRACTION PROCESS: In the mills, the ore is taken first to the sorting and crushing stations, where it is screened in revolving trommels with holes two inches in diameter. The fines are then trammed out, while the remaining ore is fed into the jaw crushers. Then they are sent to the stamp-batteries where they along with the fines are crushed with water. The ore from the bins flows through a series of stamp batteries. The crushings, assisted by water transport are moved over blanket strakes, where the heavier gold particles liberated from the crushed, pulverised ore are trapped. The lighter ore containing the remaining gold goes to similar further stages in series via sand pumps. The flow is thus passed over a series of blanket tables, where further deposition

of gold takes place. Finally, the slime containing the gold that does not settle on the blanket tables under gravity is taken to the slime treatment plants. There, sodium cyanide and lime are added, to dissolve the gold in the slime. This mixture is agitated with compressed air at a pressure of 40 to 50 psi for a proper dissolution of the gold. This agitation is continued for about 12 to 14 hours till the gold in the slime is completely dissolved. The reaction in the slime treatment plant is -

$$4\ Au + 8\ NaCN + 2\ H_2O + O_2 = 4\ NaAu(CN)_2 + 4\ NaOH$$

The pulp now containing the sand tailings, and the gold solubilised with cyanide, is transfered from the agitators to Butter's canvas filters. The gold bearing filtrate is allowed to pass through the filters, and the clear gold solution is then allowed to the extractor box, packed with zinc shavings. Here, the gold gets precipitated as the zinc dissolves into the solution depositing the gold on the surface of the residual zinc shavings. Metallic zinc reacts with the solution, precipitating gold according to the chemical reaction -

$$2\ NaAu(CN)_2 + 4\ NaCN + 2\ Zn + 2\ H_2O = 2\ Na_2Zn(CN)_4 + 2\ Au + H_2 + 2\ NaOH$$

The gold precipitates along with the remaining zinc shavings are recovered by filtering. And while the filtered solution free of gold is returned back, the gold-zinc mixture is given acid treatment to dissolve the zinc. The residual gold, along with the gold recovered in the earlier stages by gravity seperation over the blanket tables, is smelted and cast into bullion for transfer to the banks (refer figures 1 to 4 showing the process flow in gold/ silver mines/mills).

SOLID AND LIQUID EFFLUENTS: The filter cake from the canvas filters is made into pulp again in the residue tank, from where it is pumped out for free flow into the valleys, lakes, nearby streams and other depressions around, outside the mine area. Thus the waste waters from the gold mines alongwith the discarded sand tailings are slurried, and hydraulically transported to the tailing dumping sites, or in the case of Nandydroog mines transfered back to the depths of the mines below, for use as sand depositions for filling the stopes. The deposition of the tailings in their dumping sites by the mines results in considerable outflow of the tailings and the wastewaters into the surrounding natural drains, streams, lakes and fields. This problem is aggravated during the rainy season, by erosion and run-off. Thus the tailings containing heavy inorganic suspensions freely escape along with the wastewaters and rain/ storm waters, through the side-slopes of the tailings and crevices. These overflows, erosions and flooding during the rains containing very fine particles silts-up the water courses, lakes, ponds and the agricultural lands in the valleys around the mine area. The present gold extraction process adopted by the mines results in waste waters and tailings containing cyanides and heavy inorganic suspensions. Their disposal into the open valleys around the mines without any treatment begets serious pollution problems, directly affecting the land and water of the surroundings.

The raw water for the mines, from borewells and as well as from the mine-shafts, are primarily used for conveying the crushed ore for different stages and processes of seperating the coarse from the fines, the gold from the fine sands; facilitate crushing the courses, blanketing, cyanidation, filteration, sand stoving the depths, equipment cleaning,

floor washing and finally to maintaion the consistancy of the sand tailing slurry for pumping the same to the dumps. The quantity of raw-water supplied to the mills varies from 13 000 to 18 000 cubic metres per day. These process waters are ultimately discharged from the mills at different points in the mining areas all around.

The water used for conveying the crushed ore for gravity seperation of the gold from the crushed ore, and the water used for washing the equipments and floors are collected in the sumps, and are pumped back to the process lines as they are likely to contain some fine particles of gold. The wastewater from the slimes settling tank is recirculated in the mill, and used for conveying the ore. The wastewater along with the slimes obtained after the cyanidation process is pumped to the residue dumps. This wastewater is mixed with Butter's canvas filter washwater and freshwater to form the tailing sand slurry. the solids concentration in the slurry is maintained at 30 to 40 %. These are pumped out to a number of pits or lakes in the dumping sites in the natural valleys around. The overflow from the residue dump pits containing cyanides and suspended solids, flow into the stormwater drains and natural streams running through the valleys and into the ponds, irrigation lakes/ tanks, fields and agricultural lands.

The mines process on an average about 1000 tonnes of ore a day. the gold contained in these ores today is around 4 gms per tonne. The gold recovered is only about 4000 gms and silver extracted is about 300 gms. These hardly come to about 5 kgs a day. Thus almost the entire bulk of 1000 tonnes of the ore mined have to be dumped out as tailings. These 1000 tonnes of solids and wastes are dumped out every day as nearly

2500 tonnes of slurry. Thus nearly 1500 tonnes of wastewater flows out of the mines every day. All these waters either flow out of the tailing dumps along the side-slopes or drain through the dumps, till they seep into the ground, polluting the land around and the subsoil water below. As a result the soil in the area is very saline, and the water is highly salty and not potable.

POLLUTION BY THE EFFLUENTS: A study of the mine effluents from two mills, by the National Environmental Engineering Research Institute, Nagpur had shown that the pH of the effluents are in the range of 8.3 to 8.6. The total COD of the effluents are 14 748 mg/l and 4 200 mg/l at the two mills. The suspended solids are 204 760 mg/l and 153 000 mg/l. The soluable BOD of the effluents are 30 mg/l and 20 mg/l, and the total cyanide concentrations being 36 mg/l and 8 mg/l. (Badrinath.SD et al 1981).

In a similar study of the effluents discharged by the mines, it was reported by Badrinath and his team that thedischarges at different points contained 253 794 mg/l to 350 330 mg/l of total solids, with COD values of 6716 mg/l to 8556 mg/l. The cyanide concentration of wastewaters varied from 30 mg/l to 100 mg/l. And the analysis of the settled tailing dumps had shown that they contain on an average of about 0.2 mg/kg to 0.35 mg/kg of residual cyanide, which get leached down below the tailings during the rains, and get carried away with wind blown tailing dusts. The particle size distribution of the tailings analysed by hydrometer methods had shown that the size distribution of the fine sand in the tailings varies in the order of one thousandth to one hundredth of a milli meter containing 4, 60 and 36 % of clay, silt and sand respectively. While the heavier particles settle rapidly,

TABLE 1: KOLAR GOLD FIELDS AREA - Physical and Chemical Quality of Water

Sl No.	Area	Total Alkalinity $CaCO_3$	Total Hardness	Permanent Hardness	Chlorides	Fluorides	Iron	Total Dissolved Solids	Turbidity	Residual Chlorine	Dissolved Oxygen	pH
		(.....in milli grams per litre or parts per million .....)										
Standards (CPHE - Govt of India)												
a)	Permissive	250	300	300	250	1.0	0.1	500	5	0.2	6	7 t0 8.5
b)	Excessive	400	600	600	1000	2.0	1.0	1500	25	-	-	6.5 to 9.2
1	Ammerhally Tank Supplies Water to the Kolar Town	25	50	50	21	nil	0.05	510	205	nil	6.5	7.7
2	Andersonpet Hand Pump - in the residential area outside the mine colonies/ area.	250	670	570	315	0.06	0.12	1260	5	nil	-	7.7
3	Bangarpet Bore Wells at:											
	a) Desihally	180	80	80	30	0.08	0.3	190	5	nil	-	8.5
	b) Bangarpet Rly Station	330	350	280	315	0.04	0.12	1080	nil	nil	-	8.1
4	Bethamangala Tank - KGF Water Supply	130	148	148	41	0.02	0.01	320	18	nil	7.5	8.2
5	Golconda Mine Area:											
	a) Effluent run-off	235	1140	1140	260	0.1	0.06	1900	26	-	-	8.5
	b) Open well Water	185	950	950	250	0.1	0.06	1500	8	-	-	8.2
6	Gosinakere	81	244	244	98	0.25	0.15	665	75	nil	-	7.9

7	KGF Road Bore Well	390	470	340	435	0.06	0.24	1050	nil	nil	-	6.9
8	Koppa Tank Bore Well	385	760	550	535	nil	0.31	1450	2	nil	-	7.1
9	Lakshmisagar Hand Pump	350	750	570	535	0.02	0.21	1950	8	nil	-	7.7
10	Lakshmisagar Lake - mine effluents from the Mysore Mines flow into the lake silting it completely	300	1200	1200	500	0.1	0.05	2100	215	-	-	8.5
11	Nagsetty hally Tank on the KGF-Bethamangala Road	64	904	904	402	0.15	0.08	2000	12	nil	-	7.4
12	Nandydroog Mine Shaft run-off	150	870	750	405	0.07	0.25	1500	25	nil	-	7.95
13	Oorgaum Mines Bulloan Shaft Water at the 4000 ft level below the surface	121	926	926	320	nil	0.02	1800	nil	nil	-	8.0
14	Swarnakuppam Residential area adjacent to the mines, behind the Robertsonpet Civil-Area, KGF	75	680	650	86	0.2	0.15	950	76	nil	-	7.45

the clay and fine silt which do not settle faster due to their smaller sizes get carried away for long distances by the run-off and very unpleasantly colour the water bodies in the area.

Samples of water from the points where the effluents have been discharged, and from the nearby lakes, borewells and open wells collected during the field visit were analysed. They all showed that these waters are highly polluted with pH slightly on the alkaline side, ranging from about 7.7 to 8.5, with $CaCO_3$ content ranging from 175 to 385 and dissolved solids from 600 to 2100 mg/l. Incidentally, it is seen from these results tabulated in Table 1 on the opposite page, that even some of the samples of water from the deep bore wells in the area, contrary to general expectations, appear to be polluted, and show higher alkalinity, hardness, chlorides and dissolved solids that are almost at the excessive limits. Thus it is seen that the waters from the deep borewells, and the handpumps in the residential parts of the mine areas and villages are all saline and unfit for human consumption. That this is so, in an area like KGF, known for almost regular monsoon fluctuations and frequent drought conditions, and regular water shortages, is a tragedy. Since the available subsoil waters have now become unpotable, these are not available to the people of the area to tide over crisis caused by water shortages. Therefore the people of KGF trudge over long distances to get some good water for drinking and cooking purposes.

WATER SCARCITY: To compound the problems of the available local water, protected water supply from the Bethamangala Water Works to KGF had remained almost static at about 2 million gallons of water per day inspite of a number of augmentation steps taken since their commissioning more

than 80 years ago. For, while 1.8 million gallons per day was pumped in 1904 exclusively to the gold mine area at KGF, which then had a population of only 38 000, today in 1987, only about 2 million gallons per day of water is being pumped to both the gold mines area and the newly come up BEML, as well as to the vastly grown Civil Area and the surrounding villages that are all clamouring for protected water supply as water shortages hit them all adversely. And the population of KGF today is around 160 000 as projected from the populations of 1971 and 1981 censuses figures which stood at 118 861 and 144 406 respectively.

The neglect of the KGF area could well be appreciated when one finds that out of the total 2 million gallons of water pumped per day by the water works at Bethamangala, nearly 0.5 million gallons i.e., one fourth of the supply goes to the new BEML area which employs only a work force of 3 500, as against 13 500 individuals employed by the gold mines. thus neraly one fourth of the total protected water goes to BEML with only 20 % of the total work force employed by both the units. In reality, out of 3 500 BEML employees not all reside in their colonies. Many come from the areas falling under the gold mines, the civil area, the nearby townships and the surrounding villages that recieve the remaining daily supply of 75 % or 1.5 million gallons of the protected water supply piped every day to the area. Thus the actual users are much more than the 13 500 workers and families of the gold mines. It should also be noted here that unlike the gold mine workers who are well settled in the area and hence support full families that are large, the workers of BEML staying in their colonies are mostly migrant workers new to the area and hence generally consist of nuclear/ small families. Thus the

mine workers and their families get on an average far less a quantity of water per head when compared to those living in the adjacent BEML colonies.

The problem of water availability with in the gold mine colonies are further compounded by the practices of the mines management. While the basic water supply comes from the State's KWS&DB Water Works at Bethamangala in bulk, the distribution of the same with-in the mine colonies is done by the mine authorities. This distribution by the mine authorities is done in a higly biased and partisan manner. While the crowded workers' colonies with just a small tap in the midst of long rows of the barrack housing the families have a very restricted water supply in most of the areas/ lines, which in the summer months, as the workers and their families complain, is once in two or three days and that too just for an hour or two, with such a low pressure that the water hardly trickles down the taps in drops, one could see lush green lawns and gardens being watered daily in the areas where the officials of the mines are housed.

Thus the families of the mining workers in the colonies are adversely discriminated. And they have to go to other areas daily in search of water for essential uses. And for other purposes like washing etc., they have to by force depend on the brakish, saline waters of the odd open wells or hand pumps, contaminated by the mine effluent seepages and runoffs all around the area from the tailing dumps and erosions during the rainy days.

CYANIDE POLLUTION: Since the mines use the cyanide process for extracting gold in which sodium cyanide - NaCN - is used as the transfer agent,

it is inevitable that the tailings and the effluents discharged by the mines contain cyanides in addition to other heavy inorganic suspensions. Such discharges obviously create severe pollution problems.(Zehnpfenning RG 1967). This is not something peculiar to KGF. Gold mines world over are known for cyanide pollution of their surroundings. And it is well known that cyanides are common in gold mill wastewaters at concentrations of 0.01 to 0.03 mg/litre. These cyanide remains are lethal to many fish species at very low concentartions of as little as 0.04 mg/l for trout. But over a period of 5 years, 0.023 mg/l seems lethal to trout, and smaller concentrations of as little as 0.009 mg/l can decrease the ability of trout to swim against water current.(Down.CG and Stocks J 1977 p 105). Hence they are inevitably washed down stream. Thus the fish population goes down in the streams affected by even very small concentrations of cyanide. As reported earlier cyanide presence in the wastewaters of KGF freely let out into the natural streams is of the order of 30 to 100 mg/l and the cyanide content in the tailings settled in the area varies from 0.2 to 0.35 mg/kg. These are far higher.

In the light of the above, it is rather very unfortunate and sad that the mines inspite of their more than 100 years of profitable existance had not taken up any pollution control measures or set up any waste water treatment plants before the discharge of their wastes into the open surroundings, or take up any steps to contain the pollution that would be caused by such untreated and uncontained discharges, or in any way tried to mitigate their adverse effects.

Unlike the workers, the management mostly had come from distant lands or places and went their way sooner or later. Hence, they suffered

Table 2: KOLAR GOLD FIELDS AREA - DUST POLLUTION

Sl No.	Area	Weight with-out dust in gms	Weight with dust after 24 hours in gms	Weight of Dust settled in 24 hours in gms	Dust settlement micro gms/ square cm/day	Remarks
1	Andersonpet Residential Area just outside the mine area, with some trees and plants around the houses	21.6	21.65	0.05	57.21	Dust pollution problem prevails
2	Bethamangala Lake Area far from the mines with lot of trees and plants	21.8	21.82	0.02	22.88	Dust pollution is less
3	Bethamangala Water Works far from the mines and located amidst well laid out garden/park with a large number of trees, plants and vegetation	22.0	22.02	0.02	22.88	-do-
4	Gosinakere a village on KGF - Bethamangala Road, with agricultural fields and trees around	21.5	21.53	0.03	34.32	-do-
5	Lakshmisagar Lake Area - far from the mine area, but is heavily polluted by the mine discharges: a barren area	21.5	21.55	0.05	57.21	Dust pollution problem prevails
6	Marikuppam Residential Area just near the mines with some trees and plants around the houses	21.6	21.66	0.06	68.65	Heavy Dust pollution
7	Pichapalli Village -far from the mines on KGF - Bethamangala Road, with agricultural fields and trees around	21.6	21.62	0.02	22.88	Dust pollution is less
8	Robertsonpet Civil Area adjacent to the mines, densely populated commercial area, and barren with little tree/vegetation cover	21.8	21.87	0.07	180.09	Severe Dust pollution
9	Swarnakuppam in Civil Area	21.8	21.85	0.05	57.21	Dust pollution

not that much, especially when they lived in exclusive areas with plentiful of protected water supply, and amidst well laid out spacious gardens with plenty of trees and plants, that to a great extent minimised the effect of air pollution by filtering out the harmful dusts in the atmosphere to a large extent in natural ways.

DUST POLLUTION AND GREEN PLANTS: The effectiveness of trees, plants and other green foliage in filtering out the dust in the air from settling on the ground has been found in the tests carried out in the area during the field visit. As could be seen from the Table 2 placed opposite, the amount of dust settling in the different areas in and around KGF studied varies from 22.88 to 180.9 micro grams/ sq meter/ day. The lowest was at Bethamangala Water Works, an area at a distance of about 11 kms radially away from the mines as the crow flies, and has well laid out gardens all around. Similar lower values were recorded around the lake area and the villages nearby the lake. On the other hand, the highest value of the dust settled was recorded at the civil area adjacent to the mines. Urbanisation has denuded the place and there are hardly any tree or other vegetative cover in this area. In other areas, the dust values recorded were of lower magnitude. The ratio between the lowest and the highest values recorded is 1 : 8.

These show that a large amount of dust settles in and near the mine areas, and this falls as one moves away from the mines. Also, the rate of dust settling in the area is not only influenced directly by the proximity of the area to the mines, but is mitigated by the trees and plants in the area. The sources of the dust in KGF area are mainly the severely eroded tailings dumped by the mines after extraction of gold from the ores mined by them from below.

TABLE 3: KOLAR GOLD FIELDS AREA - Soil Respiration

Station No.	Area	Quantity of HCl for Neutralisation of NaOH in ml (a)	Quantity of NaOH Consumed by CO_2 absorption in ml (b = 30 - a)	Quantity of NaOH consumed by CO_2 due to soil respiration in ml (c = b - ref b)	Quantity of CO_2 absorbed due to soil respiration in gms	Soil Respiration per sq cm of land area in micr gms/ sq cm	Remarks
Reference	Cemented hard smooth surface at Bethamangala Water Works KGF - no soil, no respiration	19.0	11.0	-	-	-	Reference Area
1	Andersonpet A residential colony outside the mine area	12.8	17.2	6.2	0.01364	88.57	Polluted area
2	Bethamangala Lake Area far from the mines, and located amidst well laid out parks with trees and good vegetation	6.0	24.0	13.0	0.0286	185.71	Area not polluted
3	Bethamangala Water Works far from the mines, and located amidst well laid out parks	7.0	23.0	12.0	0.0264	171.43	-do-
4	Champion Reef Mine Workers Colony nearer the mines - within the mine area	11.0	19.0	8.0	0.0176	114.29	Polluted area
5	Edgar Shaft Mine Area	12.0	18.0	7.0	0.0154	99.99	-do-
6	Golconda Mine Area	14.6	15.4	4.4	0.00968	62.86	-do-
7	Gosinakere Village far from the mines on the KGF-Bethamangala Road	7.5	22.5	11.5	0.0253	164.29	Area not polluted
8	Lakshmisagar Lake Area downstream of the Mysore Mines with heavy flow of mine effluents	16.0	14.0	3.0	0.0066	42.86	Polluted area

9	Marikuppam residential area very near the mines	11.5	18.5	7.5	0.0165	107.14	Polluted area
10	Nandydroog mine area	15.4	14.6	3.6	0.00792	51.43	Polluted area
11	Oorgaum colony residential area	14.9	15.1	4.1	0.00902	58.37	-do-
12	Pichapalli Village far away from the mines on the KGF - Bethamangala Road	9.0	21.0	10.0	0.022	142.86	Area not polluted
13	Shellite Plant Area	16.5	13.5	2.5	0.0055	35.71	Polluted area
14	Kamsandra Village far from the mines on Bethamangala -Bangarpet Road	6.5	23.5	12.5	0.0275	178.57	Area not polluted
15	Swarnakuppam lake area not far from the mine area behind the Robertsonpet Civil Area	10.0	20.0	9.0	0.0198	128.57	-do-
16	Robertsonpet Pump House in the civil area within a compound containing a number of fruit trees	9.0	21.0	10.0	0.022	142.86	Area not polluted

SOIL RESPIRATION: Soil around the mine area tested for their capacity to sustain life showed that the soil respiration in the mine areas and nearby were very low, when compared to the distant valleys, villages and areas relatively free from pollution by the mine discharges of effluents, and the runoff from them and the endless dumping of the tailings. Areas polluted by their proximity to the mine discharges and the tailings dumped by the mines, showed lower levels of respiration. This soil respiration, indicative of the life activity that goes on in the soil shows, that the soils in the mine areas and nearby as also the areas downstream of the effluents discharged valleys, are all affected by pollution. Of course this would be altered considerably by factors such as the type of soil, moisture content, and mans activities like irrigation, application of manure, soil disturbances and agitations caused by ploughing, cultivation of the fields and plantation. However, the tests do indicate that the nearness to the mines and pollutant discharges flowing through the area adversely affect the capacity of the soil to support life and hence the lower soil respiration recorded, as could be seen in Table 3 placed opposite.

