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PRESIDENT'S COLUMN

The Workshop on "Industry and Mining – Reclamation, Resettlement and Rehabilitation", recently organized on 16th December'2006 at Bhubaneswar has entrusted the Society with certain responsibilities which cannot be fulfilled without active support of all its members. Welcoming the recent trend in growth of mining and industrial activities in the state, it was unanimously decided that the Society should act as a facilitator to counter the unethical resistances raised by a few, who speak adversely against mining, citing wrong and unscientific facts. Technically competent experts of the Society should take lead role in countering these biased views and publicity against the growth of mineral industries and all development activities. Support from each member of mining community and related institutions are solicited to highlight the positive impact of their activities in improving the local areas and periphery zones. These achievements are to be documented and highlighted and publicized. Public awareness has also to be created to support the growth of mineral sector, which in turn would bring economic development and prosperity to people. Keeping this in view, SGAT has now decided to work for promoting mineral development through constructive interaction with policy makers, intellectuals and media persons.

The construction of the permanent building of SGAT on the plot allotted by the Govt. at Nayapalli, Bhubaneswar is to start soon. Generous contributions by members and mining community can help in completing the building soon to have our full-fledged office with library, documentation and data center.

Let us all join hands to strengthen the Society to work together and contribute towards development of the country and the people.

Dr. R. C. Mohanty
(President, SGAT)

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GEOINFORMATICS: AN INNOVATIVE WAY TO CONSERVE BIODIVERSITY OF ORISSA STATE

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ABSTRACT

This article describes progress in the application of Geoinformatics (GPS-Global Positioning System, Remote Sensing and GIS-Geographical Information System) in biodiversity conservation, and outlines the procedure and steps of the use of GIS to conserve biodiversity of the state. It focuses especially on the severe problem of lack of awareness of the potential functions of GIS in the field of biodiversity inventory, monitoring and analysis. Specific suggestions are provided to improve the efficiency of biodiversity conservation with the help of GPS, Remote Sensing and GIS.

The primary conservation objective is maintenance of all ecosystem components over time and over large areas to ensure the protection of all aspects of biodiversity (Noss and Cooperrider 1994). Conservation planning includes identification of conservation targets (e.g., species, communities, vegetation types), and their selection and design, and management of conservation areas. Increasingly, conservation-planning activities are focused on the problem of selecting networks of conservation areas that are representative of conservation targets in large regions (Margules and Pressey, 2000).

In case of the state of Orissa, the areas with rich biodiversity such as Chilika Sanctuary, Bhitarkanika National Park and Similipal Biosphere Reserve etc., comprising many endemic plant and animal species must be selected as conservation targets. Rapid economic development, urbanization and unfavourable human activities in these regions have posed tremendous threats to the biodiversity of these areas. Hence efforts on biodiversity conservation and sustainable development have been called for these areas. These efforts in turn call for the compilation of a comprehensive GIS database characterizing the spatial distribution of plants and animals as well as spatial distribution of various human activities.

Ministry of Environment and Forest, Government of Orissa, NGOs, Institutions, and Universities with the help of Orissa Remote Sensing Application Center, Geological Survey of India, and Forest Survey of India should have long-term goal to develop a comprehensive spatial database, to support research on biodiversity conservation and sustainable development using GIS.

Keywords: *GPS, Remote Sensing, GIS, Geoinformatics, Biodiversity, Conservation, Orissa.*

INTRODUCTION

The majority of vegetation and wild life in Indian sub-continent is mainly distributed in four distinct geographical zones. The regions are Himalayas, Vindhyans, Western Ghats and Eastern Ghats. Amongst them Easternghats (in the states of Orissa and Andhra Pradesh) possess a rich flora of flowering plants, gymnosperms and wild life with a high degree of endemics (of about 30%). According to Forest Survey of India Report (2001), Orissa has 27972 sq. km dense forest, 20866 sq. km open forest, and 5782 sq. km scrub forest spreading almost in all the 30 districts of the state. Total forest area of the state is about 30% of the total geographical area of Orissa. This area is a storehouse of biodiversity and natural habitat of wildlife. In addition, Mangrove forests covering 219 sq. km are found in Balasore (3 sq. km), Bhadrak (19 sq. km), Jagatsingpur (5 sq. km) and Kendrapara (192 sq. km) districts. However, overgrazing, excessive use of fuel wood, forest fire, shifting cultivation, deforestation for establishment of industries, landslide etc. are different causes of depletion of forest resources. It is estimated that deforestation is occurring at a rate of between 15-17 millions ha per

year and 5 to 10 percent of tropical forest species may face extinction within the next 30 years largely due to human induced land cover changes (Murthy, 2004). Moreover, indiscriminate use of pesticides, draining and filling of wet lands, destructive fishing practices, air and water pollution, and conversion of wild lands to agricultural and urban uses caused ecological imbalance and simultaneously drastically changed hydrological cycle and bio-geochemical cycles of the nature. Hence several initiatives must be worked out at global, national and state levels for assessing, preserving and sustaining the biodiversity of this state.

Now-a-days, Geoinformatics has made tremendous progress due to availability of reliable and authentic information through Remote Sensing and Global Positioning System (GPS) and information processing and data handling capabilities of Geographic Information Systems (GIS). GIS arose at the interface of earth science and information science. Their development includes various disciplines involved in the collection, storage, and analysis of spatial data such as geography, geology, cartography, computer science and remote sensing from the real world for a particular purpose. GIS synthesizes techniques and approaches from these disciplines, combines spatial and non-spatial data from different databases, and provides useful information for planning, management and decision-making through visual display and modelling. It has numerous applications. GIS software can map, explore, manage and examine the information about the environment. Subsequently new ecofriendly applications have been worked out by integrating GIS with other technologies. GIS has replaced a range of traditional information management and decision-making tools, and brought about tremendous economic and social benefits in such diverse fields as resource and environment management, agricultural product assessment, natural disaster control, design and management of traffic and communication systems, city planning, economic decision-making and trade. As a result, it has helped to improve the functioning of entire economies (Yan and Fellowes, 1996). The biodiversity conservation planning is no exception. Hence it can be certainly executed with perfection by the application of Remote Sensing and GIS. Such an innovative use of Geoinformatics to conserve biodiversity and species habitats is gaining recognition throughout the world. Therefore use of Geoinformatics for sustaining the rich biodiversity of the Orissa State must be accomplished.

REMOTE SENSING AND BIODIVERSITY CONSERVATION

At Global to local scales, the only feasible way to monitor the earth's surface to prioritize and assess the success of conservation efforts is through remote sensing. Currently a suite of remote sensing satellites having various resolutions are available to generate spatial information on vegetation and land cover from global to local level. The remote sensing based vegetation and land cover information provides a potential spatial framework and works as one of the vital input layer for the following (Murthy, 2004).

- Vegetation and land cover losses and conversion
- Stratification base for optimal ground sampling and assessment of diversity
- Fragmentation and neighbourhood analysis
- Delineation of broader vegetation types and analyzes species assemblages along with ancillary data.
- Identification of gregarious and ecological important species

- Inputs for species habitat models
- Spatial delineation of biological rich zones
- Developing conservation strategies

Therefore the satellite data of different spatial and temporal resolutions in generating inputs for assessing the biodiversity of Orissa State are need of the hour. There are different spatial and temporal resolutions. They are coarse resolution, high resolution and very high resolution remote sensing and are briefly described herewith.

Global datasets from coarse spatial resolution sensors have become more and more readily available. Use of satellite image data for mapping and monitoring global land cover, biomass durning, estimating geophysical and biophysical characteristics of terrain features, monitoring continental-scale climate shift is a primary input for biodiversity assessment. Rapid change in land use in tropical areas and the need to map changes in land use over large areas effectively calls for high to very high resolution satellite sensors applications. At the state level, IRS, Landsat or SPOT imagery can provide finer scale information on forest type distribution and agriculture expansion. Radar Systems such as JERS and Radarsat are not affected by clouds and are useful for determining the extent of forest and non-forest landscapes. Very high resolution data (1-m panchromatic and 3-m multi spectral) that are now available from the commercial IKNOS II satellite may be useful for determining the actual activities on the ground that have led to forest clearing (Murthy, 2004; Arino and Melinotte, 1995; Townsend et al., 1994; Pearson, 1993).

GPS AND ITS APPLICATION IN BIODIVERSITY CONSERVATION

The translation of the ground measured data into a spatial domain or linking with any other spatial or non-spatial parameters to analyze the relationships and understand the trends, precise locations and areas under consideration assume primary importance. In this regards Global Positioning Systems (GPS) provide powerful tools for acquiring accurate locations and areas. Currently available flora that provides valuable information about the species distribution pattern doesn't indicate specific locations. With the advent of availability of GPS, the recent Phytosociological surveys provided enormous information on species distribution with specific locations. Use of differential GPS survey will help in estimating the accurate area change, type and the kind of species alternation with pinpoint coordinates, demarcation of permanent plots and patches for temporal monitoring (Murthy, 2004).