SOIL POLLUTION: Samples of soil and silts deposited by the mine effluents and the runoff in the area were collected from different spots in and around the mine area, and were tested for germination of the seeds in them. These tests showed that except for the soil samples collected from the residential areas, and the distant villages, these soils did not permit germination. Even in other cases, soils obtained from near the mines showed a lower percentage of germination, and the growth rates were slightly on the lower side. The exception to these results were the lower percentage of germination in the distant village of Nagsetty Hally. Apparently this is due to the fact that the valley into which

Table 4: KOLAR GOLD FIELDS AREA - Germination Test in Soils of the Area

Sl No.	Area	pH	Electrical Conductivity micro mhos/cm	Percentage of Germination of Moong observed at 12 hours intervals - and root+shoot length 12	24	36	48	60	72	84	Remarks
1	Andersonpet	7.15	1.75	60	80 1 cm	80 2cms	75 6/7 cms	75 8/10cms	70 10/12cms	70	Germination is Good
2	Bethamangala	7.4	0.245	80	80 1 cm	80 2cms	80 6/7cms	75 8/10cms	75 10/12cms	75	-do- -
3	Golconda Mine Area			-- Highly Polluted Area --							
a)	Effluent discharge area	7.78	16.65	0	0	0	0	0	0	0	No germination at all
b)	Dry-double recovery tailings	9.1	65.00	0	0	0	0	0	0	0	-do-
c)	Wet tailings area	9.9	3.25	18	40	60	Decay started and no growth at all				
4	Gosinakere Village on KGF - Bethamangala Road	7.2	0.28	80	80 1 cm	75 2cms	75 7/8cms	70 8/10cms	70 10/12cms	70	Germination is Good
5	Lakshmisagar Lake Area		- Polluting Effluents from the distant Mysore Mines flows into the lake -								
a)	Dry sediments	9.8		0	0	0	0	0	0	0	No germination at all
b)	Wet/fresh sediments	9.1		14	50 very very thin roots of 1 cm	50 length 2 cms	20 3 to 4 cms	20	Decay started		Growth not sustained
6	Mysore Mines Area	7.86	11.5	0	0	0	0	0	0	0	No germination at all

7	Nagsettyhally - a Village on the KGF - Bethamangala Road										
a)	Lake Area	7.1	2.25	50	65 1 cm	60 2cms	25 3/4cms	Decay statrted	-	Lake area is polluted by mine flows	
b)	Village Area	7.68	1.1	60	75 1 cm	70 2cms	60 5/6cms	60 7/8cms	60 8/10cms	60	Germination is poor
8	Oorgaum Mine Colony Area										
a)	Workers Colony	8.6	1.15	50	80 1 cm	80 2cms	80 7/8cms	80 10/12cms	75	75 12/14cms	Germination is not bad
b)	Watch & Ward Lines	7.62	1.65	50	75 1 cm	75 2cms	70 4/5cms	70 6/7cms	70 8/10cms	Germination is not bad	
9	Swarnakuppam in Civil Area	6.0	0.13	80	80 1 cm	70 2cms	70 7/8cms	60 10/12cms	60	60	Germination is good
CONTROLS											
a)	JNU Garden Soil	6.5	0.13	80	80 1 cm	80 2cms	80 6/7cms	80 8/10cms	80 10/12cms	80	Germination is good
b)	JNU Garden Soil with cyanide added after 24 hours			80	80 1 cm	80 2cms	Decay started - Growth is not supported because of cyanide pollution				
c)	JNU Garden Soil soaked with with cyanide			o	50	25 1 cm	20 2cms	Decay started		-do	
d)	In cyanide sollution			0	0	0	0	No germination at all because of cyanide in the medium			
e)	In a Medium with 50 % Cyanide and 50 % Distilled Water				0	0	0	-do-			

the discharges from the Nandydroog mines and the Double-Recovery tailings dumps and the Scheelite Plant near the old Golconda mine shaft flow out, leads directly to the Nagsetty Hally lake on the way to Bethamangala, and hence the area is also highly polluted. But the major exception comes from the Lakshmisagar Lake area beyond the southern end of KGF, where there is no more any water in the lake. The daily discharges from the not so nearby Mysore mines had already silted the lake into a vast bleak plain flat level ground, and it looks like a cinder topped huge football or an open but carefully levelled playground. The water contained in the effluents apparently seep into the ground very quickly leaving the silt to dry soon after the discharges stop as in the case of any sandy area. While the sample collected from the dried-out parts of the lake recorded no germination at all, the freshly deposited wet sediments showed relatively delayed germination of about 50 %, but soon the shoots withered away, decayed and died. Perhaps, the moisture content in the fresh sediments have some effect on the germination of the seeds. These results could be seen in Table 4 placed opposite. These indicate the severe levels of soil pollution in the area.

ADVERSE EFFECTS OF POLLUTION OF THE AREA: From these, one could infer that, as the mines discharge their effluents - without any treatment, but diluted with the polluted mine wastewaters, not with an idea to bring down the percentage of the pollutants in the discharge, but due to their technical and operational requirements of having to pump the sand waste tailings to the dumping sites of natural depressions

and valleys outside, - they freely flow into the neighbouring fields and hitherto used irrigation tanks. The effluents, with the highly toxic cyanide radicals and heavy inorganic suspensions, accumulate and fill the tanks and lakes and ultimately flow into the streams and agricultural lands around. Since the seepage of the water in the effluents results in considerable amount of infiltration of dissolved toxic solds, reagents and other elements of the effluents into the earth, the wells, handpumps and even deep bore wells in the area give these days only contaminated water. It can therefore be seen that the waters of the area are highly unsuitable for human consumptions.

As a result of the effluents and water pollution, the land in the area is also so polluted that the EC values are mostly above the crisis levels of 3 m mhos/cm, in most of the places. Consequently the germination of almost all the crops are affected, and the yields are severely reduced. This has been confirmed by the germination tests carried out on the soils and water from the samples collected from the area. It is therefore no wonder that the agriculturists of the area complain of fall in the crop production, and many directly affected by the discharges flowing into their lands and around their homes almost pathetically ask - 'Will this problem of mine discharges not end? Why do the Govt allow the mines to discharge these wastes and tolerate our ruination?' One at this stage is reminded of the grim epigram which Mr Sreenivasan heard in the area and reported in his report later, 'Keelay pona ponam, melay vanda panam.' Translated from the Tamil Original, it would read, 'It is suicidal to go down, but wages are there if one

can come up.' Literally it means 'Corpse if you go down, money if you come up.' That helpless are the people living here, and having to put up with the polluting effluents flowing around. Like the workers dependent on the mines knowingly and willingly risk their lives to go inside the depths of the mines, to earn their livelihood in case they come back up on to the surface alive, these people cling on to their lands hopelessly, even when it is going bad before their very eyes. For, they have nowhere else to go. As for the role of the Govt once again, the experience of Mr Sreenivasan in the early 1930, when he enquired into the conditions of the mine workers, comes to memory. He was, as reported by him later, during one of his many visits to the workers' hutments was asked by an old experienced grey-haiared man very humorously, 'Enna Saami Ónga Mysore Government than thangathai poyee vellakkaranukku kuduthutu irumbay nondran!' This meant, 'What Sir, your Mysore Government only after having given away even the gold to the whiteman, is now digging the earth for iron.' So shrewdly the old man censured Mr Sreenivasan on learning that he was a friendly Mysore Govt official enquiring about their conditions of life. This reflects the peoples annoyance, ridicule and contempt towards the State Govt's wisdown in giving away the exclusive rights to the British to mine the Gold and take them away to their land after paying a little royalty of a token 5 or 10%, while the State engaged itself seriously and laboriously to produce iron and steel in their plants at Bhadravathi! In a similar vein, are the people's anguish about the Govt's indifference, antipathy and irresponsible attitude towards their losses and sufferings, as the mines are freely allowed to discharge their effluents in such a way

as to flood the agricultural lands being cultivated by them, thus snapping the only source of their livelihood, employment and income.

While the affected people weep, swear, curse and grudge, at their helplessness and impotent state of inaction in the face of the big, mighty gold mines, and the neglect and indifference of the Govt and its machinery and officials, the polluting effluents continue to merrily flow daily, inundating newer and larger areas, as the old dumping grounds silt up and the effluents spill over all around. The effect of both the physical and chemical pollution of the land is manifest on the crops as stunted growth, poor germination, staining, leafburn, poor quality of yield like grains, fruits and vegetables from the area. The fact, that most of the farmers have stopped cultivating long-back, crops like paddy and have taken to sowing moderately resistant crops like ragi, cholam and in many other places have totally given up cultivation and now hopefully depend upon the eculyptus plants to mature for harvesting and sale, adequately testifies to the detoriated quality of the ground water, soil and the crisis situation in the area.

Summing up, one sees that in the KGF area the ground water and subsoil water resources are fast depleting and wells go dry totally, or over increasing periods every year, even when as many wells and hand pumps turn out to be saline, and their waters become unfit for human consumption. But the demand for water keeps increasing. Therefore, the pollution of this basic commodity assumes greater importance in this context. Hence, here in KGF, where already the people are impoverished for lack of basic known needs such as food, clothing and shelter,

the problem is deteriorating so fast, that the very life sustaining line of water is threatening to snap, along with the availability of good land and air. This is really very danger ous indeed, by any standards. The slow, but steady adverse effects of pollution on the health, all around in the area adds an element of urgency to the problems of KGF.

SOCIAL PROBLEMS: Since independence, many industrial concerns owned by foreign nationals have been nationalized. On 29th November 1956, the Kolar Gold Mines were bought from John Taylor and Sons, for Rs 164,000,000 by the Government of Mysore. In December 1962, the mines were taken over by the central government.

The transfer of ownership brought about numerous changes in the social structure of KGF and in the operation of the mines. A large proportion of the technical and executive personnel of the mines were traditionally foreign nationals. After the first nationalisation, some foreigners were persuaded to leave, while many others left voluntarily. However, the vacant positions had to be filled by native, subordinate officials. And these, in nearly all cases, happened to belong to only one caste group- the Brahmins of different shades. Earlier socialized by their foreign superiors, these Brahmin officials filled the vacuum created in the mining industry and in local social life when the foreigners departed. They carried with them their biases and prejudices. And "nepotism" and "casteism" came to operate more thoroughly than did merit, as factors involved in considerations of job tenure, promotions etc. And, in the long run, this and related considerations militated against the efficient and profitable operations of the mines. (G.N. RAMU. 1977)

The KGF population grew by around 400 per cent between 1901 and 1951, but thereafter, had shown a downward population trend (Davis, KINGSLEY et al 1959). The growth until 1951 was correlated with the progressive expansion of the areas under mining industry, and the productive and profitable operation of this industry. The decline, since that time has been due to -

a) the progressive retrenchment of the workers by the mines, and

b) the exclusion from enumeration in the 1971 Census of 70 villages formerly included with KGF.

c) fall in the activities of the mines.

Mining, being an ectractive industry, does not continuously expand. As years pass, extraction must be conducted at deeper and deeper levels, and deep mining is both uneconomical and hazardous. Hence, the retrechment. During peak operations--around 1950--the mines employed over 30,000 workers, but the strength steadily went down to about 13,503.

In general terms, only three or four decades back, several thousand Tamil migrants moved into KGF, seeking employment in the mines. The British owners of the mines at that time recruited workers without considerations of nepotism or casteism. Now, however, with the increasing numbers of provincial and political considerations that are operative in the local context, nepotism and casteism in employment considerations are more apparent. Understandably, the inflow of people from other states has been discouraged. But there are others who can undermine and get through any regulations or barriers. When persons are now recruited for jobs at the newly established Earthmovers factory, for example Kannadigas get preferance. This is substantiated in part by the fact that more of the BEML employees are non-KGF born workers, and they come from the interior parts of the Karnataka State than any other general areas,

despite the proximity of KGF to Tamilnadu and Andhra (RAMU GN 1977 p.18) Another point is the situation of decreasing economic opportunities to the people of KGF, who are mostly Tamilians and Telugus. Being non Kannadigas they face lots of problems, right from the time of admission to schools. While they are apparently discriminated, others coming from different parts of Karnataka are not all essentially Kannadigas. This is the tragedy.

EDUCATION: According to the 1981 Census, the percentage of literates in Karnataka, the Kolar district and KGF respectively, are 25.4 percent, 21.3 percent and 35.9 per cent. This shows that though the literacy per centage of the district was lower than the State, KGF has recorded far higher than the whole State average. During the period of the British ownership of the mines, education was meant only for a chosen few. The British did not encourage the native underground workers to send their children to schools, figuring that with education, the children would be less willing to peform the hazardous and routine underground jobs. They therefore, encouraged only technical apprentice or tradesmen schools, so that the children coming out of them could be straight away employed in the mines. However, things have changed very much since the time of independence, and the mine workers children increasingly took to schools and higher education. This fact is reflected in the increase in the number of schools since 1951, and the higher per centage of literacy in KGF, far above the State average. According to 1981 census there now are over 160 primary schools in KGF offering the first seven to eight years of education. There are also 13 high schools offering higher secondary education, while a convent for girls offers the first two years of college education. The KGF college offers all five years of education leading to an undergraduate degree in the liberal arts and science. This contrasts with the situation when the children of

KGF had to go for their High school studies to Bangalore and even to far off Madras till the forties and fifties. In brief, the introduction of compulsory education and the opening up of more primary high schools and colleages, signifies the growth of education in KGF. Today one can find more and more lower caste, lower class and poor children in schools and colleges. In fact, more than 60 per cent of all the KGF college students and a comparable per centage of the students in KGF public schools come from lower caste backgrounds. Furthermore, proportionately, a very considerable number come from "untouchable" caste background. Each colony in the mining area has at least several night-schools. As a result, many of the respondents take night-school education seriously, and in modern KGF, illiteracy has come to be looked down as a social stigma, and many persons now refuse to consider themselves illiterate though in fact they might be. However, the striking fact is that there are no Engineering or other Technical or Professional Colleges here even though, the people are technically and professionally oriented and are highly skilled, and also there are needs for qualified Technical Personnel in the area. And Karnataka is known for a large number of Engineering colleges! Thus only outsiders come into KGF for taking up higher technical employments and professional or managerial offices.

ECONOMIC ORGANISATION: KGF occupies an important place in the national industrial map for two reasons: (a) the Mines of the Kolar Gold Fields operated by the Central Public Sector Enterprise BGML, and (b) the Bharat Earth Movers Limited' Factories, another Central PSE, which manufactures heavy eaarthmoving equipments such as bulldozers, heavy trucks and dumpers.

These major industries are what have made KGF what it now is, and help to make it an urban, industrial setting. The Kolar Gold Mines now employ about 13,500 workers and Bharat Earth Movers Limited about 3,500 employees. In addition, a few small scale industries are situated in KGF, and these support over 200 persons. Various agencies of the State Government employ about 2,000 KGF individuals. The per-centage of KGF residents engaged in mining (40.2%) is very high. However, earlier nearly 75% people of KGF were employed or dependent on the gold mines.

Economic disparities are quite striking in KGF, as reflected in the income of the people. Half of the KGF make less than Rs. 300 a month. Slightly more than 10 per cent make over Rs. 900 a month. Many make less than Rs. 150 a month, getting paid only for the work they do, as and when they can find some work. With the average KGF household consisting of 5 persons, this group is perhaps the poorest in the KGF. Because of their poverty, these people can provide only inadequate clothing and shelter for themselves and their families.

In KGF, economic disparities stand out clearly, and a large-sized house or an automobile as symbols of affluence are certainly conspicuous here. Consciousness of class tends to be well-developed in KGF. For example, many of the people are acutely aware that they comprise an economically depressed group. And many of them frequently refer to this fact. They make cynical remarks about the 'haves' of the community, generally the officials and the wealthy Jain Marwaries. The more affluent in KGF also are somewhat cynical, in at least some of their attitudes towards the poorer local residents. Many attribute the poverty of the workers to their aalcoholic and bigamic practices. Most of the Kolar

district businessmen, marwaries and jains are found in the small area of KGF. This reflects the volume of their business in the area and as to where their real interests lie. In terms of numerical dominance, 'Adi-dravida' and Brahmin groups standout as the workers, and managers or other administrative officials respectively. The hindu and jain vaisya caste groups, though numerically not as dominant as the above caste groups locally are important in terms of their economic, political capablities and influences (Ramu GN 1977 p 29). The important determinants in the classification of class groups are income, residential conditions, life style, club memberships, the prestige and power the jobs they hold command in the community. The lower and upper classes of people in KGF can be easily distinguished. Upper class people can be identified without much difficulty as they demonstrate their affluence in conspicuous consumption amidst allround poverty and general conditions of shortages, as could be seen in terms of life styles, cars, large houses and so forth. Lower class people can be seen anywhere, as they have no option but demonstrate their poverty in terms of their own life styles, small huts, torn cloths, emacipated physique and impoverished life. These show that the post independence KGF has really gone to reinforce the social stratifications, economic isolations, cultural distances, and widen the unfortunate ethnic differences amongst the various groups than develop the area, the overall economy, the people and the society into an united, homogeneous, dynamic, forward-looking progressive society.

PROBLEM OF LIQUOR: Liquor is the largest item of unproductive expenditure in the labourers budget, next only perhaps to the evil of interest being paid by them to the marwary and other money-lenders. Many observers do indeed regard the drink of evil as the root cause of all the poverty and squalor, and all the demoralisation and crime that exist amongst

do indeed regard the drink evil as the root cause of all the poverty and squalor, and all the demoralisation and crime that exist amongst the mining population. As an evil, liquor addiction comes next only to the problems of money-lending and low wages, specially wr t to the nearby BEML employees. It is by no means easy to assess the average amount spent on intoxicants by the workmen in KGF. Estimates in regard to this vary as widely as the capacities and addiction of the individuals. Of all items, it is about this item of expense that a man is least willing to impart accurate information, and even the spouse fights shy of revealing the confidence.

The labourers of KGF hold the record for arrack-tipping in the State. The incidence of consumption of liquor per head of mining population was if the Excise Administration Report is to be believed as high as 17 times the State average. The number of arrack shops are more in the area. KGF also holds the palm for toddy consumption in the State. The incidence of consumption per capita of toddy here is very high, about 3 to 4 times more than many other industrial areas. There are many arrack/ toddy shops, country beer tavern and special liquor shops, and also shops that illicitly sell ganja and opium. KGF reported for about 75% of the total consumption of the country-brewed beer in the State.

The relation of drunkeness to bad housing and unattractive environment is very positive. The provision of better housing and a more cheerful and attractive environment in the lines is itself a temperance measure of the first magnitude. The mine worker who comes up from a strenuous days work and finds no better prospect than that of spending the

evening in his dingy, crowded little hut or amidst gloomy surroundings, finds the bright company of the tavern attractive, and likes to have the temporary exaltation or illusion which he can purchase there. It is the same all the world over. "Booze" said Bernard Shaw, "is chloroform that allows the poor to endure the painful operation of living..... If you take his booze away, you must give him some pleasurable acativity in return." Right Hon. Philip Snowden who was the Chancellor Exchequer in UK, linked the controversy as to whether drink caused drink, to the question "whether a dog running down the street with a tin kettle tied to its tail runs because the kettle runs." He said, "the effective treatment of the drink problem therefore, will be comprehensive. It will aim at reducing the temp tation to drink, at strengthening the moral fibre of the men and women, and at making the conditions of work and living more healthy and natural. Small and uncomfortable homes drive men to the more congenial rooms of a public house." Confirmation of this was also given once, by the chair men of the Bath Brewery Company, who, speaking to the shareholders about the decrease of drinking said, "it was largely due to the better housing of the working classes. A man nowadays, instead of going home to a dirty untidy cottage, full of children in one room, found his house was more comfortable." He had also quoted the observation of the Physical Degeneration Committee that "every step gained towards the solution of the housing problem is something won for sobriety." (MA SREENIVASAN 1930)

SOCIAL REMEDIES: On the steps that could be taken to make the houses and the Lines and colonies more comfortable and pleasant, it had been suggested to start an attractive and brightly lit tea-shop in each line and colony, and issue hot tea at specially reduced rates in the evenings. Free, open-air cinemas showing interesting programmes of instructional, devotional, health and temperance subjects offer an invaluable means of education and social uplift. In fact there are a number of such films with the Government of India and some with the State Governments. They all lie unutilised or underutilised. All these and more could be got from wherever they are available. A lively programme of music suited to the local taste and folk arts, could be made a special feature of these evenings. Matches, tournaments and open competitive games would provoke and preserve a healthy interest in sports. It is on these lines that a great deal of constructive welfare work is urgently needed in the area. These all appear to have been forgotten. The co-operation of social service institutions like the Y.M.C.A. and other genuinely people's organisations could prove as valuable in organising and conducting welfare work among the mine employees, and their families. Removal of liquor shops to a distance would also help. A number of labourers and influential headmen, popular representatives, and even contractors have suggested the removal of all the liquor shops to a suitable distance from the Lines and Workers colonies. As far back as in December 1923, an Adi-Dravida Conference held at Robertsonpet, passed a resolution "To request the Government to remove all the toddy and arrack shops in the Kolar Gold Fields area at least to a distance of 3 miles from the Mining area proper." This resolution was communicated to the Government

by the President Mr. Murugesam Pillay, with a prayer for early action. The matter was placed before the Excise Licensing Board, who expressed themselves as "not in favour of enforcing the propossition." So responsive are the Govts to the needs of the people even when specific requests come from the people. There is a good deal of local opinion in favour of some such measure. It is a fact that during the closure of the mines during the strikes, a marked reduction in drunkenness as whole had been noticed, much to the relief of the womenfolk, though the more inveterate drunkards might have gone as far as Bowringpet, Kolar and the neighbouring villages for their habitual refreshment. A good part of this abstinence is due to the lack of cash and the exhaustion of pawnable resources.

TECHNICAL PROBLEMS: The mines are extremely deep. Relative differences in pressures and temperatures caused by deep mining results in frequent roof cavings and dangerous rock bursts causing many fatal accidents. Hence large quantities of steel and wooden supports have to be provided all along, as the digging proceeds. And supports have to be provided for, with stone masonry work, brick works, sand stowing or concrete works. Purchase, transportation and utility of steel, wood, cement,. stones and bricks render itself as a weak spot from which, both finance and material leak out of the mines. While steel and wooden reinforcements are part of the mine working almost every where, the three mines of Nandy ddroog, Champion Reefs, and Mysore Mines by their managerial styles, technological options and working depths opt either for sand stowing and pumping in of tailing slurries, or stone works, or concreting for support. The problem of cyanide pollution of mine waters as a result of stowing the mines with the tailings has thus been introduced into

the mines - perhaps affecting the health of the miners further, as they very often use the mine waters out of sheer necessity at the hot depths.

Kolar Gold Mines and Mills have operated for the past 100 years and more. Many installations are old and their efficiency are hence considerably lower. With the mines reportedly prooving unprofitable, replacaement of the old equipments is not a priority consideration. Hence adoption of modern innovative technologies that could change the quality of the wastes and effluents are a big constraint. Only improvements in reagents use, monitoring and control, to increase recovery and improve the per-centage of extraction of the Gold in the existing equipments are being considered.

ACCIDENTS: The statistics of mining accidents in the Kolar Gold Fields are hard to get. Available figures indicate that on an average, there had been about 200 fatal and serious accidents a year during the quinquennium of 1924-1928, and the number of accidents rose to 283 in 1929. It has been reported that while the KGF accident rate compares very favourably with the corresponding rate in Transvaal, the death rate from mining accidents in KGF has been steady, whereas it had showed a more or less steady decline in Transvaal. This is reportedly accounted for by greater use of machinery in place of men in the Rand Mines, and also by the better physique of the African native. It is also understood that the rock temperatures are comparatively lower in the Transvaal Mines permitting longer hours of work without fatigue stress. It is also said that the Kolar Gold Fields rock is harder than the rock in the Transvaal. The average number of persons killed for each unit of

gold produced during the same period was 3 times in the Kolar Gold Fields as against Transvaal, showing the higher toll of life levied in winning the precious metal in this part of the World. Sadly enough inspite of the reported safety precautions taken, this pattern, it is complained continues till date. The Chief Inspector of Mines reported that the higher death rate in KGF was mainly due to the greater frequency of rock-bursts in the KGF Mines.