Within local environments under the same climatic conditions the development of spatial variation in habitat quality in Chilika, Bhitarkanika, Similipal and other biodiversity rich areas of Orissa can be determined by the disturbance regime (such as fire, timber harvesting or wind), the physical environments (such as soil texture, fertility and nutrient status) and biotic factor or neighbourhood effects. GPS is effectively used in precise location and mapping of fire prone areas, logging, trampling, grazing etc., which are in turn used to develop potential disturbance surfaces and relate with habitat structure and function (Frelich and Reich, 1999; Murthy, 2004).

GIS- TOOL FOR BIODIVERSITY CONSERVATION

The integrated analysis of spatial data generated both from remote sensing and other sources becomes critical in order to generate information on several aspects of biodiversity viz., landscape processes, habitat evaluation, characterization of disturbance regimes, analysis of forest structure and function in spatial domain. However, GIS provides a powerful tool to undertake such integrated analysis. GIS plays important role in landscape analysis, species composition and habitat analysis, geostatistical analysis and spatial modeling etc.

Hence GIS database depicting the spatial distribution of natural resources is indispensable for biodiversity conservation and sustainable developmental activities. Such a GIS database certainly assists researchers to study and understand patterns of spatial distribution and interactions of plants and animals over landscape; and to evaluate the impacts of human activities on these spatial patterns, so that appropriate conservation/restoration strategies can be designed for any proposed area of this biodiversity rich state (Murthy, 2004; Ravan, 2001; 2002).

Many biologically diverse biomas and habitats are not amply safeguarded. They represent gaps in conservation programs, i.e. existence of unprotected biomas (rich in endangered species) among the protected biomes. To preserve long-term biodiversity, environmentalists must work out to fill as many of those gaps as possible by identifying and preserving imperative areas. Hence use of geographic information systems to protect biodiversity is called *gap analysis* because it attempts to identify gaps (Brokaw and Scheiner, 1989; Cochrane, 2000; Coops and Catling, 1997; 2002; Scott et al., 1993).

Chilika Sanctuary, Bhitarkanika National Park and Similipal Biosphere Reserve etc. are areas of high biodiversity in our state, Orissa. According to Forest Survey of India, dense forest, open forest, scrub forest and mangrove forest spread over about 54000 sq. km. in Orissa. They all consist of many endemic plant and animal species. Rapid economic development, urbanization and unfavourable human activities on these regions have posed tremendous threats to the biodiversity of these areas. Hence efforts on biodiversity conservation and sustainable development have been called for. These efforts in turn call for the compilation of a comprehensive GIS database characterizing the spatial distribution of plants and animals as well as spatial distribution of various human activities. Ministry of Environment and Forest, Government of Orissa, NGOs, Institutions, Universities with the help of Orissa Remote Sensing Application Center, Geological Survey of India, Forest Survey of India should have long-term goal to develop a comprehensive spatial database, to support research on biodiversity conservation and sustainable development using GIS (such as finding Gaps for conservation of plants and animal species), and to provide a GIS-based platform for policy making and for public participation in conserving biodiversity over these areas. The database includes data on topography, hydrology, climate, vegetation types, biodiversity (distributions of key plant and animal species) and current land use activities. This study obviously includes compilation and archiving of existing digital/analogue data (such as topographic data, socio-economic data, and field observations), development of techniques for characterizing the spatial distribution of soils, vegetation types, and techniques for predicting the distribution of specific plant and animal species (Ravan, 2001).

Biodiversity is receiving the attention of various academicians, scientists, administrators and decision-makers due to its importance as a natural reservoir with tremendous economic potential. Conservationists should focus attention on this fast depleting resource of this particular state, Orissa. At first, identification of most valuable biodiversity spots of Orissa containing non-timber forest species such as endangered flora, medicinal plants and wild varieties of cultivated crops should be worked out. While identifying such spots, it is also important to take into account the land use and human activities around the forest. Though a lot of information already exists; however, it is dispersed widely across the state among a large number of organizations. Moreover, some of it is not easily accessible or available in readily usable electronic form. Also, there are significant gaps in database in many areas. Hence, assessing biodiversity of mega-diversity state like Orissa is a herculean task. However it can be simply achieved with the availability of spatial analysis tool like GIS.

SYSTEMATIC STEPS FOR BIODIVERSITY CONSERVATION PROGRAMME

The Geoinformatics (Remote Sensing, GPS and GIS tool) can assist researchers and academicians in following tasks, which are essential steps for biodiversity conservation programme (Zhu et al., 2002; Ravan, 2002; Patrick et al., 2000; Poiani et al., 2000):

- Preparation of biome/ecological zone maps using satellite remote sensing data, incorporating topographical details and biogeographical classification of Orissa.
- Characterization of landscape to identify disturbance gradient and selection of priorities area (bioprospecting zones) of the state for biodiversity conservation.
- Customize of the software 'BIO-CAP' over Arc/Info GIS and its operation on different standardized databases. This software provides facilities for display, overlap, integration, analysis, statistics and modelling of landscape of the state.
- Study of the habitats that are endangered/endemic plant and animal species, and the scale effect on the characterization of these habitats.
- Study of the interaction of natural and human boundaries over the landscape and the study of the mechanics of landscape patterns, study of the land use, land cover change, study of the relationships between vegetation patterns and the environment in the context of biodiversity conservation and sustainable development.
- Estimation of the energetics, growth, and reproduction potentials of wild animals over landscape.
- Prediction of changes of plant/animal distributions over landscape due to climate changes and land use changes.
- As a result identification of areas of high productivity and high biodiversity of the state can be worked out.
- Development of data mining techniques for discovering knowledge on biodiversity and other environmental conditions.
- By gathering related data, a biodiversity inventory of the state should be compiled and documented.

Database on spatial and non-spatial information at various spatial scales such as bioclimatic maps, forest boundary, roads and rail settlements, digital elevation model, terrain complexity, species information database can be integrated into a single system in digital domain. Such a system will help in monitoring and assessment of biodiversity, identification of risk habitats and developing suitable conservation strategies. Government of Orissa should develop such a BIS (Biodiversity Information System) with an objective of collection and organization of the available but distributed spatial and non-spatial database into an interactive system. The components of the BIS are Biospatial, Biospec, PhytoSIS, FRIS and BioCon. Individually all these components focus on separate but related issues of biodiversity and forest resources management. All the components are scalable and upgradable (Murthy, 2004; Debinski and Humphrey, 1997; Wiens, 1989).

By the help of GIS tool, forest mapping and monitoring, Biomass and productivity estimation, landscape level assess, biodiversity characterization, wetland conservation planning, habitat suitability analysis, forest fire modeling and mitigation planning, Protected area networking and the eco-development planning (Ravan, 2002) in Orissa can be worked out in a better and easier way. GIS is undoubtedly a potential tool for biodiversity conservation by mapping disturbance zones in natural ecosystem and quantifying its impact on the biodiversity and biomass accumulation along the disturbance gradient (Csuti et al., 1997; Flather et al., 1997; Hann et al., 1997; Church et al., 1996; Kiester et al., 1996; Austin and Margules, 1986). GIS was used in this study for quantifying patch sizes, shapes, porosity and patchiness of vegetation types (Pelissier and Goreaud, 2001; Gould, 2000). GIS was also used to extrapolate results of ground based estimations such as species richness, diversity index and biomass values (Ravan, 2001; 2002; Reynolds et al., 1997; Quigley and Arbelbide, 1997; Pressey et al., 1996; Reid et al., 1995; Pressey et al., 1993). The results of above studies will certainly assure the success in identifying bioprospecting zones for conservation prioritization at regional level by making use of GIS and remote sensing.

CONCLUSION

UNEP, UNESCO, Tata Energy Research Institute (TERI), Wildlife Institute of India, G.B. Pant Institute of Himalayan Environment and Development, Centre for Ecological Sciences (Indian Institute of Science), Kerala Forest Research Institute, Gujrat Institute of Desert Ecology, French Institute of Pondichery, Ministry of Environment and Forest, Department of Biotechnology and Department of Space of Government of India, Forest Survey of India, Geological Survey of India, Botanical Survey of India and NGO sectors such as World Wide Fund for Nature-India (WWF-India) have stepped in the biodiversity conservation efforts using GIS in many parts of India. Government of Orissa with the help of such NGOs and institutions should initiate such conservation programme in our state. Administration and public should put hands together to save biodiversity, the most valuable resource of the state. In addition, baseline database on important national parks and sanctuaries of our state should be developed. The attempts must be taken to link taxonomic details of rare and endangered species to GIS database. The huge amount of databases being generated by various organizations needs to be structured for evolving Biodiversity Information System (BIS). Such information system is the scientific tool

for the conservationists to perform better in the area of forest and wildlife management and biodiversity conservation.