The cause and character of the disastrous phenomena of rock-bursts in KGF are understood to be different from those of the rock-bursts in Transvaal, owing to the characters of the rocks, and the conditions of mining. From the study of the seismograph records maintained in the Field, the Chief Inspector of Mines infers that although the underground workings of the Kolar Gold Fields' Mines continue to suffer much severely from these rock-bursts, the same appear to be limited to certain areas. These may be partly accounted for by the improved methods of supporting the underground workings, including with granite packs and concrete fillings which have gradually replaced the earlier use of compressible wooden cribs, stills etc. However it is considered that a number of fatal accidents were of an avoidable nature, and were directly due to non-observance of the Mining rules. With a better understanding of the rules on the part of the workmen, with improved methods of supporting the underground workings now being practiced, and a more intense safety-first campaign, there might have been a considerable reduction in the numbers and also the effects of these accidents in the KGF mines. Once, the President of the Transvaal Chamber of Mines, had reportedly said to the members, 'the Accidents Prevention Committee did admirable work. We shall never reach the stage when we shall regard any particular accident death rate, however low it may be as "satisfactory," and the efforts

of everyone in the industsry and in the Mines Department are directed to ensuring every possible improvement."

We hope, that this equally expresses the view of the Mines Managements in the Kolar Gold Fields. "Safty-First." picture posters were originally brought to KGF from London. Now a number of them could be seen posted in the work places in and above ground. On specific suggestions that attractive posters be printed in Tamil and that there is a need for a good many of such posters, a large number of posters in local languages have been put up. Provision of first-aid and ambulance, reasonably prompt surgical and medical attention to the injured have reportedly brought down the fatalities. But the workers are still sore for the poor medical attention. The Kolar Gold Field appears to be one of the earliest St. John Ambulance Stations in India. Every mine has a large number of first-aid stations, at the shaft tops, at the main working levels, in the workshop mills, and cyanide works, with the necessary equipment of stretchers blankets and first-aid boxes ccontaining iodine, guaze and dressing, splints, bandages etc. The Mines have motor ambulances for the conveyance of the injured to the Companies' hospital, and maintains wheeled stretchers. Systematic training in the first-aid are given to the employees in English and in Tamil. A central rescue service for use in cases of fire in the Mines has been in existence since 1923. Underground fires in the Mines with their large quantities of timber and the forced ventilation have terror peculiar to themselves. The rescue station has men trained in Mine rescue work with equipment like "proto" Oxygen breathing apparatus, "Burrel-masks" etc., ready for emergencies.

There is a well equipped hospital at Champion Reef. The hospital is primarily intended to meet the needs of the mining employees and deals with all cases of accidents. There is a civil hospitalm at Robersonpet entirely maintained by the State Government, and a small dispensary at Champion Reef. In addition, there is an Epidemic Diseases Hospital, and Government Maternity hospitals. These hospital facilities are undoubtedly excellent so far as they go, but they do not go far enough. The hospital is primarily intended for the treatment of the Companies employees. The sick wives and chi ldren of employees are treated as out-patients, but if there are cases for admission they are generally sent to the Civil, Maternity on Epidemic Diseases Hospitals. The beds in the hospitals are as a rule more than full and sick relatives of the employees have generally to go to other dispensaries or to the Government Hospitals. The Companies hospital is at any rate too far removed from many of the workers Lines to be of any use to the sick from these LInes especially in emergencies. Lack of regular public transport in the colonies add to the problem. In any case, the nearest hospital for many is the Government hospital, and even that is not a small distance for the women and children to go. The need for well-equipped dispensaries suitably located to serve the workers and their families, at vantage points in the mining area, has always been felt. Apart from these, the mine workers complain the medical authorities with indifferent, partial biases and differential treatments. They feel that the doctors are under the total control and influence of the mine officials, that their attitude is not to treat the workers and cure them completely of their sicknesses or injuries, but to push them out somehow, off the sick lists and force them back to the depths of the mines to work even before the workers have adequately recovered, if not fully cured.

POLLUTION CONTROL: The mines just do not have any waste water and other effluent treatment plants. Consultancy was provided by the National Environmental Engineering Research Institute Nagpur in 1980, and they had recommended appropriate treatment plants at a total cost of around 25 lakhs. The Karnataka State Board for prevention and control of Water Pollution has approved in 1983, a Rs. 20 lakh scheme for chemical, treatment of domestic and industrial effluents of the Mines. One has to wait and see for the improvements.

As part of environmental rehabilation, control of erosion, run off and dust pollution, hagave and euculyptus plants have been planted. These are expected to reduce the air pollution of the area caused by wind erosion of the large number of tailing dumbs all around. Though the trees have come up, the physical dimensions and other paramenters of the tailings are large, so long, tall, and huge, with steep sloping sides, that erosions due to rains do continue to take plaace still. The workers feel that the dumps need to be stabilised first with clay topping to prevent loose tailing dusts from being liberated and carried up into the air during hot summer windy days or gully erosions during the rainy seasons. Since this has not been done, the workers feel that the managements are only indulging in cheating them with half hearted revegetative environmental recovery measures in the area. Another point that disturbs the workers, are the extensive plantations of different types of trees by the old British management in the areas where they lived. These trees do protect these areas from dust and heat. Now that the management had been taken over by the Govt., the Indian Officials managing the mines live in these old British Areas and they have not bothered to plant similar trees and other plantations in the workers

colonies which are not only barren, but are sandwitched between the tailings - stone rubbles and cyanide dumps - all around, and hence their risks of exposure to dust pollution are very large.

MANAGEMENT STAKES: The mines are drying up. Well any mine will, and one day/ all have to ultimately close up. This was and is a known fact. The old British Management was aware of it and was silently working for its safe withdrawl in time. They then made their intentions public in the early 50s. But the State Govt first, and the Center next, feared a great political crisis in the area. For, if the mines had to be closed, that would mean throwing out all the mine workers into the streets without any employment, abandonment of the area, evacuration of the families, and collapse of the economy of the area that depended entirely on the monthly salary disbursements by the mines, for a considerable profit.

Before abandoning the mines, and to beat the nationalisation dead line, the British Companies raised the production, and extracted maximum possible Gold. The production of Gold once again reached a high of 7,000kg of gold per annum as against the law of only 3734 kg in 1946. After the Nationalisation of the Mines by the then Govt of the State of Mysore, on 29th November 1956, the gold production steadily went down. This state continues even after Govt of India's take over of the Mines w.e.f. 1st December 1962. It is alleged, that often Gold is being smuggled out of the Mines, and other materials get diverted from the mines, or even before the supplies reach the mines, under the convenient pretext of poor quality of ores, low yields of gold and the inevitable losses in the mines. Whatever may be the varacity of the truth, there is no doubt that the mines are being mismanaged. Requesite

materials, tools, men and machineries reportedly do not reach the work spots in adequate quantities and qualities in time. Yet the management feels that it is accountable for production and has to achieve the daily monthly and annual targets of ore mined. Hence undue pressures are being put on the workers. Each gang of workers detailed at the different work spots are forced to deliver/turnout the stipulated number of trolley loads of ores. 'Cheat the Management that cheats the workers,' is the policy adopted and practiced by the workers. So they almost religiously turn out the requisite loads, even though they may not be actually pregnant with gold. Whatever they could blast out, within the time available, they load, irrespective of the fact whether they are ores or ordinary stones. Mortally fearing the risk of the deep underground work spots, unable to tolerate the actual working conditions there-in, where the air conditioning and air cooling are not effective enough, many of the supervisory and middle management level officials stay away - preferably on the surface, on one pretext or the other. Not willing to participate in the working, but keen to exercise their authority and show their powers, they resort to the age old colonial traditions of vertually barking down at their immediate juniors and subordinates and to punish and victimise the helpless and the lowliest workers. With this type of managerial style and resultant lower morale amongst the workers, it is really a wonder that respectable quantities of gold/ore is still being produced by the mines.

Not only the trade union leaders and local politicians, but senior officials, bureaucrats and Ministers including the Prime Minister who had visited the Mines, 'promise' almost everything they can to the workers

as they discuss in private, or address the workers in public. But once they are out of the mines, and away in their distant offices at New Delhi or elsewhere, they comffortably forget the Gold Mines and their unrestrained 'Rhetorics.' Whatever may be the facts otherwise, the workers remain where they are and what they are - poor, under paid, emancipated and harassed by the management, and the relentless but deteriorating environment.

Earlier the mines were operated by the private British Managers, and the disputes between the Workers and the Management could be arbitrated by the Govt Officials and the State and Center could effectively step in, at least theoretically as Neutral Umpires or Judges when required. Now with the Mines under the Govts control, the managers being on the Govt's pay roles, the workers just do not have any place to go, cry or represent. The question therefore being asked dis, who had benefitted and who benefits by the great Nationalisation of the sick, drying and dying gold mines? The workers' answer is, it is the white collared, well 'educated' Indian Managers who stepped into the British Managers old warnout shoes. If on the other hand, the Govt had then allowed the British Companies to wind up their show as they ultimately did, but instead of getting some good compensation for handing over the near empty mines to the State, were forced to close the mines only after paying compensations to the workers and settling their accounts, and acted as real responsible paternalistic umpires, the Govt could have ensured a decent settlement between the workers and the company. But that would have brought the additional responsibility and burden on the Govt to defuse the political problem in the area, of lay off of thousands of workers overnight, and evacuation and disbursement of hundreds

of the mines and their families, who would have understood the situation as inevitable, and could have left in peace, perhaps with tears in their eyes and an heavy heart for leaving their place of birth to the original lands of their forefathers, and to start a new life. Now more than the workers, it is the management which is worried about the closure of the mines, and consequent unemployment. Hence their interests in a whole range of new activities and the desire to somehow keep the mines active, alive and open, even while blaming the mines and the workers for the lower production of the gold and eventual losses of the enterprise.

The present situation in KGF could have been saved, if a well planned and meticulously executed re-employment programme for the rehabilation of the mine workers had been taken up. In fact our much maligned Political Executives running the Governments did act, and came with a new major Public Sector Enterprise in the area, to absorb the mine workers. The Bharat Earth Movers Limited (BEML), a multi-crore giant Defence Undertaking was located in the area with this explicit understanding, and also a plan to gradually take-over the buildings and assets of the mines. The only transfer that took place was some of the mine lands to BEML, and sharing between BEML and BGML of the treated waters from the Bethamangala Water Works meant for the Gold Mines. But then, either it is the lack of will on the part of the Govt and the bureaucracy, or the failure and mismanagements of the executive officials and managerial personnel, or the finer technicalities and the fraility of our social system, that the BEML management brought in their own sets of new people to the area, recruited and appointed hundreds and thousands of outsiders from all the far corners of the Nation, even at the lowest workers and

operators levels, instead of absorbing the surplus mine workers or recruiting their family members and children in distress, in need of employment; thus burdening the meager resources of the area and stressing the envirnment considerably. Man is really vain!

Seen thus from any angle, the sufferers are the Mine Workers and their Families. The question that is in the minds of all who know the area and the people is -

Is this discrimination and indifference due to cumulative marginalisation of the mine workers, who are regionally, linguistically, religiously and caste wise minorities?

CONTRIBUTIONS OF THE GOLD MINES: In the ultimate analysis, what are the contributions of the gold mines to the State?

Dr Colin p Simmons of the Depaartment of Economics in the University of Salford UK, once wrote that no account of the modern evolution of the erstwhile Mysore State and the present Karnataka can afford to ignore the multi-dimensional impact of the gold mines. And then, Mysore was long regarded as a 'model princedom.' Today the states capitol of Bangalore lies hardly 87 kms west of the gold mines. So one feels that there will be a mine of information on KGF and its contributions to the state in the govt offices at the secretariat. But unfortunately there is a great paucity of primary material relating to KGF. The papers of John Taylor and Sons are reported to have been destroyed, and hence no authentic records are available. This is reported to be so even in their native country of England. There are only fragmentary documents available in Bangalore and as well as in Kolar. The state archives report their helplessness in this regard. This is really a sad state

of facts. This shows the extent to which the people remember the once valuable gold mines, and how fast people forget and start neglecting the past. But one important document that has survived, and is available, is the 1930 report on the Labour Conditions in the Kolar Gold Fields by one Mr MA Sreenivasan, an official of the then Mysore State Civil Service.

KGF was a major labour intensive enterprise in the State. And this influenced other employers in the State. Labour conditions in KGF were frequently asserted, not least by the Whitly report itself, to be generally superior to those pertaining in industries elsewhere in India then. The KGF mines helped willy-nilly to create, what is reported to be 'the first genuinely mass proletariat labour force in a "Native State." It was at such a time, in the year 1930, in the month of March, the then Dewan(Chief Minister) Sir Mirza Ismail of the then Princely State of Mysore, caused the appointment of a Special Officer of the State, to study and report on the economic and social conditions of labour in the Kolar Gold Fields. For then, the myth about KGF being a model enterprise had been crudely shattered. There had been a big Strike in the mines and the Police had resorted to firing at the workers. It is this report of Sreenivasan on the Labour Conditions in the Kolar Gold Fields that has fortunately survived. This throws much valuable light on the real conditions of not only the mine labour then, but the whole state of affairs that evolved, prevailed then and set the pattern of growth for the future of the area. So in a way it outlines the pattern of contributions by KGF to the area, its surroundings and the State.

KGF at that time, as had been the case during many other periods, was the only gold mining industry in the whole of India. Hence all the gold produced in the country so far had practically come from KGF. This is the major contribution of the mine to the Nation. In the days gone by, it was an influential and prestigious British Enterprise. It had come to be regarded as a 'little empire' in itself. Many VIPs of the State and the Country, including the Presidents and the Prime Ministers of free India had visited the mines, since KGF for long remained to be a big, major industrial and mining enterprise in the country even after independence, and almost till recent times. It had such a great and important history of its own, and was equally so important to the State and the Nation.

The mining leases for most part of the history of the mines were held as referred to earlier, by the British Companies, under the overall management of Messrs John Taylor and Sons, London. During their days, they were operating and managing the mines directly, and were represented in the country by an Executive Member of the British Management, resident on the field in KGF itself. This resident was usually a very highly influential person. KGF was that important and crucial, even for the British and the mines managements. Now the resident executive member of Messrs John Taylor and Sons London had gone, along with other British Managers. For the mines have now been nationalised by the State and then re-nationalised by the center. Yet, even now, years after this nationalisation and renationalisation, they reportedly remain as the principal consultants to the mines. For they not only know the ins and outs of these large mine complexes, but also are a well known firm of mining engineers and consultants. This in many ways, reflect the

true state of mining knowledge and technology acquired by the state, and expertise accumulated by the technical institutions in the country, inspite of the mines having been in existance in the area for more than 100 years as of now.

Throughout, the workmen of the mines were mostly Tamilians from the nearby Madras Precidency, now the State of Tamil Nadu, who were in general reported to have been good workers, and 'a canny, cheerful lot - with an incurable itch to invent epigrams, compose and sing instant balads on every exciting topic.'(Sreenivasan MA 1930). There were few Kannada speaking workers hailing from within the then Mysore State, for they were not so adventurous, and willing to take personal and social risks, though they were otherwise simple and lovable folks. This indicates the risks involved in the mines, as well as the fact that while the mines created work opportunities that benefitted people from outside the state then, very little employment benefits went to the people of the area or the State.

Mr Sreenivasan reports that, when he as the Special Officer of the State, started his investigations in the area, memories of the strike and the mine workers traumatic confrontation with the govt authorities, the ways of some police and other officials during the strike were still fresh in their minds, and hence the workers were naturally suspicious of any government official visiting their colonies and asking questions. This indicates the atmosphere of distrust, a measure of the situation in the area, and the people's standards and quality of life, as also the extent to which the workers have been harassed, exploited and suppressed. They therefore, just cant afford to trust any officials, intellec-

tuals or outsiders coming new to the area, or understand the motive behind the visits. This attitude of the workers and the local people in the surrounding areas, still remains the same even today.

The mines are playing havoc with the surroundings, as they merrily dump more than 2500 tonnes of wastewater with 1000 tonnes of solid wastes, consisting of finely ground sand into the neighbourhood every day, unmindful of the consequences and protests from the mild, simple local people of the surroundings. This is the major, but adverse contribution of the mines to the area, that would be long remembered even after the mines cease to exist.

Inspite of these many negative effects, the mines have stayed on, backed by the indirect coercive force of the state and the interests of the empire in the British owned and managed mines. They had high stakes in mining the rich gold wealth lying deep below the area. Even otherwise, the interests on the huge funds invested in the mines were great, that none of them would have agreed to foget them and leave.

Though not to the locals, the mines did provide employment to thousands of people, leading to the prosperity of the area, growth of a major township in the state, and many recreation facilities - though the best, and most of them remained for the exclusive use of the white officials, managers, supervisery personnel and their families. Though this charge was true, it is equally true that the native management when they took over the mines along with all the assets including the hitherto excluded recreational facilitiers, had no interest in them that many of them soon went into disuse, neglected and into ruination. All movable assets vanished, pilfered, dug-out and torn-off, that ultimately

local power groups and vested interests partitioned and shared them out, and influenced the State to transfer them out of the mine areas and allocate the immovable assets to private interest groups' exclusive personal uses and benefits.

The mines provided the impetus to the private and state authorities to harness the energy of the Cauvery Water-Falls to generate hydro-electric power, erection of the then longest power transmission line in the world from the power plant to KGF. This incidentally was branched off to supply power on the way to the State Capital of Mysore and the Cantonment of Bangalore, where the British Resident in the State of Mysore was stationed with British troops and Indian troops under the direct command of the British Officers. Bangalore,which recieved electricity in 1905, if we exclude KGF, was the first city in India to be electrified. That it was so, because of KGF, indicates the influence and impact of KGF. This also incidentally led to more generation of electricity and their supply to other industries on the way and elsewhewre in the State, helped in the rapid industrialisation of the state.

KGF also caused the erection of the KGF Water Works at Bethamangala to supply protected piped water to the mine area in KGF.

The demands and needs of KGF helped to develop many a small and cottage industries in and around KGF.

The State Exchequer benefitted immensely, by way of royalties, taxes and recovery of the investments in the hydro-electric power plant, transmission lines, and the water works, many-time over within a few decades.

Commerce and Trade, in and around the area flourished, with a large number of mine and contract employees being getting paid regular wages. These also, by themselves contributed to the increased tax and other commercial revenues to the State. But, by and large the income from KGF, by way of royalties, taxes on gold mined etc., remained to be one of the major incomes to the State, as reflected in its annual budgets.

All the above are the positive contributions of KGF to the people, area and the State. Ofcourse, given the selfishness and human nature being what they are, built in all these apparent development activities, advantages and benefits were many underlying negative aspects that were to eat into the health and well being of KGF and its people, the majority of whom, as is the case elsewhere, are simple common people and workers. That is the unfortunate aspect of the whole process of development that went on, with the sinking of the deep gold mines in this area. And the biggest victims are, the environment and the people of the area.

Man the world over is becoming aware of the problems that are being created to the environment by his own activities. The traditional response of man throughout the history to the problems created by his own activities is one of rushing-out with a legislation to prohibit all socially harmful acts and threaten to prosecute and penalise the offenders. Often all that man did therefeore was to legislate and then forget both the problem and the law and its enforcement. Making such simplistic attempts to find solutions to complex social problems and hoping then, that the problem will solve by itself, or the law will take care of things, have themselves become a problem to man and the society.

While some prefer such legal approaches, others would resort to moralistic and religious recourses, while many would swear only by scientific and technical solutions. All these unfortunately remain incomplete solutions or just vain attempts that are helpless in solving the problem. What really needed is, an holistic approach to the problems created by man himself, that threatens him, the whole society and the future generations. In this, law does play a crucial role. Hence the need to take a look at it. But the problem in our country is that, like the bullock carts and modern jet aircrafts co-existing in the area of transport, indiffrent responsibility to the society and antiquated legal principles have co-existed in addition to the complex problems thrown up by the modern age. Laws on environment, and industrial pollution are typical of this. The water and air pollution environmental laws remain paper tigers in the face of potential disasters by modern industries throwingout complex effluents.

Till now, the law on liability for negligence of Environment was stunted and depended entirely on a crutch provided by an ancient English case.

This case,Rylands vs Fletcher, decided in 1866 referred to a mill owner who employed contractors to build a water reservoir on his land. Due to the negligence of the contractors while building the reservoir, the water escaped into the neighbouring mines, causing damages to the mines. The mines therefore sued the mill for compensation and won the suit. The British House of Lords, laid down the rule of 'strict liability' in this case. It said that a person, who for his own purpose brings on to his land and collects and keeps there anything likely to do mischief if it escaped, must keep it at his peril and if he fails to do, is prima facie liable for damage which is the natural consequence of its escape. Later English decisions covered under this rule, the escape of oil, gas, noxious fumes, effluents, electri city, vibrations and poisonous vegetation.

EXCEPTIONS:

This case law and the ruling in Rylands vs Fletcher is followed in the Commonwealth Nations, with appropriate modifications. But local decisions over the years also carved out a number of major exceptions. For instance, if the victims had also contributed to the tragedy by their negligence, the liability of the company would be reduced to t-hat extent. Similarly, the disasters caused by 'Acts of God' as in the cases of natur-al calamities like cyclone, earthquake or lightning strikes, frees the company from liabilities for the damages caused by the pollutants, leaking out of their premises. Similarly if the company had statutory authority to store dangerous substances in its premises, it would be excused, if it escaped and caused harm to others. Thus,State and State enterprises acquired a sort of statutory immunity.

SUPREME COURT'S INTERPRETATION:

The exceptions that have creeped into the Rylands vs Fletcher case law decision, nullify the claims of the victims of pollution leaks and environmental tragedies. A negligent company could avail of thes e

exceptions, and a very smart lawyer of the firms when pitted against weak and helpless victims in a callous, indifferent State, can distort the law to the advantage of the firms, in reducing their liability, if not get off completely free without any commitment to pay damages in compensation to the losses suffered by the victims. Perhaps these arguments may no longer be valid in this country after the latest judgement of the Supreme Court in the Shriram gas leak case of MC Mehta vs Union of India. Now, an enterprise engaged in a hazardous or inherently dangerous activity, is strictly and absolutely liable to compensate all those victims affected by an accident, if any harm results to anyone on account of an accident in operation of such an hazardous or inherently dangerous activity. Such liabilities are not subject to any of the exceptions in the decided case law of Rylands vs Fletcher.

The Supreme Court also specifically ruled out, the possible defence on behalf of the enterprise that they had taken all reasonable care, and the disaster occured without any negligence on their part. These new principles are justified on the ground that only the enterprise engaged in an hazardous or inherently dangerous activity has the knowledge and resources to discover and guard against dangers, and warn the likely victims against potential hazards. The public and the victims of pollution have no information or capablity to analyse the sophisticated functions carried out by the unit, nor do they have any mechanism to know or be warned of an impending danger.