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"THE NAVARATNAS"- A GEMMOLOGICAL APPROACH

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ABSTRACT

Gems are pure and tangible concentrates of value, which never lose their appeal, whether as ornamental objects, a collector's items or simply an investment. At one time, they were believed to be of celestial origin endowed with mysterious and miraculous powers and brought luck to those born under the sign of zodiac with which they were associated. Vestiges of such belief still persist in the new millennium.

Gemstones play a very important role in the fields of parasciences such as Astrology, Palmistry, Astro-palmistry, Gem therapy, Cosmic ray therapy, Medical astrology, Astro medical gemmology, Vastu and Fengsui.Astrologers Numerologists and, Palmists usually recommend gemstones to their clients, most of whom are novice to the subject and depend mainly on hearsay. Hence there is a need for the gemmological approach to the Navaratna and their identification for the benefit of the common man. In Hindu astrology the Nine Gems or Navaratna governing the corresponding major planets are ***Diamond for Venus, Ruby for Sun, Red coral for Mars, Pearl for Moon, Yellow sapphire for Jupiter, Blue sapphire for Saturn, Emerald for Mercury, Hessonite for Rahu, and Cat's eye for Ketu****. All these stones belong to the Mineral Kingdom of both organic and inorganic origin.*

With advancement of science and technology the global gem market is flooded with various types of simulants, which may be natural, or man made having a superficial resemblance to the gemstone it imitates. These simulants, which may or may not have the same physical, chemical and optical properties as their natural counter parts are used to simulate the more costly gemstones in the gem market. Basing on the observation in the Gem Testing Laboratory of the Directorate of Geology, Orissa, the common simulants encountered for the nine gems are as follows.

- *DIAMOND– Cubic zirconia, Moissanite, Glass, White topaz, Quartz, Synthetic & natural White sapphire.*
- *RUBY—Glass, Synthetic ruby, Natural & synthetic pink sapphire, Rubelite(pink tourmaline) , Pink corundum, Dyed corundum, Synthetic cubic zirconia, Pink spinel, Rhodolite garnet, Dyed crackled quartz, Dyed hessonite, Pink topaz, Kunzite,(pink spodumene) etc.*
- *RED CORAL—Glass, Jasper, Dyed coral & Shell*
- *PEARL—Plastic & glass beads.*
- *YELLOW SAPPHIRE—Yellow topaz, Citrine, Hessonite garnet, Apatite, Heliodor, Synthetic cubic zirconia, Synthetic yellow sapphire.*
- *BLUE SAPPHIRE—Synthetic blue sapphire, Blue spinel, Indicolite(blue tourmaline) Kyanite, Iolite, Blue corundum, Glass etc.*
- *EMERALD—Fluorite, Onyx, Dyed crackled quartz, Aventurine quartz, Heddenite (green spodumene), Green beryl, Green tourmaline, Peridote, Synthetic emerald, Composite stones etc.*
- *HESSONITE—Almandine garnet, Glass & brown tourmaline.*
- *CAT'S EYE (CHRYSOBERYL CAT'S EYE)—Quartz cat's eye, Apatite cat's eye, Jadite cat's eye, Nephrite cat's eye, Sillimanite cat;s eye & Synthetic cat's eye.*

Key word: Gems, Zodiac Sign, Navratna

INTRODUCTION

Gems are pure and tangible concentrates of value, which never lose their appeal, whether as ornamental objects, a collector's items or simply an investment. At one time, these were believed to be of celestial origin endowed with mysterious powers and brought luck to those born under the sign of zodiac with which they were associated. Vestiges of such belief still persist in the new millennium.

Gemstones play a very important role in the fields of parasciences such as Astrology, Palmistry, Astro-palmistry, Gem therapy, Cosmic ray therapy, Medical Astrology, Vaastu and Feng Shui. Astrologers, Numerologists, Palmists usually recommend gemstones to their clients, most of whom are novice to the subject and depend mainly on hearsay. Hence, there is a need for the gemological approach to the "NAVARATNAS" and their identification for the benefit of the common man.