Another great leap in the judgement is the measure of compensation. So far, the courts have been taking into account the earning capacity of the victims, multiplying it with the number of years the person was likely to be capable of earning, and a few such other factors. While these norms would hold good for ordinary damage suits, an entirely new criter-

ion has now been laid down for mass disasters caused by industrial accidents, by the Supreme Court after its decision. Compensation would now be correlated to the magnitude of the disaster and the capacity of the enterprise, and not by the earning capacity or status of the victim. "The larger and more prosperous the enterprise, the greater must be the amount of compensation payable by it."

A significant aspect of the judgement is that the Supreme Court has also asserted that if the victims of pollutants are unable to, on account of poverty, disability or other similar causes, to move their Governments and the courts for compensation, they can straight away come to the Supreme Court. It will hear the case, if the violation of their fundamental rights is gross,patent,glaring, on a large scale or affecting a large number of persons.

MINE ACTS: But when we come to the environmental issues and other problems of the mines, the pollution starts right from the word 'go.' Yet most of them attract very little attention. Take for example the very classic case of the Kolar Gold Mines. Very few talk about it, even though we have very many self proclaimed and voluntary activists and environmentalists. Even in the nearby State capital of Bangalore, people talk about the fancy Western Ghats, Doon Valley, Himalayan Ecosystems, the Acid Rains of Europe, Canada, USA and the Stockholm Conference. But many have not even heard about the problems of KGF, except for the general knowledge information that there Gold is mined for the country,but they are unfortunately drying up, and are running at a loss. Talk abaout the environmental problems of KGF, the people blink and show hown shallow their knowledge is,even as they speak big about the environmental problems in the country.

Basically, mines attract very little attention as they are generally tucked away from sight and public knowledge, in some remote corner, in

some distant forset or hill, inhabited by the tribals or other rural, semi-illiterate, poor, marginalised and hence dispensable people. But, it is a wonder, when we come across the public ignorance, indifference and lack of knowledge about KGF. For the area is neither distant nor remote. Nor is it inaccessible and not visited. The people are marginal, poor and outcastes, that is true! Perhaps that explains the position. So no one takes interest. Apart from these biases, the existing acts governing the mine opereations in the country do not contain adequate provisions to take care of environmental probloems. For, during the time these laws were framed, environmental awareness and problems were unfortunately not even been realised in their proper perspective. Since the laws do not provide for measures to be t aken for environmental protection, the mine management both in the public and private sector do not feel obliged or constrained to t ake care of environmental preservation and safety measures, On the other hand, environmental protection are considered to be an additional, and avoidable burden, that add on to the operational costs and cut into the profits of their enterprises.

They are looked at, as add on considerations, that are avoidable, and unrelated to the main areas of activities of their mines. Stopping short of environmental safety measures, is therefeore considered to be to the economic advantage of the mining operations as a wholoe. Hence, even the expertise available with the mining companies, invariably does not include personal having knowledge, exposure and specilisation in environmental problems. Therefore, they are unable to percive the environmental problems as they arise, and remain silently inactive and conveniently ignorant, even when the environmental degradation sets in, in their own mining complex and around.

CHANGES IN LEGISLATION: The environmental problems can be greatly aleviated, and reduced considerably, if the mining legislation includes and incorporates

specifically, environmental restoration, conservation and also environmental discipline on the part of the mine managements. This would compel the professionals in the discipline of mining to undert ake environmental safety measures seriously.

To begin with, the least the legislat ions can do, is to make it mandatory on the part of the mine managements to regularly assess and publish the state of their effluents--the quantity and quality of the solid wastes being dumped by them in the neighbourhood, the liquid discharges from the mines, and the gaseous exhausts released into the atmosphere --their complete physical and chemical compositions, and the treatments to which they are subjected to before discharge. Any suppression, falsehood or distortion of the facts in this regard must be made a serious punishable offence. This would then enable the public to at least know and understand the changes being brought about by the mines to the area and the environment, even if they are by themselves otherwise helpless to study and analyse the quality and nature of the effluents scientifically and systematically.

ENVIRONMENTAL IMPACT OF THE GOLD MINES IN KOLAR GOLD FIELDS

THE GOLD FIELDS:

KGF over the last 100 years and more of their modern existance saw the birth and death of many companies and si·nking of many deep shafts. They officially yielded so far 47.8 million tonnes of gold at the average rate of 16.48 gms per ton of the ore mined, and valued Rs. 15,047 crores at the current prices. Against this, about Rs. 1000 crores of royalty was paid by these mines to the State. In addition, the State has levied various heavy taxes on the mines and the mine employees from time to time. Further considerable profits/earnings acrued to the various government departments in selling, supplying electric power and water to the gold mines. KGF mines were once the deepest and the most exploited mines in the world. Today the position is not very clear. Probably they are now the second deepest mines, next only to the South African Gold Mines. After many decades of successful and profitable operations of extracting as much as 20 tons of gold per year, the production fell from 7 500kgs of gold per year in the early forties, to 3700 kgs in the year 1946. The production from then on went upto 7000 kgs and above. After nationalisation of the mines, and their take over by the Government of Mysore in the year 1956, production has come down rather steeply to the present levels of 1500 kgs and below (Refer Annex - II). Is it that the mines which were going slow, accelerated the pace of mining before the nationalisation? Is it that the mine management is proving to be inefficient after nationalisation? There just is no ready answer to these questions.

The Gold Mines of KGF, brought to Kolar Gold Fields a busy life. With it came a broad guage railway line and all weather modern roads connecting it to the big military cantonment at Bangalore and the port city of Madras, even before many other parts of the country had some roads to connect them. That was in 1894. Soon, modern facilities, like electricity in 1902, and protect piped water supply in 1903/4, a well planned and meticulously laid-out township, came up. These were some important landmarks and improvements, even though the mining colony was basically built to house single mining coolies in miserable one-roomed temporary barracks. Most of these not only stand in rows of long straight narrow blocks still, but also accommodate full families of the mine workers that are often big, and also their livestocks of sheep, goat, dogs, cats and some poultry. However, even by today's standards these barracks and the surroundings are much more and far better than the modern city slums of our industrial and old cities.

Since the birth of modern gold mines here, were the cause of planning and erection of the first (hydro) electric plant in the whole southern Asia, to supply power to operate the modern machineries of the mines, it brought electricity to the mine township, though not to the mine barracks and their homes till date. Incidentally it also brought electricity to the city of Mysore, the then Capital of the Princely State, and the major British Cantonment and the Resident's Garden city of Bangalore. It also soon brought electricity to the nearby town and the old taluk headquarter of Bethamangala, on the banks of the River Palar (which in Tamil means the river of milk), from where protected water was being specially supplied to KGF. The water treatment plant erected exclusively

for this purpose at Bethamangala near the ancient lake formed by the masonry dam and weir across the river, originally built by the ancient kings for supplying water all through the year for agricultural purposes, is modern in many respects. Planned with meticulous care and foresight, providing for many possible rare eventualities and problems, this plant was built with machineries and materials imported from England. Plant originally had its own independent steam power plant and steam engines to operate the pumps. Water was pumped from here in nearly 6 miles (9.7 kms) long 16 inches (40.64 cms) diameeter raising mine to KGF. All these were completed within a year, work having been started in August 1903 was completed and the plant became fully operational by August 1904. This, by any standards is a real engineering, managerial, planning and executive achievement, even by modern standards.

Growth of a busy modern mine, colony and township, availabaility of protected water and electricity, well connected by fast transport network of all weather roads and broadguage railway, had given incentives to rapid urbanisation, industrial and commercial growth.

The life style, leisure, games and comforts of the British managers, the undulating landscape, the climate, the moderate rain, the pleasant cold winter nights, made the British feel at home in KGF and love and place. They called KGF as their 'little England.' Even the mine workers and other residents of KGF were proud of their little town, which was many times bigger than the old taluk headquarters of Bethamangala, the new taluk headquarters at Bowringpet now called as Bangarpet, also the district headquarters at the ancient historic city of Kolar, and man y other towns and cities in the State. This is so even today.

Those were perhaps the finest moments of KGF, apparently lost for ever.

ENVIRONMENTAL DEGRADATION:

In their moments of glory, happiness and pride, very few residents of the KGF realised the continuous and increasing damage being caused by the mines to the environment in the area, and the way it is going to close in on them and the lives of their future descendents. Very few also foresaw the future through and beyond the uncertain, false, temporary glory and the fortunes of the area. Very few realised the short or long life of the Gold Mines, and the total bleak dark future that would descend on themselves and their children or grand and grand children.

Very few therefore, took notice of the trees being felled by the mines and mines' contractors, to provide support and errect scaffoldings at the operating levels and other working spots deep in the mines, and the protective lining of the roofs and walls of the old working levels, serving as access and connecting passages from the shaft to the work spots, between different shafts and the escape routes in case of emergencies, and to build temporary and permanent roofings to the innumerable horizontal passes at the various levels.

Very few realised that the rapid rate at which the natural depressions, fetile valleys and small neighbourhood irrigation lakes were being filled by the stone rubbles and tailing discharges are going to cover all the natural life, valuable soil, and seal for ever the life supporting system of these areas. Flow of regular paltry wages to the mine workers was in many ways considered to be a big benefit or boon to many of the people. This new found euphoria lulled them to a drunken state of indifference

to the loss of the valuable hitherto cultivated agricultural lands being neglected, or left fallow and laid waste by the continuously and fast flowing tailing discharges.

The tailing dumps growing into beautiful isolated mounds and peaks, with steep layered characteristic greenish grey trepizoidal shapes, like the majestic magnificient towers of great budhist pakodas, initially here and there at the pit-heads and next to the mills were reportedly awe inspiring, beautiful in their own way. But it was not realised that these were the beauty of the evil, and that they would gradually grow to endlessly long lengths and tall heights everywhere, behind their houses, right in front of them, crowding the skyline and destroying the beautiful natural topography. Thus none of the locals and the mine workers ever for once visualised that these tailing dumps would crowd them out like the agents of death, and fill their land as if the place had turned out to be a valley of modern pyramids over their 'dead environment,' burying forever their fertile lands, lush green valleys and life sustaining drinking and irrigating water tanks in the Gold Mine area, polluting those around in the neighbouring areas, as well as the subsoil water, turning their wells saline and rendering them unpotable.

The metrological data, the soil conditions, the land structure, all show that Kolar is almost in all respect similar to its adjacent district of Bangalore (Gazeteer, KARNATAKA STATE 1982). Yet, these two , identical neighbouring areas are characteristically different in their present day environment.

HISTORICAL RAVAGES: Like the beauty of a girl turning to be her enemy, the wealth of gold in KGF, was the cause of its all troubles. Those did not come with the British companies, but was experienced throughout

the history. This area, which had reportedly sustained gold mining from time to time, through out the ages, right from the very early ancient times, is barren today. For, the land had been extensively edxploited. The forest cover had steadily been declining, yielding land to the farmer for agriculture and for residential purposes, and for exposing the secret wealth of gold in its bosom.

Kolar, historically been at the meeting places of more than two different antagonistic states, and had therefore been a hot-bed of dynastic conflicts and wars for supermacy of one over the other, where the fortunes of many a rulers and kingdoms had been made or ended. As the ruling houses rose and fell, and powers, authority and future prosperity of the states were decided, Kolar passed into the hands of many local lords and shulted many times between the northern, southern, eastern and western states in and around the maidan table-land of the Decan plateau and Southern India. As the fortunes fluctuated, troops, people, trade, pilgrims and language of the officials cris s crossed in many directions, ravaging the people, their culture and the land, demanding and taking every ounce of its resources. Today, the area is a strange mix of all religions of Indian subcontinent and the languages of Kannada, Telugu, Urdu, and English. Now one finds incursions of Hindi and other northern and eastern languages from the Indo-Gangetic regions.

After the defeat of Tippu Sultan's Mysore Army in the hands of the British Troops, there came the intensive modern deep mining of the late 19th century. These mines and the high concentration of the mining populations, swallowed up the remaining remnants of the forest and other tree covers to fuel the ovens in the kitchens of the homes, burn the fireplaces elsewhere, power the furnaces of many of the small industries including the brick and tile manufacturers, and to line the roofs and other for

uses in the mines on the surface and deep below the surface. So, soon the forest line receded to be almost out of the district by the very first two decades of the twentieth century (Gazetter Mysore 1930).

Denied of the natural protective clothing of vegetation shielding the precariously balanced unsteady state of Kolar's environment, it began to go down-hill rapidly, degrade and collapse, that life in Kolar has become, for man vertually a perpetual struggle for existance. Depletion of vegetative cover and steadily vanishing trees that bound the rather very thin layer of soil and earth over the protruding rocky base at shallow depths caused the land to become very unstable. Under the on-slaught of tropical hot sun, the earth dried rather very fast, quickly cracked and loosened. So when the regular rains came with the monsoons, the soil nutrients swiftly dissolved, and whole layers of the top soil quickly and completely melted away, and was washed off from the highlands into the lakes and valleys. From those lakes and valleys which were not covered by the rapid dumping of the mines' stone rubbles and slurry tailing dumpdings, these fine siltings were readily taken out by the locals to manufacture tiles and bricks for which demands began to build-up with the mines. What was left still on the highlands and the elevated landscape of the area was soon carried away in the strong windy months of the next hot summer as dust and sand storms. Thus very soon, not only was the precious soil lost, but the very useful layers of the earth also vanished, exposing the characteristic dark green schist layers, or the grey granite rocks and small, big and massive stone boulders.

Thus degraded and exposed, no amount of toil, and no amount of concern and care could now restore the land to its original state of health and well being, unless a very laborious, costly and energy intensive task of covering the exposed rocky elevations with earth, toping it with good

fertile soil, and binding them carefully in-situ, is undertaken and meticulously executed, till natural vegetations and plantations could slowly take root and establish themselves and hold the soil and earth cover in the place. Otherwise, left to itself for the natural forces to operate, slowly weather the rocks, allow some life to take hold and develop into a steady and mature state, it may take another millenium and perhaps outlast man on this earth

WATER SHORTAGES: The exposed, elevated rock surfaces, vegetationless valleys, and highly silted lakes hold very little water, and that too far very very short durations of the year. The water either is lost as surace runoff, or is quickly evaporated by the sun. The only thing that holds the water for sometime in this area, is the elaborate systems of an endless series of bunds, wiers and tanks across the rivers and streams almost outside every village--with each tank overflowing into one or two down stream lakes on either side of it, down below the gradient to the benefit of the successive next lower level villages. This situation sustains some form of agriculture in the villages in the vallyes. But even slight seasonal cyclic fluctuations of the rainsover the years has adverse consequences. Unlike adjacent Bangalore that has the same geographic, geological and meterological conditions, Kolar is frequently visited by famine, and regularly faces drought situations. (Gazeteer, Karnataka State 1982).

Since the forest cover in Kolar is negligible, there is very little diversity and density of trees, other flora and fauna, even though the other natural factors are similar to Bangalore known for its varieties of vegetative cover. It is not that the lands of Kolar are not fertile. The land in Kolar, wherever, it had not yet degraded, is very fertile and sustains good lush green crops and plantations.

that yield good harvests to the farmers only if they could provide adequate water to their lands. Hence one finds, in addition to the large numbers old network of lakes, greater numbers of wells, and very deep, bore wells. Wells of depth more than 100 ft is common, and there are many deep bore wells that report depths of the order of 300 ft and more. The density of these wells and bore wells in addition to the hand pumps and well developed and well maintained irrigation tanks are reported to be the highest in this district in the entire st ate and whole of India.

The district authorities state that lack of vegetation cover on the land quickly drains the rain waters and do not allow sufficient time for the soil to hold the water so as to enable the water to percolate down. Hence the underground water table does not have a chance to adequately charge itself, except indirectly through the water held by the bunds and impounded in the lakes and other tanks in the valleys. This charging of the subsoil water is so inadequate that as soon as the lakes are emptied by the riots and their beds go dry, the water in almost all the open irrigation and other village wells also go dry even before the onset of summer. In many places the lakes dry off by January/February, the spring months. So any cropping in Kolar area has to necessarily and also increasingly depend upon irrigation facilities of the lakes when they hold water and at othertimes on deep bore wells that are growing deeper and deeper with the years.

The deep mining of the gold in the area is reportedloy draining off much of the subsurface soil and deep underground water of the area into the shafts and various levels of the mines. These are welcome addition to the starved, thirsty mines and are used up by the mine authorities for their internal uses and processes in their mills, to seperate the gold from the ores. This benefit to the mines occurs at

the cost of the farmers. Further, the state water works authorities responsible to supply water to the mines, have to also supply water to the new establishment of Bharat Earth Movers Limited (BEML),a Government of India owned Defence Public Sector Undertaking recently located in KGF. The water requirements of BEML for both their industrial use and for consumption in their township/colony is growing. As a result, the state authorities have started to look for and tap deep bore well waters in many areas. Already they have sunk deep bore wells in two areas around the mines and two areas near the water works at Bethamangala. The farmers of the area consider this to be an encroachment and unfair competition by the state. The state being powerful and resourceful, has an upper hand and is winning over the farmers and the village people of the area. But the farmers are angry. There are a number of cases where individual deep bore wells sunk by the state water supply department have been sabotaged and deliberately damaged and rendered unservicable. Even otherwise, there are many instances of both the government and the private farmers' bore wells tapping the same valley, water basin and located almost side by side within a few yards and in close proximity. Such continuous, competitive tapping of underground water naturally depletes the availability of water steadily. And this is the reason for the falling water levels and increasing depths and increasing numbers of open wells and deep bore wells, as well as increasing incidences of their failure and reported drying up of the wells for considerable periods of the year. Under such circumstances, any failure and even a marginal shortfall in the rains and their periodic and cyclic fluctuations over the years affects the district, and draughts and famines set in the area rather frequently.

VISIBLE IMPACT: The obvious impact of the mining activity is the visual impact. Fortunately there is no land subsidence in KGF area. The nature of the earth, hard rocks, the occurance of the ores at deeper levels, restrictions by the Mine safety authorities in permitting horizontal diggings only below safe minimum depths depending upon the individual spot, has protected the area from the normal problems of land subsidence associated with the mines in and around mine areas. Apart from the barrenness of the land in spite of the fertile nature of the soil, the area is full of miles and miles of long, high olive green tailing dumps. Some of them are very old--nearly 100 years. Others are of more recent origin. In between is a whole lot of not so old and not so recent tailings. These tailings have remained barren for years. Sun, monsoon, rains, dry hot summer wind and cold winter nights have played havoc on them. Many of them are deeply eroded, with wide gulleys and deep pits.(Refer Photo Section).

IMPACT OF POLLUTION: The eroded tailings have polluted the land, wells and subsoil water. Water in the entire Kolar Gold Field Area is saline and unfit for consumption. Summer windy days, are reported to grow dusty, and the fine dusts from the tailing dumps cover the whole area, depositing large qualities of dust at home and everywhere else. Since the tailing dumps are mostly products of cyanide leaching of the ores for gold,these are referred to as cyanide dumps. And it is the run off, and dusts from these tailings that cause the pollution. Qualitative and quantitative tests do indicate traces of cyanide remains. The mine authorities reportedly do not have any treatment plants either for their wastewaters or for their solid dumps being pumped out in the form of slurry. These pollute newer and newer areas. The Nandydroog mines pollute the valley on the northern side, affecting lakes which ultimately flow out to river Palar. The Mysore and champion reef mines

discharge their wastes into two other valleys which flow out to Lakshmi-sagar lake in the east and Kamasamudram lakes in the west and south which flow out ultimately to Palar again and Southern Pennar. In the process, large areas of agricultural lands of the farmers are slowly being encroached. As the Lakshmisagar lake has already been completely silted miles away frosm the last mine shafrts on the southern end, like a big, level, play-ground, the silts and water overflow into the nearby farm-lands which the lake used to irrigate earlier. And the water in the area has already turned saline. Only very few wells have potable water in this region. (Refer Map Section for River-Basins and their Water-Sheds).

DEATH TRAPS: The worst affected appear to be the mine workers and their families. Their houses built by the mines nearly a hundred years ago, is now being overshadowed by the tall tailings dumped just behind their houses. Now their houses nestles at the very edge and foot hills of these dumps. Often, only the drain that carried away the water from the slurry as the sediments settled and the water trickled down, separates their houses from the dumps. They thus live in constant sight and close vicimity of these dumps.(Refer Photo Section).

Slowly some grass and some small plants and herbs have grown on these dumps. Being nearby, animals and children always climb over them to nibble the grass and herbage, or to play. Some seriously eroded, hollowed out ones, or those that have settled under the surface, cave-in causing serious injuries. Accidental falls, and major cavings have at times also resulted in fatal injuries. But no authenticated statistical data has been compiled or is available.

The people fear these cyanide dumps. They consider them as the death traps. They feel that it causes cold, leading to fever, stomach

disorders/pain, and ulcer. The dust apparently is related to the bronchital and asthmatic diseases common amongst the men, women and children. However, once again no health survey data is available and no medical statistics have been compiled.

The mine workers often suffer from injuries from accidents in the mine that are common. There are people who have miraculously survived major accidents, earth and roof cave-in, in the work spots in the deep mines, but getting injured in small accidents. Major casulaties and fatal injuries are common that both the mine workers and mine management take t hem for gr anted and do not really bother about them. Dust, heat , quality of water and other environmental factors in the work areas, deep under the ground reportedly cause incidents of silicosis, pneumonokoniosis, tuberculosis and bronchites amongst the workers. The workers get medical treatment from the mine hospital and as well as the civil hospital in Robertsonpet, KGF. Waterborne diseases like Typhoid,Cholera and other infectious diseases break-out rather regularly.

Though occupational diseases could be linked-up with the Mines, the health of the old and young, women and children of the mine workers' families, has so far not been directly linked with the environment, though the people genuinely feel--rightly or wrongly--that their health problems are caused by the Mine and its Environment. Recently a team from St.John's Medical College, a Jesuit Institution from Bangalore, has conducted a survey on the health problems in this area. Their findings are still under compilation and are hopefully expected to be released shortly. However, there is one published report of 1979 which says that a 3 year survey of mortality rate in 424 families reported 111 deaths, of which 57 were of children below 15 years and 5 Mining accidents, whereas only 3 were natural deaths. This is a sad situation. (MATHEW. G. MARCH 1979.)

MINE WAGES: The workers are poorly paid. Until 1984 they did not have any regular monthly pay scale. They were reportedly paid only daily wages with an yearly increment of 5 paise. They were not entitled to any leave or holidays. They did have a weekly off on Sunday. But they were not paid for that day. Even now their pay scales are very very low. It is justified on the grounds that the mines are running under loss.