In Hindu astrology the Nine gems or Navaratnas governing the corresponding major planets and stars are Diamond for Venus, Ruby for Sun, Red coral for Mars, Pearl for moon, Yellow Sapphire for Jupiter, Blue sapphire for Saturn, Emerald for Mercury, Hessonite for Rahu and Cat's eye for Ketu. All these stones belong to the mineral kingdom of both organic and inorganic origin.

With advancement of Science & Technology the global gem market is flooded with various types of simulants that may be natural or man-made having a superficial resemblance to the gemstone it imitates. These simulants, which may or may not have the same physical, chemical or optical properties are used to simulate the more costly gemstones in the gem market.

TABLE-1

The Navaratnas and the planets that they govern:-

Sl. No.	PLANETS	GEMSTONES	INDIAN NAMES
1.	Venus(Shukra)	Diamond	Heera
2.	Sun(Surya)	Ruby	Maneek
3.	Saturn(Sani)	Blue Sapphire	Neelam
4.	Jupiter(Guru or Bruhaspati)	Yellow Sapphire	Pokhraj
5.	Mercury(Budha)	Emerald	Panna
6.	Ketu	Chrysoberyl, Cat's Eye	Lasuniya or Vaidurya
7.	Rahu	Hessonite Garnet	Gomed
8.	Moon(Chandra)	Pearl	Moti
9.	Mars(Mangal)	Red Coral	Prabal or Moonga

DIAMOND

GEMMOLOGICAL PROPERTIES: -

Diamond is crystalline carbon, akin in chemistry to graphite, which is one of the softest minerals. It crystallizes in cubic system. Hardness-10. Specific gravity-3.52. Colour- colourless, yellow, blue, brown, pink, orange, green. Lustre-adamantine. Dispersion- very high, fluoresces under ultraviolet light and has remarkable thermal conductivity. The characteristic absorption line is at 5040 A^{o}. Microscopic study reveals various mineral inclusions, fracture feather and bearding etc.

SIMULANTS: -

The most common natural simulants for diamond are colourless quartz, topaz, white sapphire and zircon, all of which can be distinguished from diamond by virtue of their double refraction. With the exception of zircon it is possible to identify all of these stones by means of a simple refractometer reading. Zircon can be distinguished by its higher specific gravity, characteristic absorption line and birefringence.

Among the synthetics strontium titanate, synthetic rutile, YAG, G.G.G, Cubic zirconia, moissanite are important.

- Strontium titanate or fabulite has much higher dispersion than diamond, with striking iridescence, low hardness, considerable brittleness and density.
- YAG- (Ytrium Aluminium Garnet) that has a slight lower refractive index than diamond, a hardness of less than 9 and greater density.
- GGG (Gadolinium Gallium Garnet) which has a fairly low hardness and double the density of diamond.
- CZ (Cubic Zirconia) which has a density much greater than diamond and lower hardness.
- Moissanite (SiC) is the latest and the closest simulant of diamond in the market today to challenge the wits of stone dealers, jewelers and gemmologists with its properties closer to those of diamond. When diamond can be separated from all its simulants by thermal conductivity test, moisanite cannot. Only its double refraction and C3/Moissanite tester can distinguish it.

RUBY, SAPPHIRE & YELLOW SAPPHIRE

Out of the Nine, three of the Navaratnas ruby, sapphire and yellow sapphire belong to corundum family having most of the physical and optical properties similar. As per Hindu Astrology ruby corresponds to Sun, the soul of will power, courage, creativity, one's sense of uniqueness and authority. Blue sapphire corresponds to Saturn which represents wisdom, true understanding of the virtues of patience, hard work, tradition and self-discipline. On the other hand, the yellow sapphire representing Jupiter brings knowledge, intellect, education, religious faith, wisdom, philosophy, morality, exploration, spiritual and material prosperity to the wearer.

GEMMOLOGICAL PROPERTIES:-

These three gemstones crystallize in trigonal system, chemical composition is Aluminium oxide. The colouring transition elements for ruby, blue sapphire and yellow sapphire are chromium, titanium-iron and iron respectively. Hardness is 9, Sp. gr. ranges from 3.98 to 4.02. These are doubly refractive having R.I-.1.76 to 1.77, birefringence 0.008, weak to moderate pleochroism. Absorption spectrum for ruby is very characteristic with a doublet at 6935 A°. For Blue sapphire absorption lines are at 4500 A°

and 4610 A°. In case of yellow sapphire absorption is not prominent. Under ultraviolet fluorescence test ruby generally appear medium orangish red in colour while blue and yellow sapphire are generally inert.