BGML today is a central Government controlled Public Sector Undertaking. Yet the lower pay scales has been reportedly justified by an Union Minister of Steel and Mines on the ground that wages earned without productive employment is a pension. (MATHEW. G. APRIL1979). One does not know how to define or understand productive employment. Are the mine workers who slog under difficult circumstances at depths below 10,000 feet under the sea level unproductive? Are these miners who are not sure of their safe return back on the top of the land surface at the end of their shift, being payed 'pension'? One does not know what the minister meant. But, it is a known fact that accidents are common, work is difficult, and the risks are great. The quantity of ore milled is not less. The quality of the ore, the workers are asked to mine is bad. The quantity of the gold extracted in the mill for depositing with the bank is less. But the quality is the same old pure, high value, much sought-after, shining, lusty yellow Gold. The mines do run under a loss, but the losses do not come anywhere near the top ten loss making Public Sector Undertakings of the Governmkent of India. It makes loss, still it produces valuable assets, unlike many profit making service establishments and Public Sector Undertakings of the Government.

GOVT'S RESPONSIBILITY: A public undertaking may be running under a

loss. But the Government, or the management under its control, running the undertaking have no right, and therefore can never be justified, if it tries to make profits or cut down the extent of the loss by avoiding to take environmental safety measures, or neglect ing to maintain essential services, such as adequate sanitary conditions, adequate water supply, adequate quantity and quality of rations to the workers and their families, or refusing to provide a decent accommodation, build-in minimum essential space for the miners and their families in the houses allo tted to them, and also neglects to repair the allotted houses. People in many parts of the world and in this country struggle for the basic needs of food, shelter and clothing. But in KGF one realises that time is running out rather fast, and with it the life line of the people--the water, is drying out. One sees people moving about to collect some water, some how, from some where.

True, there are many parts in the world, and in this very country, where women and children trek miles and miles daily for a pot of water at least to drink. But in a modern industrial area, and amidst the competitive social life of towns, no one has either the time, energy or patience to go in search of water for long over great distances. Yet, these problems strangely do not c onfront the management and their families, who live in well marked out separate areas. That is the tragedy of management. This agitates the minds of the workers.

Sale of liquor, both legal and illicit is a big business. It is understood that the old management, which was itself used to the pleasures of liesurely and measured drinking, encouraged the supply and sale of liquor to the workers of hard labour in the mines. Incidentally, today it is a source of big and quick money for many. And this money and asso-

ciated wealth can come only from the ruining heal th, falling standards., deteriorating well being and degrading welfare of the mine workers and their families. Yet the Government traditionally has been sleeping over this issue.

SOCIAL STABILITY: In Kolar, the mining society is in a delicate instable equilibrium. Any tilt could destabilise it, unleash violent forces and the bent up anger of the people. The first Indian Prime Minister in an introduction to a book once wrote to the effect that there are many societies which are in perfectly contended stable equilibrium at very very lower levels. If we are to raise the levels of those societies, then we have to deliberately disturb and destablise them. Then some levels do go down and others will go up. And then in their attempts to stablise and catch up with the higher levels which are reluct ant to come down, forces of g rowth gets released and there is a tendency in the society to climb up, level up, and stablise at higher levels. In a similar manner, there is today a sense of false contentment amongst some sections of the mine workers of KGF. They get very very low wages. They are sore about it. They have to be worried, for they have to spend their limited low income in buying their needs in the same market where the better paid workers of the nearby Bharat Earth Movers Ltd--another Government of India Public Sector Undertaking--make purchases. The local market which catered almost exclusively to the needs of the Gold Mine Workers, today operates at a level to absorb the higher income and their sparable surplus. Today the price line in KGF market is much higher than in the closeby state capital of Bangalore, nearby Madras, and distant Delhi. Hence BEML has become a curse for the gold minhes. The market forces neglect the BGML workers, even though exploitative forces of a different kind operate at different levels from the same market in a different way to siphon away even the little monhey they do earn every month, and the supplementary income by the members of their families.

To somehow,subsist, many resort to stealing and take out anything they could. They are so frantic that they try to chipoff even the steel reinforcements from structures. Some go about panning the drains in the hope of finding some gold deposited by gravity as the wind, rains and water leach the tailing dumps. They thus, not very much legally, prospect for gold and sell them off for a few rupees now and then to various underworld outlets operating in the area. Many do keep sheeps and goats that ravish the left out grasses, herbages and other vegetation--further ruining and accelerating the environmental degradation.

Unconscious or semiconscious, and feeling helpless amidst the market forces, the workers do hope for a better wage settlement and higher payscales and allowanc es. But they don't seem to be getting anywhere and feel frustrated. Yet, they are in many ways happy and feel contended with the management for very simple innocent reasons availability of extremely cheap houses, though they are temporary one room barrack tenements meant for single mine workers with very thin, delicate asbestos, zink sheet, concrete, or woven bamboo mats and screens, without electricity, water, or toilet facilities and built almost 100 years back.

- availability of some ration, though of a very poor quality and in inadequate quantities.
- highly subsidised food in the mine workers canteen, though it is extremely poor in quality and in nutritional value.
- availabilityy of some medical facilities, in the mine hospital.
- paid inpatient detention or sick period, in the case of the old workers for treatments to injuries sustained at the work spot.

New workers are not paid any salary, while forced off their jobs due to injuries received while working.

The mine workers apparently don't see or believe in a better balance of earnings, with a higher payment for better facilities vis-a-vis a much better and comparable pay scales. Also some of the workers don't see the indifference of the hospital authorities to the health, safety and well being of the workers and their susceptality to be influenced by the Managements to discharge the patients before complete cure of their injuries or recovery from their ailments and restoration of their health. They are also unable to see the ineffectiveness and inadequacy of the health and medical facilities that could save many lives.

LEADERSHIP FAILURES: The politics of the Unions, the exploitative style of the Union and Political leadership have also reportedly contributed to the misery of the mine workers, and left them in the unenviable position in which they are today.

Fortunately retirement age limits have been very recently introduced-from the middle of the seventies. Earlier the mine workers used to work till their sickness and old age physically rendered them immobile, or injuries crippled them or made them incapable of working in the mines, or mercifully the mine accidents el-iminated them from the face of the earth. The mines work three shifts of 8 hours each. And in the day or in the middle of the night, in rain or hot sun, the workers have to trudge miles from their homes to their mine shafts and return back. They walk dirty, black, undernourished, unhealthy, like skeltons that have risen from their graves. Even now, while for the nearby BEML, specially requistioned State Transport or factory buses ply commuting their few hundred workers to their work spots and back, only one bus

of the mine reportedly makes a round of the area through the main arterial road, for the thousands of the mine workers, that the mine workers prefer to walk than rush and crowd into the single bus. Of course, from the shafts to the work spots, off from the cage, they have to walk miles and miles again under the ground.

SUMMARY:

IMPACT OF ENVIRONMENTAL DEGRADATION ON MAN

IN THE KOLAR GOLD FIELDS.

Man has come a long way from the days of a simple food gatherer, the life of an hunter, and his fear of being hunted by other powerful wild animals. Meanwhile, his quest for mining minerals had grown from simple collection of stones like quartz for making instruments and weapons; searching for and picking-up of native metals like gold and copper from here and there for ornaments, instruments and weapons; making salt and trading in them as a precious valuable mineral; to deep mining, nearly 4 kms below surface as in the Gold Mines of Transvaal in South Africa, and the Kolar Gold Fields in the State of Karnataka.

Man's unending quest for minerals had taken him far and wide, over the land and across the large formidable deep seas. And the desire to own and exercise control over the mines and the mineral trades, had led to major wars across the continents. The urge to find new mineral deposits had launched man on many a great adventurous explorations, and driven him under the ground and to the bottom of the seas. The dream of converting base metals into Gold had inspired great many scientific breakthroughs. Yet, the man who was unreservedly proud of his conquests and mastery over nature, is today facing the very dangerous prospect of running out-of, and exhausting most of his mineral reserves, within the next few decdades; and almost of all of them, and his fuel energy resources within a few hundreds of years.(Laptev I 1978). Hence man, who believed that he is destined to conquer, and had to master and transform the surrounding world to his tastes; and that he had inherited a world full of inexhaustible wealth of resources; has to face the crude shock that he

is running so fast that he is exhausting himself out of breath, health, energy, minerals, water, food and air. He is sadly realising that in his hurry, he had hastily snapped and snuffed out, thousands of bonds linking him biologically with nature and the world that bore him into existance and nursed him into his physical and intellectual growth.

Man now realises that he has to reassess his role and place on the Earth, and that he is far too insignificant before nature, though he had taken many a liberties in playing with it, offending it, and hurting it. The new sense of understanding surprises, shocks and scares man. At the present time he finds that he is no less and perhaps much more dependent upon those aspects which he considers as the weaknesses and harsh unpredictability of nature, than he was previously dependent upon the mercy of its blind un-understandable forces.(Laptev I. 1978 p.10). For the first time, he realises that he has only one earth and that too a small one. He also knows that he cannot produce or create or recreate an Earth and all its myriad puzzles, surprises, varieties and gifts to man, and he has to necessarily preserve this Earth (BUDAI VG et al 1982 p.344) not only for himself and his existance, but for his children and future generations.

These socio-physical realities of man and Nature is neither unique, nor distinct for someman somewhere. These are applicable to everyone of us everywhere. And so is the case in the Kolar Gold Fields.

THE BEGINNINGS:

Kolar Gold Fields, a small little place, which as we had seen earlier, lies in the South-Eastern end of the Southern Taluk of Bangarpet, in Karnataka's South-Eastern District of Kolar. And this is almost at the lower center of the otherwise peaceful, fertile Deccan Plateau. But this apparent

fertility and tranquility of peace had been lost long time ago and perhaps for ever in this area. This and surrounding nearby areas, lying in some old narrow stretches of geologicdal puzzle of dark green rocks had been yielding Gold to the great many dynasities of the Nation right from the Prehistoric Days. So man was active in these areas exploring, cutting down trees, digging out the earth to look for Gold, and grab whatever he could find whenever he had a chance. The history of the area is full of repeated reports of treasure finds that were gifted to the ruling dynasities of nearby kingdoms by the local chieft ains to ensure, and get confirmation or recognition for their rule and authority over the people in the area (Gazetter, Karnataka 1927-30). Whether it was due to the occurance of Gold or because of the unknown regularity of treasure finds, or the state authorised or cloandestine mining of gold, or the very shear geographical position at the centre of the plateau where great many kingdoms of the southern half of the sub-continent met, this area was the center of great many battles that decided the f ate of many a local chieftains and the fortunes and the extent of the sway of the surrounding kingdoms. Thus ravaged by frequent wars, a rather busy activity of the prospector s, the normal activities of the local farmers, and the steady flow of criss-cross movements of pilgrims and travellers across the southern peninsula, this area slowly lost its forest, tree and other veget-ative covers.

DEEP MINING:

Then came the British with their technology and modern heavy machines. When they hear d about Gold, they studied the area carefully, and then dug deep, first with steam power. They consumed lots of wood for making bricks, tiles, mortar, and line their underground mines. Then in 1902, they caused the building and erection of a big hydro-electric powerstation

on the river Cauvery at Shivasamudram falls to produce 43 MW of 25 cycles electricpower for exclusive use of the Kolar Gold Mines. This was the first of its kind in Asia. The 147 kilometers long 78 KV powerline to KGF from Shivasamudram, was then the longest transmission line in the world. This incidentally supplied power for street lamps, and other industrial, official, domestic uses at the princely state capital town of Mysore and the cantonment city of the British Resident in the St-ate at Bangalore, which were at a distance of 70 and 112 kms from the powerplant.

IMPACT OF MINING:

The Gold Mines brought to KGF not only electricity, but also Railways and protected water supply. It also helped to creat e a well laid out mining colony proudly referred to by the British Managers of the Mines and other European officials as their 'little England,' though it contained many a rows of crammed single room tin and bamboo-mat accommodations to house single men which later bacame the residences and homes of the miners and their small and big feamilies.

The mines gave incentive to many a small cottage, village and rural industries to supply the mines with the bamboo mine-safety hats, thick bamboo woven-mats for the walls and roofs of the barracks, bricks, "Mangalore" and village tiles for the house roofs, woolen blankets required by the mines in processing the ores to recover the Gold in their mills. So, a big busy township and active market place developed nearby, in what is now known as the Robertsonpet Town or the KGF Civil Area. Many small satellite areas like Andersonpet also grew up around.

The mines also caused mushroom, haphazard growth of cooly or contract labour colonies, as hundreds and thousands of them were daily supplied by the labour contractors to the mines. Also, there came up a big business

of brewing liquor. A number of liquor and toddy shops, taverns, and drug shops sprouted to cater to the needs of the overworked, tired, exhausted mine workers who wanted to forget themselves and the world, and also throw away recklessly their little hard earnings. On to the scene came the inevitable Indian 'Shylocks'--the Marwaries. KGF perhaps holds a record for the number of toddy and liquor shops and Marwary pawn-brokers, in an area. Thus, as the KGF and the people grew along with the mines, the seeds of deteriation and decay also took roots in the area simultaneously. And on the top of all these, we have the inevitable intellectual parasites- the educated and the otherwise responsible managements, the bureaucrats and other civil servants in the area, who all live on the toil and sweat of the labourers, in the name of managing the affairs of the enterprise, the social establishments, and the law and order problems of the area. The law is one of exploitation of the workers, and the order is of course social suppression in a very very safe legal way to maintain the peace, security and comfort of those who benefit from the system. Thus oppressed by the sheer weight of the business, economic and administrative forces, the workers of the mines have been groaning under these burdens over the last 100 years and more. So will they be, as long as the mines continue to work, or wherever they go, unless they choose sadly to emulate the intellectuals and practice unfortunately the very same parasitic styles under the burden of which they, their families, parents and forefathers had been suffering. A shuffling of the cards or an inevitable expansion of the system, it will then be! So grows and pervades the social decay.

As the mining activity progressed, great many tailings came up. The dusts from these filled the homes and all the areas around. And the dusts in the mines at the workspots, the working conditions under the ground, the work culture evolved by the different mining companies, the extensive hard intensive manual labour, deep mining, the peculiar quality of the

rocks gave raise to occupational diseases like silocosis or pneumonokoniosis, bronchiotis, tuberculosis and asthma. But Karnataka known as a model, modern, enlightened, progressive pincedom forgot to look at the conditions of these workers till the mine workers themselves revolted under cumulative depriv ations and marginalisation. Perhaps, fearing the attention or reaction from the State or rebellion by the workers, the mine authorities including the Medical Authorities of the mine hospitals were then meticulously ensuring that the incidences of siliciosis or peneumonokoniosis was suppressed and kept hidden. Care was taken that the workers did not become aware of the fact that the diseases are the results of their occupational hazards. The state medical authorities, even in the civil and nearby areas, did not make an issue of the cases of silicosis or pneumonokoniosis of the mine workers and exworkers whom they had treated. Thus the disease was left officially not recorded or assoc iated with the mine occupations for a long time. Therefore, they were not made compensatable, allowing the mines to go scot free even as the miners caughed blood (SREENIVASAN M.A. 1930) and died like sick rats in the colonies, in the railway stations, in the trains, back in their native villages, houses, nearby hospitals and even within the mines. It was brought to light only after troubles in the mines, leading to police firing resulted in the state Government setting up an one man enquiry which submitted its findings known as 'Srinivasan Committee Report of 1930' after going into the labour conditions in the Kolar Gold Fields. Even then, it was sought to be suppressed both by the medical Department and the Mines. The Mine Authorities, then even threatened, that they would pulldown their shutters, close their shops--the mills and mines--and go home. When pressed to either agree for payment of compensations, or close the mines down, their bluff was called off. They entered into a compromise agreement, that they would by themselves pay compensation in future, as

if on their own, in case the State agreed to delete the findings of the commission and its recommendations in this respect, from the published report.

This is suffix to understand the magnanimity, enlightenment, benevolance and paternalism of big, international, profit making enterprises that step-in in the name of development, and the horsetrading that goes on between the Managements, Bureaucratic Authorities and the all powerful Government, all who claim themselves to be working for the welfare of the people and the workers. Thus, the workers who often remain simple, trusting and suspecting nothing, keep breaking their backs and continue to struggle with heat, sun, wind, cold and difficulties both night and day, shedding tears, sweat, blood and often laying down their lives to create transferable wealth and permanent or lasting assets. And then, as till the early years after our nation's independence, Kolar Gold Mines remained one of the richest, biggest, powerful, and important enterprise in the whole of the country. It was the nations proudest show piece. And VIPs visited the KGF Mines. The first Prime Minister of India in the year 1951 with his daughter who later herself became and came to KGF as the Prime Minister of the country, and the then Presideent of India in 1954 visited the Mines.

Many union leaders of the mines became MLAs, MLCs, MPs, Ministers and one even became the Chief Minister of the State. Because of the Mines, this area was in the center of Political upheavels that like in the past decided the future of the state Government, even in the Modern days. At least one Government fell because of these mines. These Mines were the center of a political controversy. The popular Government of the State declared publicly it's intention to Nationalise the Mines. The Mines and others interested bargained and tried to stall the Nationalisation. Intense

horsetrading went on. Government at the Center appointed an eminent economist who was himself then it's Finance Minister, to study KGF and look into the problems. There were strong lobbying for and against Nationalisation before the commission. The Finance Minister of India then submitted his report against Nationalisation. But pressed hard by the State, and also fearing a big political upheaval on the issue, the Government of India rejected its own Finance Minister's recommendations and allowed the State to Nationalise the mines.

Since then, the complexion of the ever present ongoing socio-political struggle of the Mine workers had undergone a sea-change. It now became a problem between the workers and officials in power, and hence between the workers and the state itself. As a result, the state ceased to be a third party which could always interfere in any trouble between the Managements and their workers. Pitted against the state and its all powerful shrewed administrtators, the workers always lost in both the long and short run, though always it appeared that the Government is conscious of the workers problems, and is out to help them, support them and solve them.

Today Kolar Gold Mines have already become historic relics, perhaps not even a tourist spot. It had slid down in importance, size and activity, when compared to many other multi-crore, gigantic industrial and other establishments. The only achievement is that the mines, the machines and the men, work nearly 4 kms below surface--a world record. It is today either the deepest or the second deepest mine in the world. But the quality of the ore has come down very badly. However, it is in no case poorer than those found in many other Gold Mines these days. It was once around 40 gms of Gold per tonne of ore, and today it is only 4 gms per tonne. Yet this compares well with the Gold Mines of South Africa, the worlds

largest Gold Producing Nation. But the problem here in KGF is, no one is interested in the Mines. They are being given up as unfortunate mines that are drying up. There are very few mine shafts that are still act-ive. There are very few new finds.

The KGF Mines have their own peculiar geological and technical problems. Dangerous 'Rock bursts' considered to be mini-earthquakes are common in KGF. They are frequent, and had been occuring almost very regularly and unexpectedly at the deeper levels, at least for the last fifty years and more, killing or maiming and incapacitating many, and damaging equipments, machineries, buildings and other properties. Hence no one is keen, int-erested and really enterprising to go down at the real working levels, investigate, explore, expand and find new deposits. Each one depends on others to get the work done at the deeper levels. As a result not only the workers know that their Managers and even supervisors are scared of coming down to the working levels, but there develop many logistic problems in making available tools and materials to the workers in time. Therefore, the volume of quality ores mined and quantity of gold extracted are far less, and hence the Gold output is coming down steadily.

The deep mines are draining and swallowing considerable amounts of underground water. The water levels in the subsoil and underground is steadily going down in the surrounding areas, that record depths are being reported by the farmers and state authorities sinking bore wells to find water for drinking and farming.

While these have happened to the miners and the mines under the ground, above on the surface the mining colonies and the families are physically shrinking. Income, real and relative are falling. Poverty, Unemployment, Social Unrest and Tension, Ill health, Malnutrition, are going up. The

area is known for sickness, unnatural deaths and infant mortality.

Liquor, debt, hold of money lenders--both the traditional Marwari Pawn Broker type, and the new local varieties of well-to-do mine officials other employees and their families are playing havoc. Active Union Party Politics and their meddling leaders divide the workers hopelessly. Thus badly divided, the mine workers no more exhibit their traditional solidarity and collective wisdom. Gone are the days of the highly conscious mining communities. They are all beaten men now.

ENVIRONMENTAL IMPACT:

The tailings dumped by the mines in shallow valleys, depressions and lakes have filled them up, and now raise all around as hills and mounds in some places, and like long walls of a big, massive, extensively large fort on all other sides. This is the Visual Problem.

The fine dusts from the tailings broken loose by the sun, rain and wind from the dumps are carried up into the atmosphere/that carry them all around over long distances by gusts of air; and the rains /erode them polluting the land. New discharges flow into neighbouring areas fouling the waters, silting the irrigation lakes, spoiling the farm lands, laying them all waste and uprooting the families and farmers living on those lands. These contain cyanides. So the soils have all become unproductive and unfit for cultivation for at least many years, and may be decades to come. This is the Problem of land Pollution.

The seepage and perculation from the effluents flowing into the open vallyes around and the dusts from the tailings have carried their chemical and physical pullutions with them. More particular among these are the problems of cyanide pollution. As these flow into surface water bodies, and seep down the ground, they spoiled the quality of water in th e

wells and even subsoil water. Hence the water dr awn by the hand pumps and the deep bore-wells, in the mine area and the surroundings is salty and unfit for consumption. The local people are abandoning their well s, and no more use the water for drinking or cooking purposes. Water availability has also become so short that an accute scarcity prevails in the area. People go long ways carrying plastic pots in buses, cycles, on their heads, shoulders and hips. Both men and women, young and old, the strong and the infirm in search of water could be seen every where. This is the Problem of Water Pollution and resultant scarcity.

The air is full of fine dust from the tailings. Summer windy days are reported to be worse, that dust storms like thick clouds enveloping the area are reportedly not infrequent. It is the Problem of Air Pollution.

The piling up of the tailing mounds all around and the result ant dusts in the area continue to c ause many health problems and particularly breathing ailments even amongst the children and women. This is the Public Health Problem.

As the mines go dry, there are no more employment. But the mines had for long and sufficiently moulded the thoughts of the men in the area, and tailored and encouraged an educational system that produced not intellectuals, or prospective white collar workers, or self-employed, but skilled tradesmen, artisans and craftsmen who could be employed in the mines for the benefit and advant age of the Managements. Now the mines don't need any more men--either skilled or unskilled. So there is unemployment, and growing poverty. These skilled men are not being absorbed elsewhere, not even in the newly set up Bharat Earth Movers Limited, established to save KGF and the people of KGF. For, they are mostly Tamilians, a linguistic minority in a Kanada speaking state. Many are also Christians, a Religious Minority in the State. And most of them are Scheduled C astes,

and no further comments are needed. Thus they are cumulatively disadvantaged. Hence it would be something of a strange phenomenon if they could find a job anywhere nearby. These are the Socio-Economic Problems of KGF and the Mining families.

CONCLUSION

'Promise of a better future,' has always been there with humanity. It was the hope of the people. And, it had been the strong point of the leaders. Asking and forcing the people, to work hard and sacrify their comforts today for a comfortable tomorrow, and for the good days of their children has been the steady stock arguments of the leaders.

Here in Kolar, Gold had been mined from Pre-historic times. Then the finds were apparently small and sporadic. Now for the last 100 years and more, scientific modern technological mining has been going on at unbelievably deep depths. And gold was, is and will be considered as wealth, though strangely man digs gold from under the ground only to hord it again under the ground. But they are held safely and securely as National Securities in Central Banks. These hoardings have been so massive that it had been reported that the floor of the Bank of England once collapsed under the shear weight of the Gold stored there in. So it is no wonder that the people, societies and Nation states have been behind it. This wealth has been produced regularly in KGF for more than 100 years in a massive way. Where are they? They have been taken out by the Mine Authorities--the Private Foreign Ones earlier, then the State, and now the Government of India. But the workers who produced them still remain poor, where they are, as they were.

The mining activity did produce changes. And many of the changes have not been beneficial, and large number of them as recounted earlier have

been environmentally degrading. These have affected the men and their families, physically, economically and socially. The Authorities grew in stature, their career and in personality. They and their families grew rich and went their way like the birds in search of fruits. The workers and the local people rooted to the ground and wedded to their homes remain--poor, sick, neglected, forgotten and dying. In the ultimate analysis, these are the realities of what have been 'the Impact of the Environment-al Degradation in the Kolar Gold Fields on the Man.'

ANNEXURES

ANNEXURE - I

LAND MARKS OF KOLAR GOLD FIELD

Location: About 87 kms East of Bangalore, and 300 kms West of Madras, in the South-Eastern District of Kolar, in the Southern Taluk of Bangarpet (Bowringpet) in the South-Eastern edge near the junction of Karnataka-Tamil Nadu-Andhra Border.

Geology: Linear North - South trending of Kolar schist belt.

Strike Length: 8 kms.

Ancient workings reportedly supplied Gold to the Indus Valley Civilisation. Recorded evidence exists of Tippu Sultan working the Gold Mines.

1802 - Lt. John Warren visits the place on hearing Gold finds.

1873 - Application by MF Lavelle for exclusive privilege of mining in the Kolar District.

1875 - Investigation of the area for Gold Mining. Sinking of the first shaft at Urigam.

1878 - Begining of Work by many companies prospecting for gold.

1880 - Begining of John Taylor's organised Mining.

1881 - Application from many others for gold mining in Kolar.

1882 - Total production of Gold of value only 38 Pounds.

1883 - Opening of four main veins.

1885 - Discovery of rich Champion Lode.

1894 - Broad Gauge Railway line to KGF.

1900 - Contract for Electric Generation and Transmission to KGF signed.

Contd .. 2/-

1902 - Electric power supply from Shivasamudram Hydro-Electric Power Station (First of this type in the whole of Asia) started.

1903 - Work on Bethamangala Water Works begins.

1903-04 - Protected water supply from Bethamangala Tank reaches Kolar.

1923 - For the first time in the world, a Rescue Station for underground fire fighting established.

1940 - For the first time in the Country, Air Cooling Plants on surface and underground were set up.

1953 - For the first time in the country, mill tailings were used as support to fill in the old shafts.

1956 - The first national R&D unit to study the problems of Rock Bursts established.

29.11.56 - Govt. of Mysore Nationalised the Kolar Gold Mines.

01.12.62 - Govt. of India took over the Mines and Kolar Gold Mining Undertaking established.

01.04.72 - An autonomous Bharat Gold Mines Limited established.

1980 - Scheelite from Water Tailing Dumps and ROM recovered.

Water Supply: KGF and the Robertsonpet Municipal Area get water from the KGF Water Works at Bethamangala. The water supply to KGF started in 1903 - 1904. Water now comes from the Bethamangala Tank on River Palar, and is augmented from the Hollally upstream Tank also on the River Palar, and from 4 bore-well areas at Gosinakere, Pitchapalli, Swarnakuppam and Marikuppam.

1904 - Water supply exclusively to KGF; 1.8 million gallons per day from Bethamangala Tank only.

1987 - Water supply to BGML (KGF) and also BEML, Robertsonpet, neighbouring towns, satellite towns and villages from the Bethamangala Tank and Bore Wells; 2 million gallons per day.

ANNEXURE - II

GOLD PRODUCTION IN KOLAR GOLD FIELDS

Year	Gold recovered Kgs.	Value £ Stg.	Royalty of State Rs.
1880	-	-	-
1882	0.3	38	-
1885	209	24,860	18,465
1890	3,435	409,526	304,620
1895	8,344	973,610	723,240
1900	16,576	1,879,086	1,399,980
1905	20,409	2,373,438	1,756.245
1910	18,205	2,107,749	1,767,045
1915	18,473	2,182,903	1,929,213
		Rs	Rs
1920	14,390	25,863,000	1,483.535
1925	13,870	25,825,000	1,389,112
1930	10,617	25,768,000	---
1935	10,241	28,425,000	---
1940	9,420	32,585,000	---
1945	5,682	34,104,000	---
1946	3,734	22,412,000	---
1950	6,169	56,981,658	---
1951	7,045	67,530,000	---
1955	6,508	--	---
29.11. '56	Nationalisation by the Govt of Mysore		
1960	4,868	59,103,000	---
1.12. '62	Take over by the Govt of India - KGMU.		
1965	3,736	44,979,000	---
1970	3,241	67,379,000	---
1971	3,656	83,091,000	---
1. 4. '72	Establishment of BGML, Ooregaum, KGF.		
1975	2,824	--	---
1976	3,152	151,154,000	---
1980	2,452	186,157,000	---
1985	1,500	--	---

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ENVIRONMENTAL IMPACT OF THE GOLD MINES

IN THE KOLAR GOLD FIELDS

DRAWINGS, FIGURES, MAPS AND PHOTO SECTION

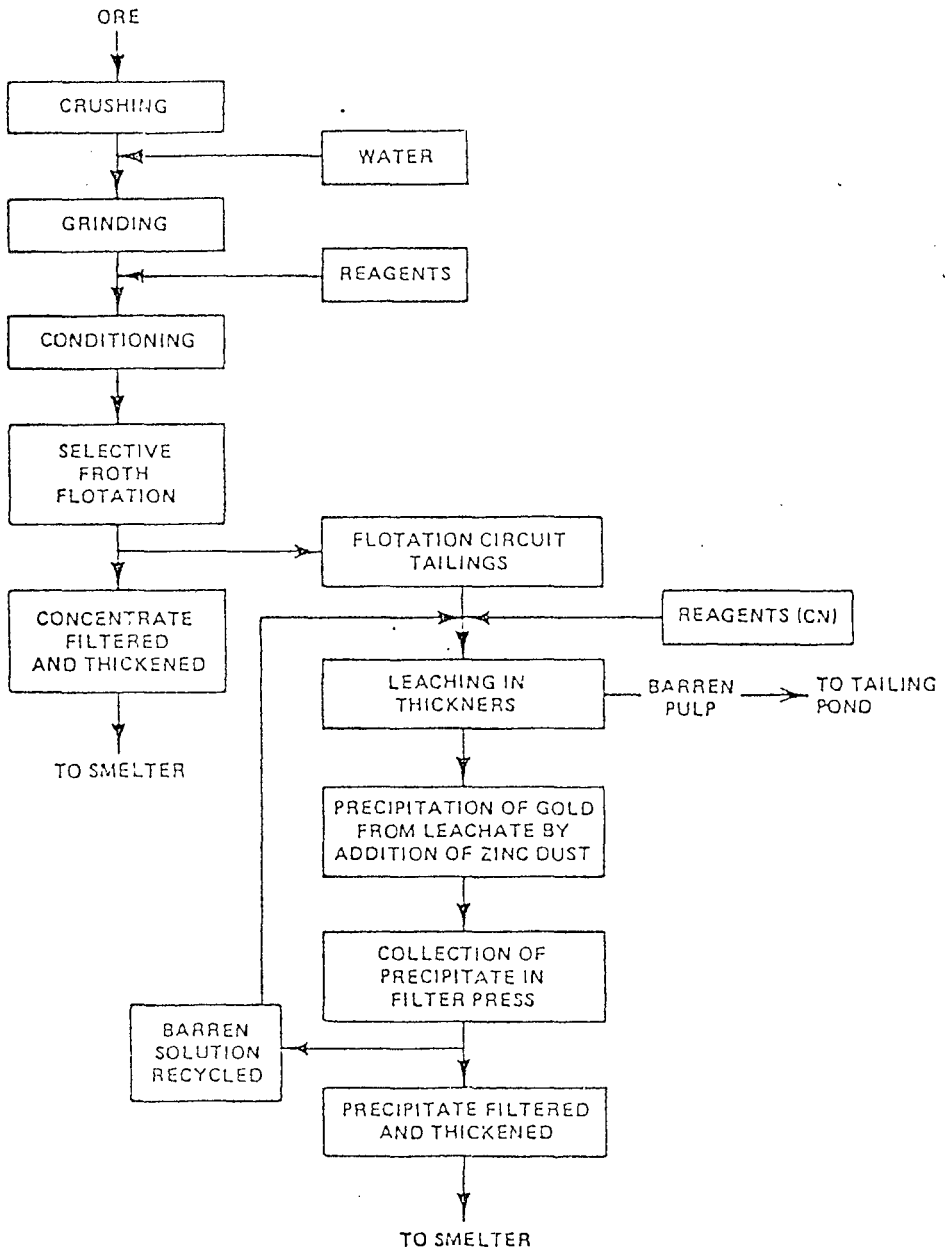


Figure - 1

FLOTATION OF GOLD-CONTAINING MINERALS WITH RECOVERY OF RESIDUAL GOLD VALUES BY CYANIDATION

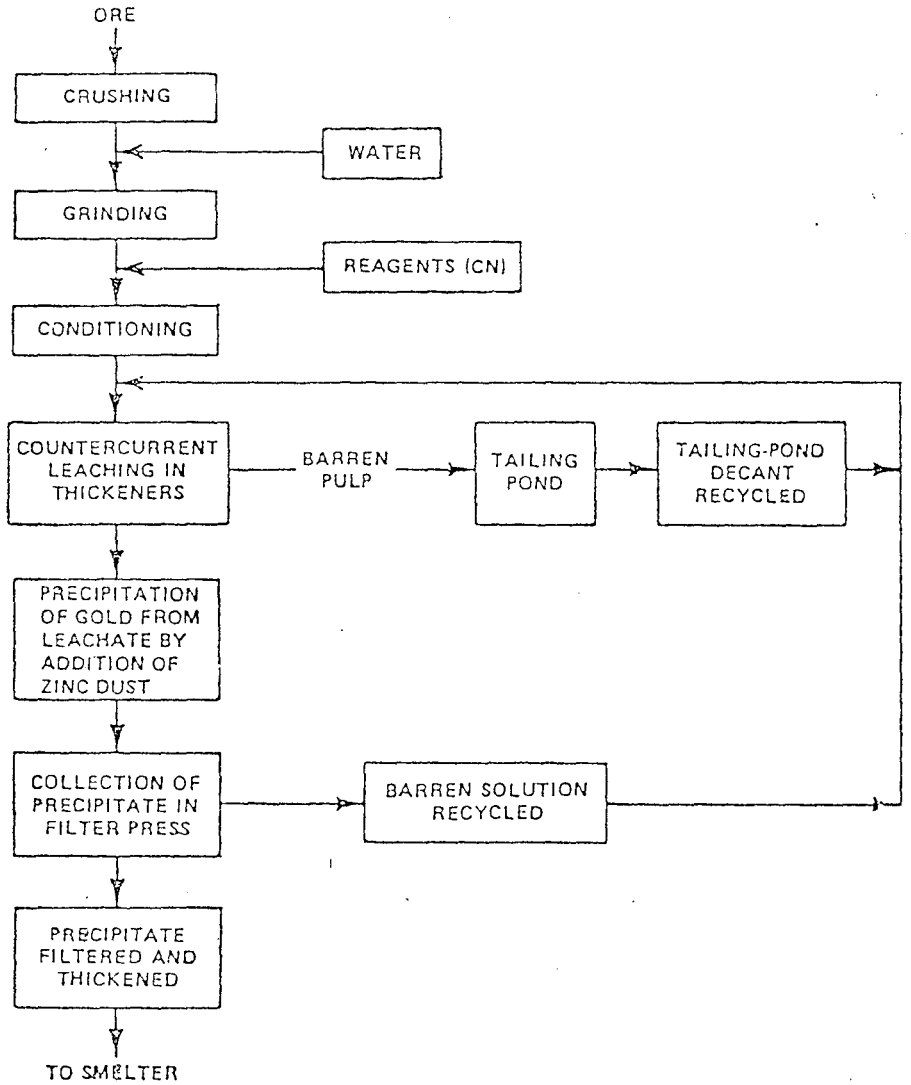


Figure - 2

CYANIDATION OF GOLD ORE: AGITATION/LEACH PROCESS

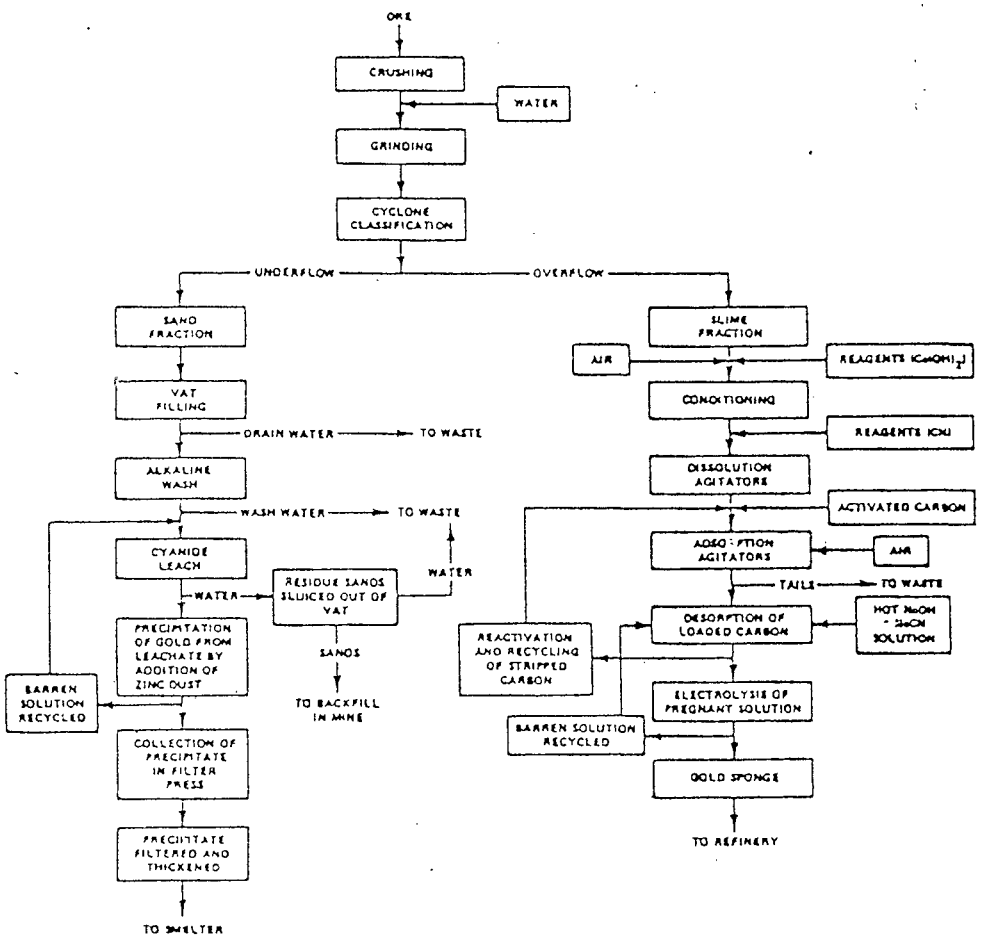


Figure - 3

CYANIDATION OF GOLD ORE: VAT LEACHING OF SANDS AND 'CARBON-IN-PULP' PROCESSING OF SLIMES

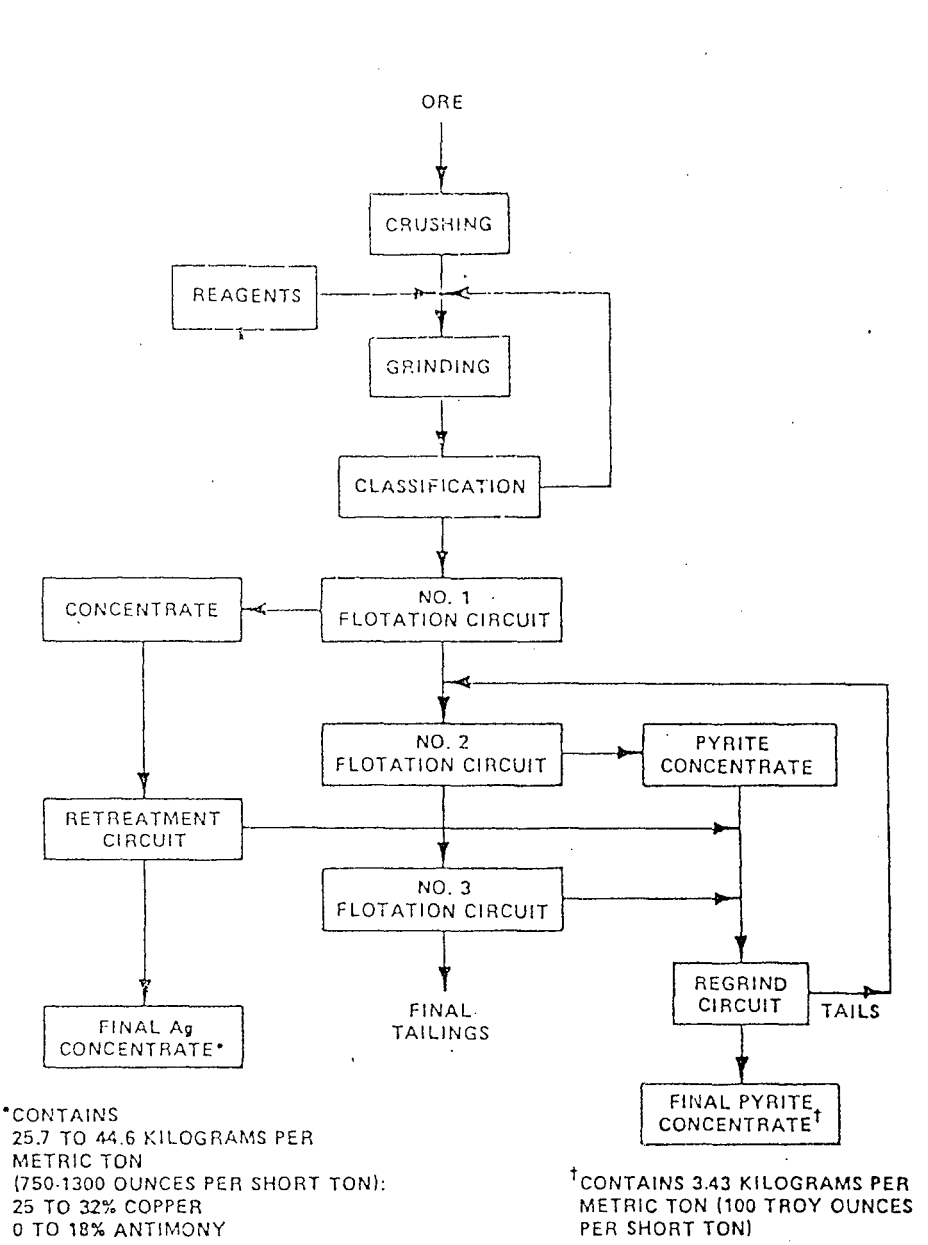
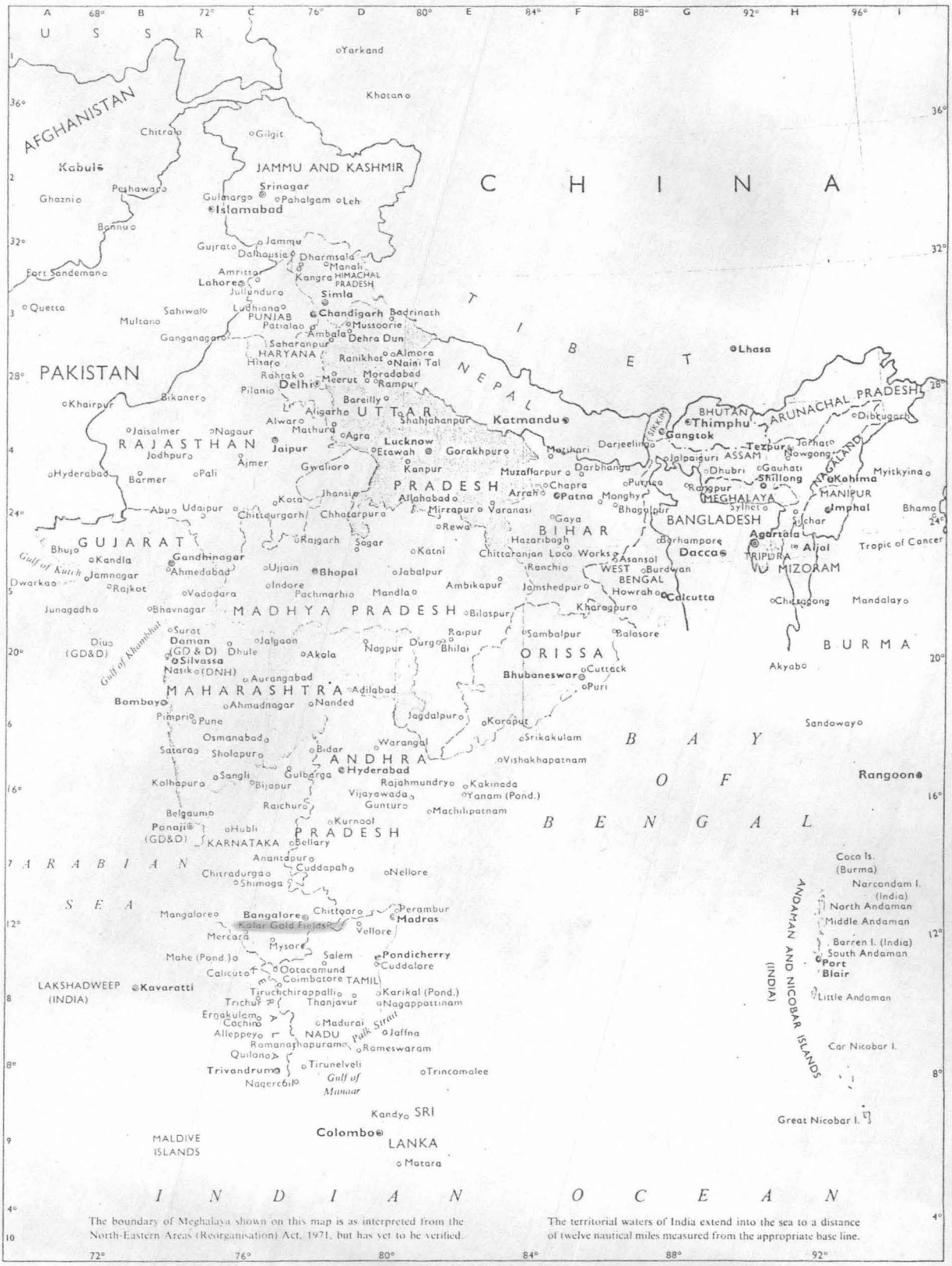


Figure = 4

RECOVERY OF SILVER ORE BY FROTH FLOTATION

MAP No. 1

INDIA: POLITICAL



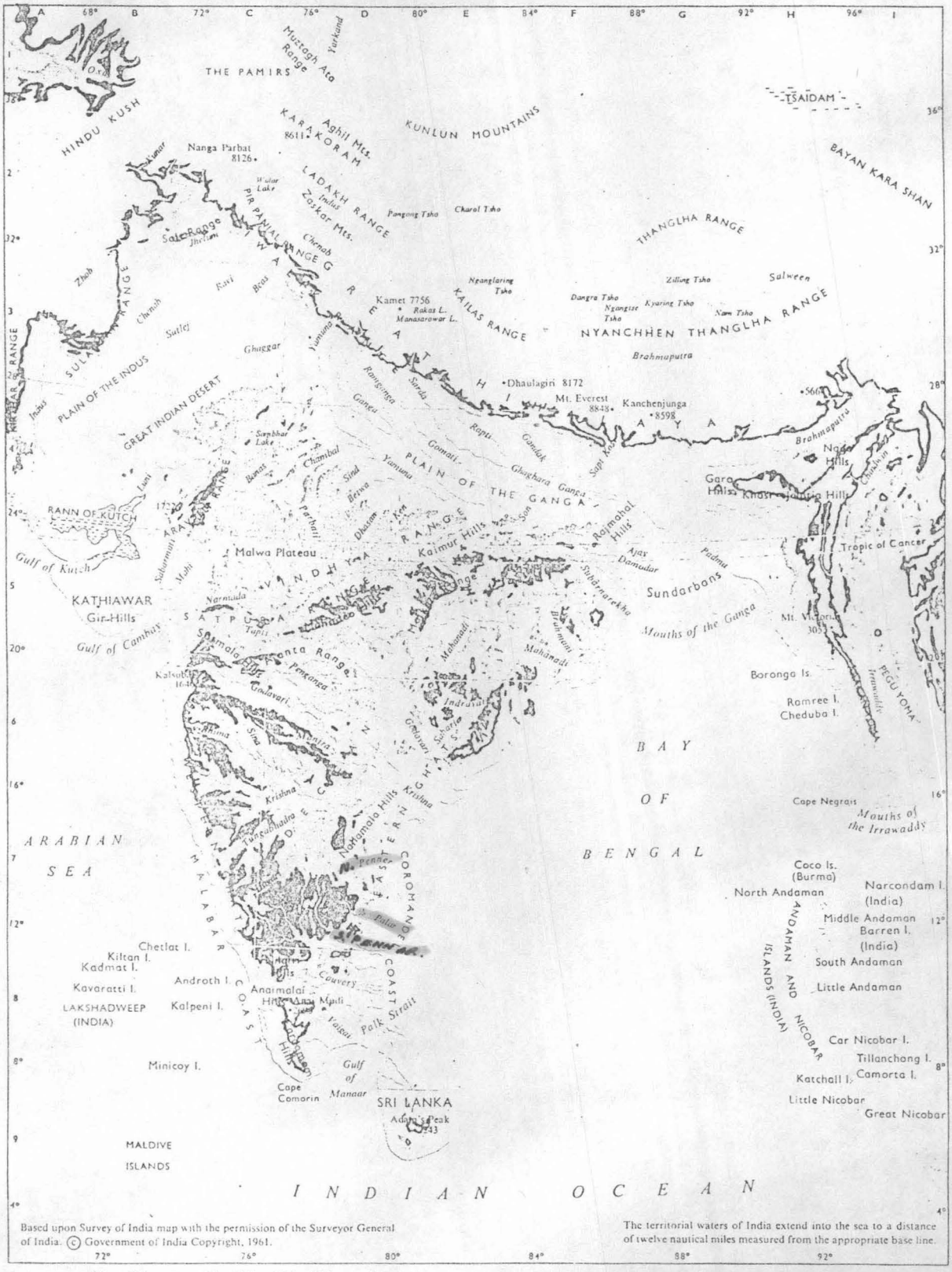
The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

Miles 60 0 60 120 180 240 300
Kilometres 100 0 100 200 300 400 500

INDIA: PHYSICAL

MAP No. 2



Based upon Survey of India map with the permission of the Surveyor General of India. © Government of India Copyright, 1961.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

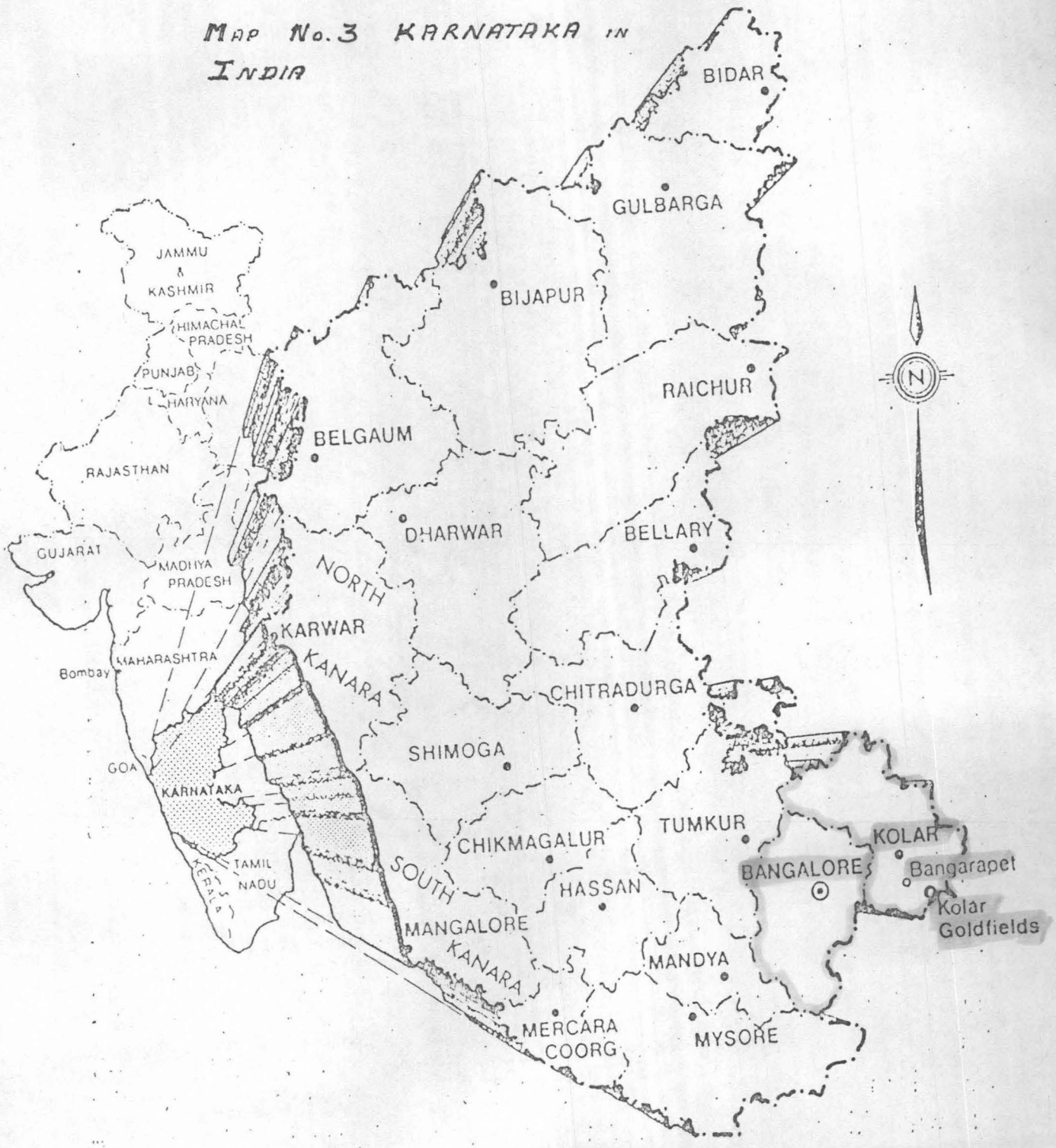
72° 76° 80° 84° 88° 92°

984 246 0 492 984 1969 3281 Feet

300 75 0 150 300 600 1000 Metres

Miles 60 0 60 120 180 240 300

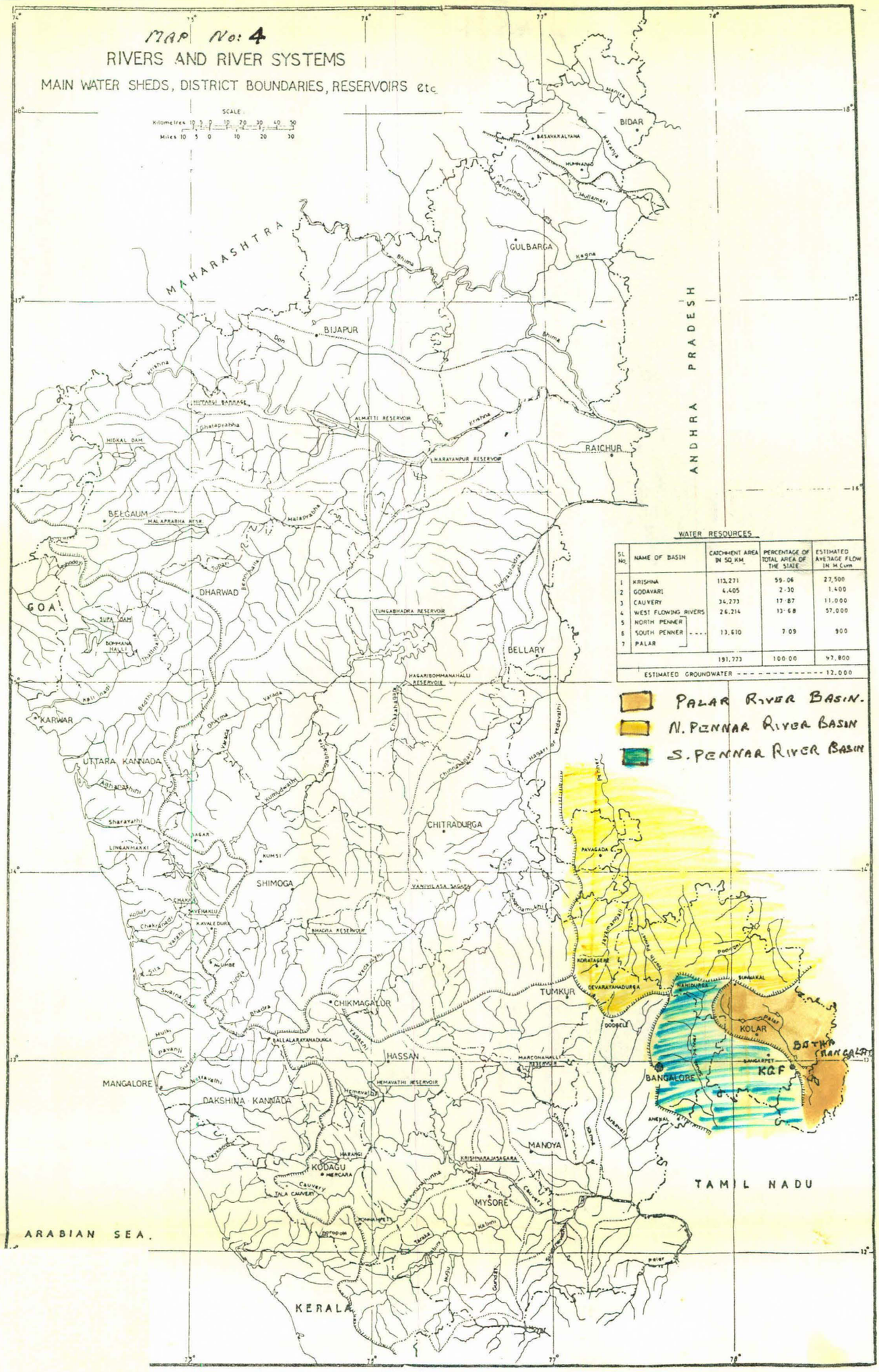
Kilometres 100 0 100 200 300 400 500


MAP No.3 KARNATAKA IN INDIA
BIDAR
GULBARGA
BIJAPUR
RAICHUR
BELGAUM
DHARWAR
BELLARY
NORTH KARWAR KANARA
CHITRADURGA
SHIMOGA
TUMKUR
KOLAR
BANGALORE
Bangarapet
Kolar Goldfields
CHIKMAGALUR
HASSAN
SOUTH KANARA
MANGALORE
MANDYA
MERCARA COORG
MYSORE
JAMMU & KASHMIR
HIMACHAL PRADESH
PUNJAB
HARYANA
RAJASTHAN
GUJARAT
MADHYA PRADESH
MAHARASHTRA
Bombay
GOA
KARNATAKA
TAMIL NADU
KERALA
N

MAP No: 4

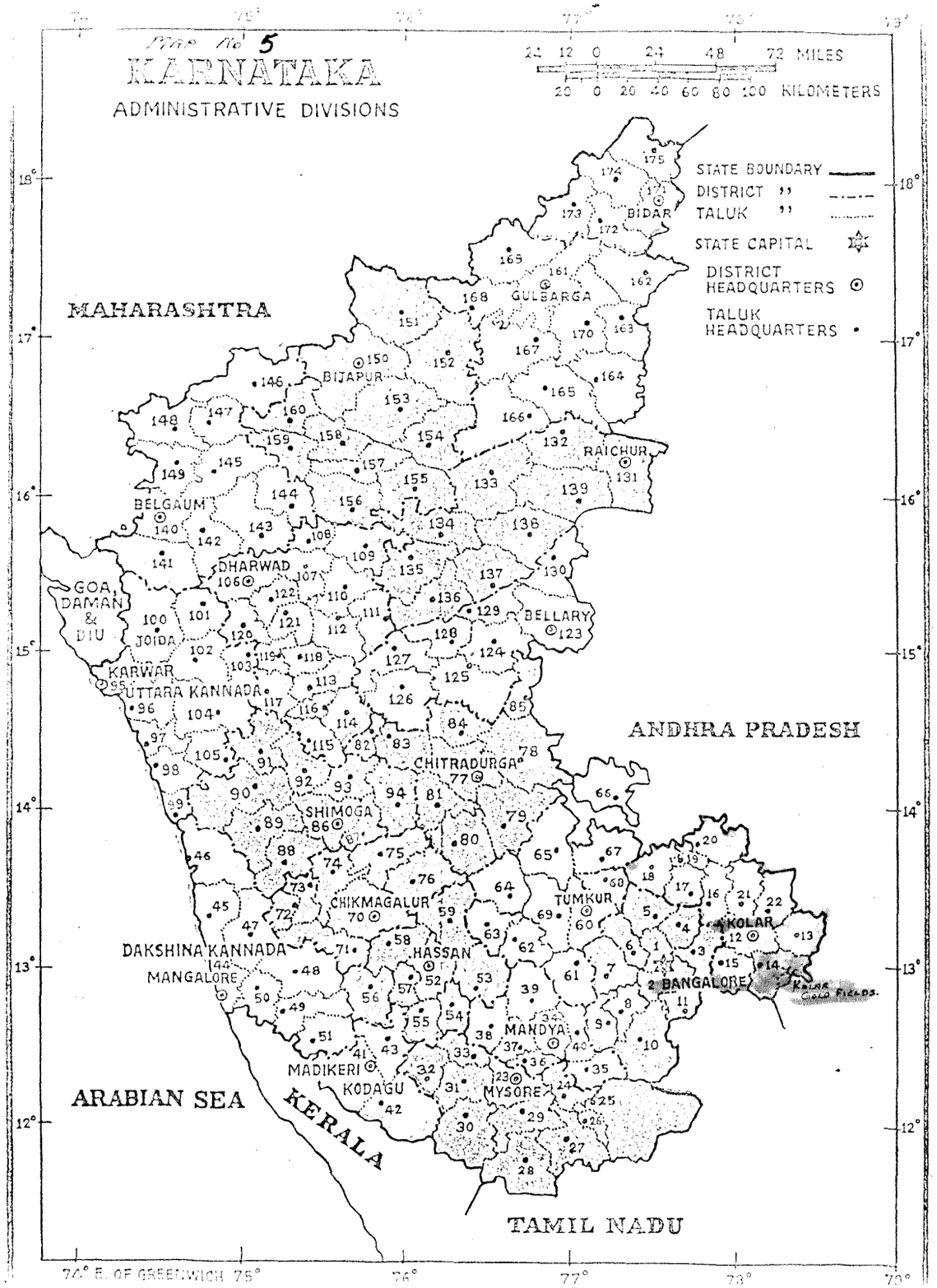
RIVERS AND RIVER SYSTEMS

MAIN WATER SHEDS, DISTRICT BOUNDARIES, RESERVOIRS etc.



WATER RESOURCES

SL No.	NAME OF BASIN	CATCHMENT AREA IN SQ. KM.	PERCENTAGE OF TOTAL AREA OF THE STATE	ESTIMATED AVERAGE FLOW IN M. Cum.
1	KRISHNA	113,271	59·06	27,500
2	GODAVARI	6,405	2·30	1,400
3	CAUVERY	34,273	17·87	11,000
4	WEST FLOWING RIVERS	26,214	13·68	57,000
5	NORTH PENNER			
6	SOUTH PENNER	13,610	7·09	900
7	PALAR			
		191,773	100·00	97,800
	ESTIMATED GROUNDWATER			12,000



REFERENCES

Bangalore

1 Bangalore North
2 Bangalore South
3 Hoskote
4 Devanahalli
5 Doddaballapur
6 Nelamangala
7 Magadi
8 Ramanagaram
9 Channapatna
10 Kanakapura
11 Anekal

Kolar

12 Kolar
13 Mulbagal
14 Bangarpet
15 Malur
16 Sidlaghatta
17 Chikballapur
18 Gouribidanur
19 Gudibanda
20 Bagepalli
21 Chintamani
22 Srinivasapura

Mysore

23 Mysore
24 T. Narasipura
25 Kollegal
26 Yelandur
27 Chamarajanagara
28 Gundlupet
29 Nanjangud
30 Heggadadevanakote
31 Hunsur
32 Periyapatna
33 Krishnarajanagar

Mandya

34 Mandya
35 Malavalli
36 Srirangapattana
37 Pandavapura
38 Krishnarajpet
39 Nagamangala
40 Maddur

Kodagu

41 Madikeri
42 Virajpet
43 Somvarpet

Dakshina Kannada

44 Mangalore
45 Udupi
46 Kundapur
47 Karkal
48 Belthangady
49 Puttur
50 Buntwal
51 Sullia

Hassan

52 Hassan
53 Channarayapatna
54 Holenarasipur
55 Arkalgud
56 Sakaleshpur
57 Alur
58 Belur
59 Arsikere

Tumkur

60 Tumkur
61 Kunigal
62 Turuvekere
63 Tiptur
64 Chikkanayakanahalli
65 Sira
66 Pavagada
67 Madhugiri
68 Koratagere
69 Gubbi

Chikmagalur

70 Chikmagalur
71 Mudigere
72 Sringeri
73 Koppa
74 Narasimharajapura
75 Tarikere
76 Kadur

Chitradurga

77 Chitradurga
78 Challakere
79 Hiriyur
80 Hosadurga
81 Holalkere
82 Haribar
83 Davanagere
84 Jagalur
85 Molakalmuru

Shimoga

86 Shimoga
87 Bhadravati
88 Tirthahalli
89 Hosanagar
90 Sagar
91 Sorab
92 Shikaripur
93 Honnali
94 Channagiri

Uttara Kannada

95 Karwar
96 Ankola
97 Kumta
98 Honavar
99 Bhatkal
100 Sirsa (hq. Joida)
101 Haliyal
102 Yellapur
103 Mundgod
104 Sirsi
105 Siddapura

Dharwad

106 Dharwad
107 Navalgund
108 Nargund
109 Ron
110 Gadag
111 Mundargi
112 Shirhatti
113 Haveri
114 Ranebennur
115 Hirekerur
116 Byadagi
117 Hangal
118 Savanur
119 Shiggaon
120 Kalghatgi
121 Kundgol
122 Hubli

Bellary

123 Bellary
124 Sandur
125 Kudligi
126 Harapanahalli
127 Hadagali
128 Hagaribommanahalli
129 Hospet
130 Siruguppa

Raichur

131 Raichur
132 Deodurg
133 Lingsugur
134 Kushtagi
135 Yeiburgi
136 Koppal
137 Gangavati
138 Sindhanur
139 Manvi

Belgaum

140 Belgaum
141 Khanapur
142 Bailhongal
143 Soundatti
144 Ramdurg
145 Gokak
146 Athani
147 Raibag
148 Chikodi
149 Hukeri

Bijapur

150 Bijapur
151 Indi
152 Sindgi
153 Basavana Bagewadi
154 Muddebihal
155 Hungund
156 Badami
157 Bagalkot
158 Bilgi
159 Mudhol
160 Jamkhandi

Gulbarga

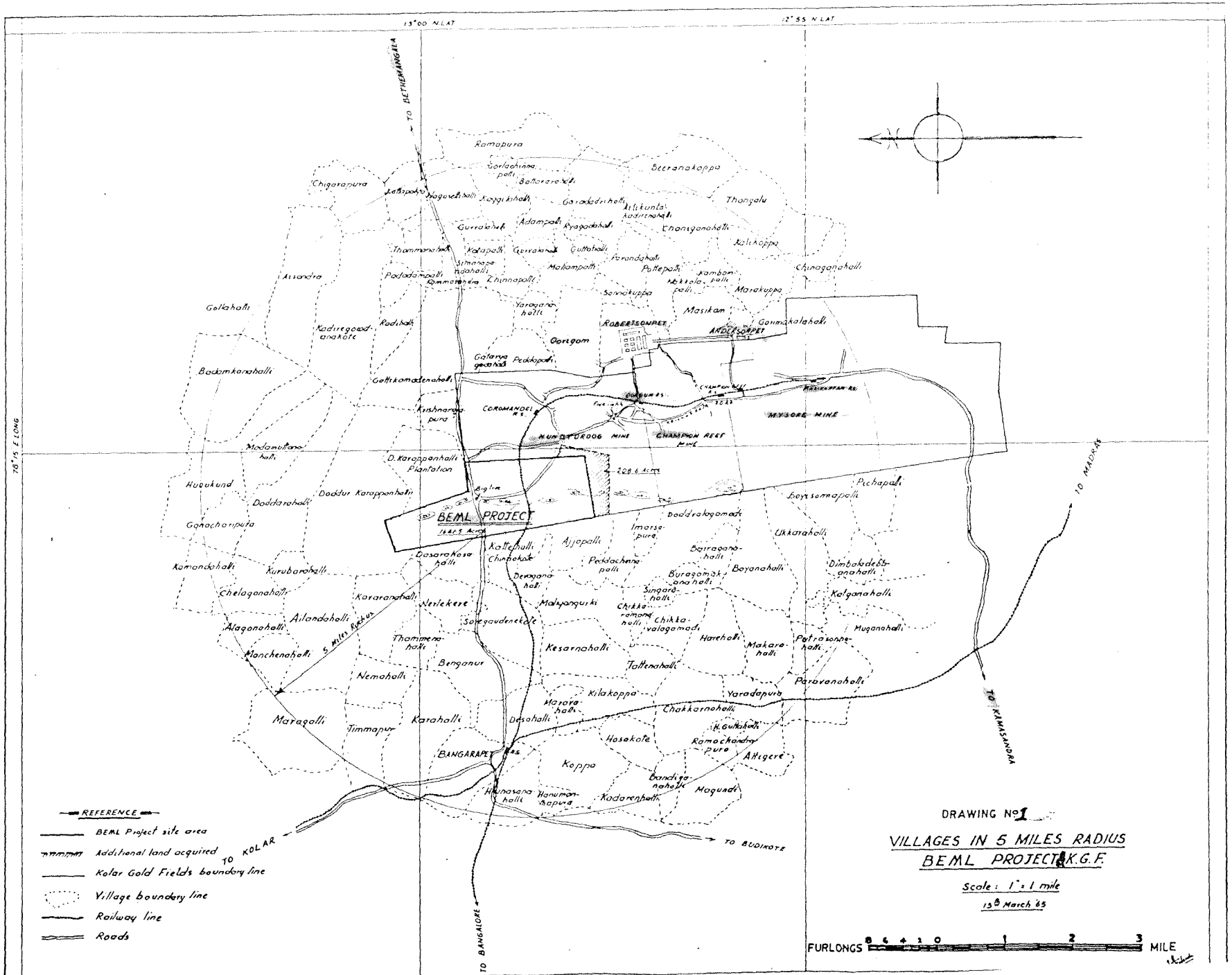
161 Gulbarga
162 Chincholi
163 Sedam
164 Yadgiri
165 Shahapur
166 Shorapur
167 Jevargi
168 Afzalpur
169 Aland
170 Chitapur

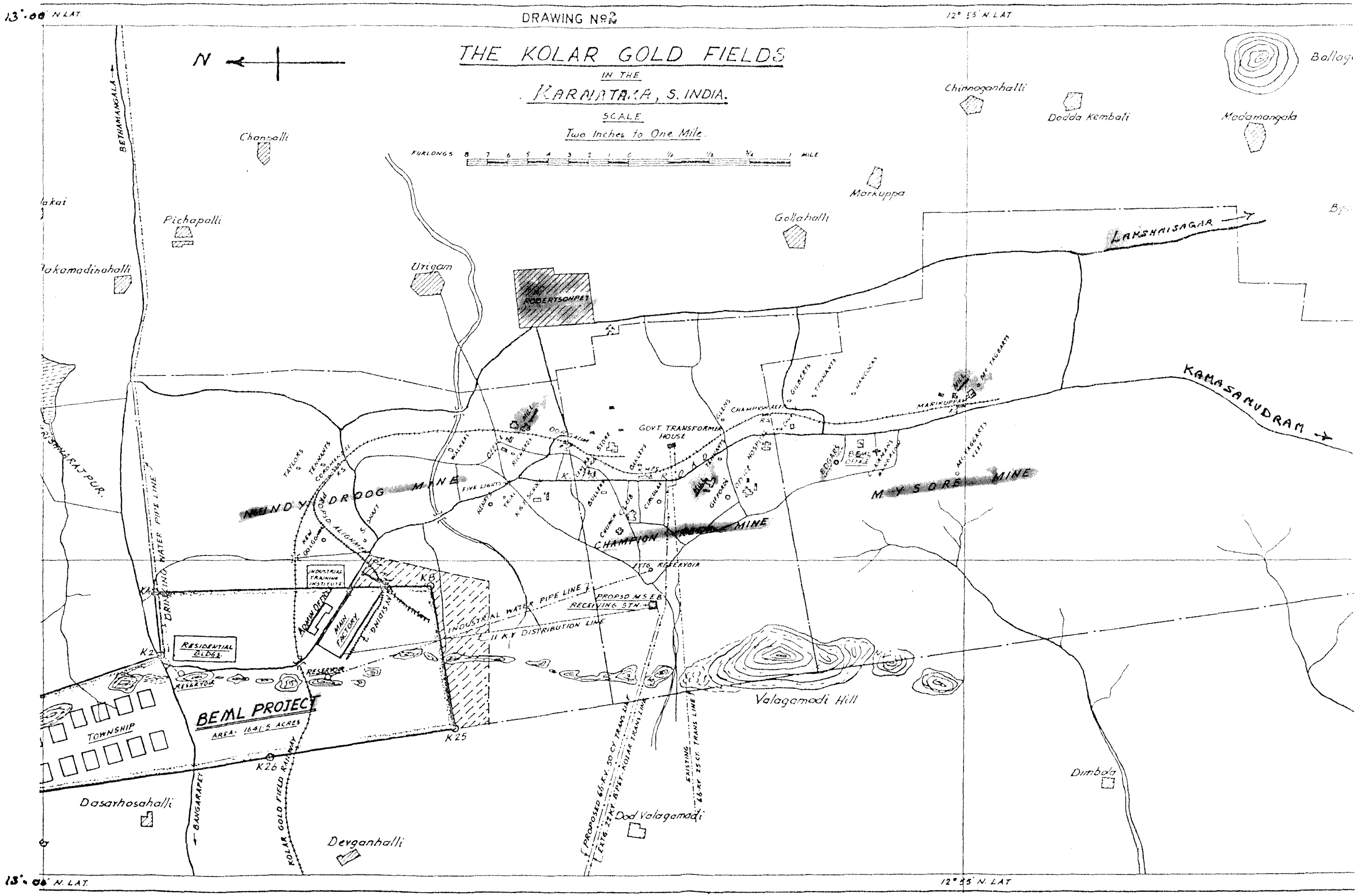
Bidar

171 Bidar
172 Humnabad
173 Basavakalyan
174 Bhalki
175 Aurad

MAP No. 6


KOLAR DISTRICT
SCALE 8 MILES TO AN INCH
B—Travellers' Bungalow. L—Inspection Lodge. S—Railway Station.
ANANTAPUR
TUMKUR
KOLAR
BANGALORE
MUHAMMADABAD
SOMPALLI
TAMBALLAPALLI
MUDIVEDU
RANGASAMUDRAM
PEDDATIPPASAMUDRAM
TARIGONDA
CHINNA-TIPPASAMUDRAM
GHATTU
KOTTAKOTA
KURABALAKOTA
MADANAPALLI
PAYALPAD
PARIGI
HINDUPUR
CHILIMUTTUR
BAGEPALLI
GUDIBANDA
GORIBIDNUR
HOSUR
CHIK-BALLAPUR
SIDLAGHATTA
CHINTAMANI
RAMASAMUDRAM
PUNGANUR
SRINIVASPUR
DOD-BALLAPUR
DEVANHALLI
VADIGENAHALLI
NELAMANGALA
YELAHANKA
HOSKOTE
MALUR
KOLAR
MULBAGAL
BOWRINGPET
GOLDMINES
BEGUR
DOMMASANDRA
SARJAPURA
KANGUNDI


13°00 N LAT
12°55 N LAT
78°15 E LONG
TO BETHAMANGALA
TO MADRAS
TO KAMASANDRA
TO BUDIKOTE
TO BANGALORE
TO KOLAR
Ramapura
Gorlachinna palli
Beeranakoppa
Chigarapura
Thongalu
Gurrakodri halli
Adampalli
Ryagadahalli
Chanigenahalli
Kalikoppa
Thammenahalli
Kotapalli
Gutthalli
Chinaganahalli
Malampalli
Puttepalli
Marakuppa
Sannakuppa
Yaragana halli
Masikam
Gonimakalahalli
Gollahalli
Kadiregoodanakote
Radihalli
Gangam
ROBERTSONPET
ARGOL POST
Badamkanahalli
Pedkapalli
Gollakomalenahalli
CORONATION REEF
CHAMPION REEF
MYSORE MINE
Krishnarajapura
CORONATION No 2
NUNDYDROOG MINE
CHAMPION REEF MINE
Madamulana halli
D. Karappanhalli Plantation
209.6 Acres
Huvukund
Doddarahalli
Doddur Karappanhalli
BEML PROJECT
1845 Acres
Gonachanipalli
Doddrakagamadi
Pechapalli
Boyssannapalli
Ukkaraholli
Kattehalli
Ajjapalli
Imarsapura
Dasarakoppalli
Chinnakote
Peddachenna palli
Bairagonahalli
Kamandahalli
Kurubarahalli
Devagonahalli
Boyanahalli
Dimbaladeddagganahalli
Chelagonahalli
Singarahalli
Kalganahalli
Karaganahalli
Jerlekere
Malpanguni
Chikkaramanahalli
Ailandahalli
Solegaudenekote
Chikkavalagamadi
Muganahalli
Alagonahalli
5 Miles Radius
Thammenahalli
Kesarnahalli
Harohalli
Makarahalli
Pattrasannahalli
Manchenahalli
Benganur
Tattenahalli
Nemahalli
Paravanahalli
Kilakoppa
Yaradapura
Marayahalli
Chakkarnahalli
Maragalli
Timmapur
Karahalli
Desahalli
H. Gutkahalli
Hosakote
Ramachandrapura
BANGARAPET
Koppa
Allegere
Bandiganahalli
Hagundi
Hanumanasanahalli
Hanumanapura
Kodarenhalli
REFERENCE
BEML Project site area
Additional land acquired
Kolar Gold Fields boundary line
Village boundary line
Railway line
Roads
DRAWING No 1
VILLAGES IN 5 MILES RADIUS
BEML PROJECT K.G.F.
Scale: 1" = 1 mile
15th March '65
FURLONGS 8 6 4 2 0 1 2 3 MILE

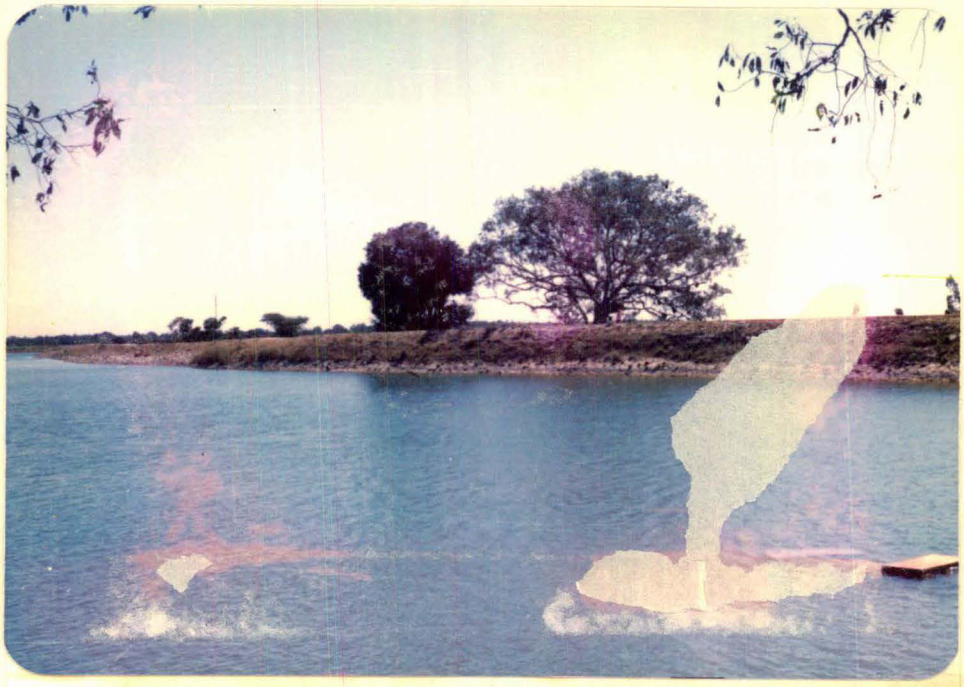

DRAWING No 2
THE KOLAR GOLD FIELDS
IN THE
KARNATAKA, S. INDIA.
SCALE
Two Inches to One Mile.
FURLONGS
MILE
N
13°.08' N LAT.
12° 55' N LAT
13°.06' N. LAT.
12° 55' N. LAT.
BETHAMANGALA
Channalli
Pichapalli
Urigam
ROBERTSONPET
Chinnaganhalli
Dodda Kembali
Madamangala
Markuppa
Gollahalli
LAKSHMISAGAR
KAMASAMUDRAM
NUNDYDROOG MINE
MYSORE MINE
CHAMPION REEF MINE
GOVT. TRANSFORMER HOUSE
FIVE LIGHTS
DRINKING WATER PIPE LINE
INDUSTRIAL TRAINING INSTITUTE
ADMIN OFFICE
MAIN FACTORY
RESIDENTIAL BLDGS.
RESERVOIR
BEML PROJECT
AREA - 1641.5 ACRES
TOWNSHIP
INDUSTRIAL WATER PIPE LINE
PROPSD M.S.E.B. RECEIVING STN.
11 K.V. DISTRIBUTION LINE
EXTG. RESERVOIR
Valagamadi Hill
K2
K8
K25
K26
KOLAR GOLD FIELD RAILWAY
BANGARAPET
Dasarhosahalli
Devganhalli
Dod Valagamadi
Dimbala
EXISTING 66 K.V. 25 CY. TRANS LINE
PROPOSED 66 K.V. 50 CY. TRANS LINE
EXTG. 22 KV B'PET - KOLAR TRANS LINE

THE SKY LINE OF KOLAR GOLD FIELDS:

near Robertsonpet Civil Lines, the nerve center of the city. The scene shows a cinema theater and private residences on the main road, dwarfed old neglected tailings dumps

BARREN LANDSCAPE OF THE KOLAR GOLD FIELDS:

at the top-left is the Scheelite Plant, and the old tailings dumps that run till the extreme right end



BETHAMANGALA LAKE AND BUND:

across Palar(River of Milk) that these days flows-out to the Bay of Bengal through Tamil Nadu: 'Dry Milky White' with not a drop of water, but only sand for most of the year

BETHAMANGALA LAKE:

right-end weir, water-intake tower and the pipe lines of the KGF Water Works, Bethamangala

KGF WATER WORKS, BETHAMANGALA:

commissioned in 1904

AUGMENTATION OF WATER SUPPLY TO KGF:

Deep Bore Wells in a dry lake bed, dry even before the onset of summer; Feb 1987

OLD ERODED, BADLY SCARRED ENDLESS TAILINGS DUMPS, OOREGAUM

ERODED TAILINGS DUMPS - CHAMPION REEFS

TAILINGS DUMPS ALL AROUND, OOREGAUM:

"VALLEY OF CYANIDE MOUNDS"

SENTINELS STANDING AS IF IN A LINE ON PARADE:

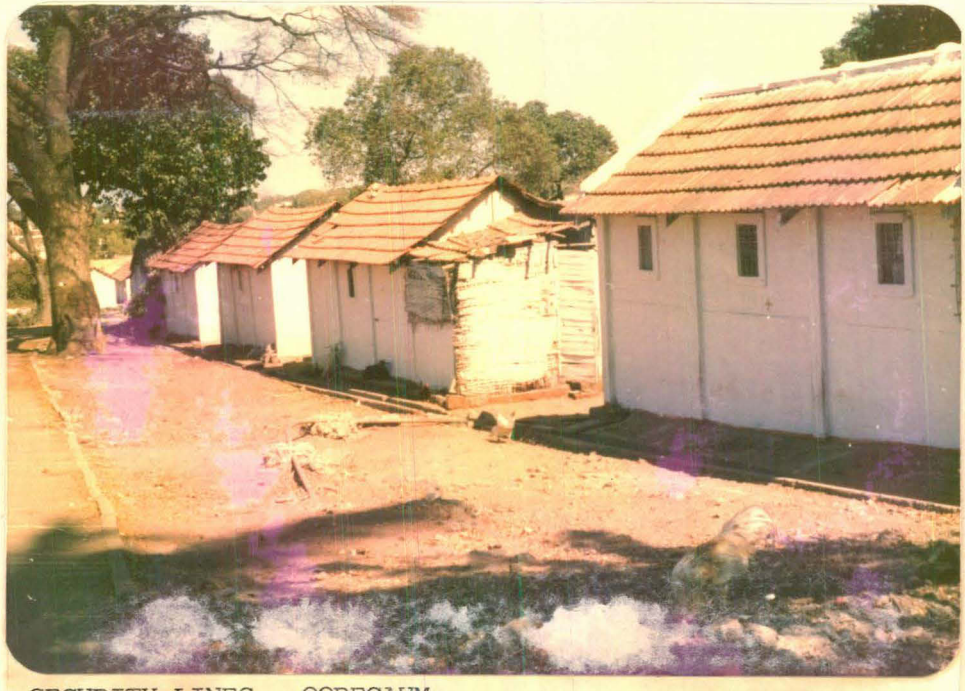
Permanently lining one-side of the entire length of the Ooregaum main Railway Station Road. Old tailings dumps - badly weathered, scarred and eroded

ENVIRONMENTAL DEGRADATION:

the source of land, water and air pollution. Deeply weathered, badly eroded miles and miles of long, old neglected tailings dumps right behind mine-workers colonies. This is Kolar Gold Fields!

SPICK AND SPAN - THOUGH BARREN AND BLEAK:

Tin-walled and tile-roofed single room tenements showing some private additions and extensions, off Ooregaum main road. Framed by a 'pagoda' like, old eroded tailings dump in the middle background



SECURITY LINES, OOREGAUM:

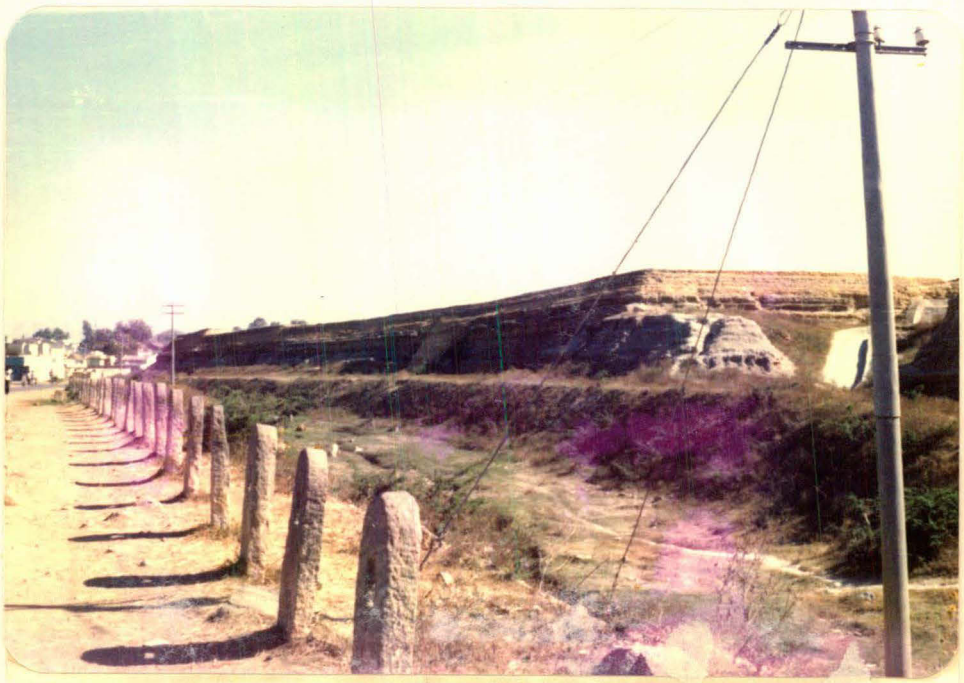
a better part of the mine-workers colony with tiled houses consisting of two rooms each 10' x 10' and made of bamboo-mat-walls. Extensions and additions to accomodate big families and domestic animals could be seen in some houses. These are till today without electricity or water points or any toilets, Ooregaum

A MUTE, SAD TESTIMONY TO THE NEGLECT OF ENVIRONMENT:

Deeply erodeed tailings dumps right in front of the houses. A specimen picture of toatal mismanagement, and Environmental Degradation

OLD TAILINGS DUMPS:

weathered and eroded with a mine-workers colony in between, Ooregaum



THE TAILINGS OF ASHOK NAGAR END OF NANDYDROOG MINES

The effluent run-off channel could be seen in the center, that leads to the natural valley beyond

CLOSE-UP OF THE TAILINGS DUMPS:

the run-off channel for the effluents could be seen in the middle. Ashok Nagar end of the Nandydroog Mine Works

GHOST FACES OF REVEGETATED TAILINGS:

Environmental rehabilation of the area! Deeply scarred tailings dumps - a close-up view, Mysore Mines

LOOSE TAILINGS OF SCHEELITE PLANT:

dumped in the open after working of the old tailings dumps. No wonder that KGF suffers from the problems of Atmospheric Dust

EFFLUENT RUN-OFF FROM RE-REFINING AND SCHEELITE PLANTS:

The run-off from the re-refining of the old tailings for recovery of the residual gold and the drains from the Scheelite Plant by the side of a shallow surface-well, used by the people around for cleaning and washing purposes

A PANORAMIC VIEW OF THE KOLAR GOLD FIELDS:

with tiny mine shafts that regularly cough-out the rubbles and give-up the Gold-Ores, dotting the scene here and there amidst deeply weathered and eroded massive long tailings dumps. A scene that also reveals utter neglect, carelessness, indifference and disregard to the Environment.

The narrow bright open drain characteristically coloured by the mine waters, accessible to sheep and other domestic cattle, flows-out from the mine shaft in the top-left-hand, passes below the culvert on the right over which a cycle track passes.

This is Kolar Gold Fields - where time appears to have stood still! The miners here are the living dead, walking skeletons, with no future either for themselves or for their children, and with only an exceptionally few, rare negligible numbers dying naturally of old age