In all the natural corundum, inclusions like rutile silk (three directional), hexagonal colour zoning, partings, zircon halos, fluid feathers and mineral inclusions are observed under microscope.

SIMULANTS: -

- **Red spinel: -** The most common natural simulant for ruby is red spinel, the trade name being Naram manik because of its low hardness compared to ruby. It can easily be differentiated by its single refraction, RI- 1.71, Sp.gr-3.50 to 3.60.
- **Rhodolite Garnet:** - It is separated from ruby by its single refraction and characteristic spectrum at 5050 A°, 5270 A°, & 5760 A°.
- **Kunzite:** - The purplish red colour Spodumene is differentiated from ruby by its low hardness (6-7), Sp.gr-3.22 & R.I-1.666 to 1.67.
- **Rubellite:** - The pink tourmaline, though resembles ruby has Sp. gr. 3.02, R.I-1.62 to 1.64 and strong pleochroism.

The common natural simulants for blue sapphire are iolite, kyanite, indicolite & blue spinel etc.

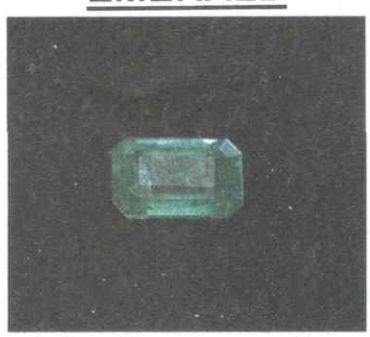
- **Iolite:** - Iolite popularly known as 'Kakanila' has a strong resemblance with sapphire but differs in having low hardness, strong pleochroism, low Sp. gr. (2.58 to 2.60) & R.I-1.53 to 1.54.
- **Kyanite:** - It can be detected easily by its Sp.gr.-3.60 to 3.62 and R.I-1.71 to 1.73.
- **Indicoloite:** - The blue colour tourmaline differs from sapphire in showing strong pleochroism, Sp.Gr.-3.01 & R.I-1.62 to 1.64.
- **Blue Spinel: - It** can easily be differentiated being a SR stone and having Sp.gr.. -3.6, R.I-1.71.

Yellow sapphire is widely simulated by citrine, yellow topaz, hessonite & cubic zirconia.

- **Citrine:** - It can easily be distinguished by its low hardness (7), Sp.gr.-3.5 & R.I-1.54 to 1.55.

- **Yellow Topaz:** - It can be distinguished by its Sp.gr.3.5 & R.I-1.61 to 1.62.
- **Hessonite Garnet:** - A light yellow colour garnet resembling yellow sapphire is differentiated by its single refraction, Sp.gr.-3.6 & R.I-1.74.
- **Glass Paste:** - It is a common simulant for all the three ratnas but are singly refractive having low hardness, R.I and typical inclusions like gas bubbles & swirls markings.
- **Cubic Zirconia:** - Most wide spread simulant for ruby, blue sapphire & yellow sapphire is the synthetic cubic zirconia which has a very high Sp.gr. (5.6 to 6.0) and strong dispersion, generally free of inclusion or have gas bubbles.

EMERALD



It is the most important gem varieties of beryl group. From astrological point of view it is used for the planet mercury and brings power of wisdom and knowledge to the wearer.

GEMMOLOGICAL PROPERTIES

It crystallizes in hexagonal system; chemical composition is beryllium aluminium silicate. The soothing velvety green colour is on account of chromium impurity. Flawless stones are extremely rare and most specimens are marred by flaws and inclusions which greatly reduce their transparency. These are doubly refractive stones with refractive index 1.575 to 1.585 and birefringence of 0.006. Emerald shows distinct pleochroism, remains inert to ultraviolet fluroscence and shows characteristic chromium absorption band at 6800 & 6830 A^{o} which differentiate emerald from other green beryl coloured by iron and vanadium.

SIMULANTS

Most common among the natural simulants are Apatite, Hiddenite, Flourite, Green tourmaline, Dyed crackled quartz, Onyx and Aventurine quartz that can be differentiated by the following characters.

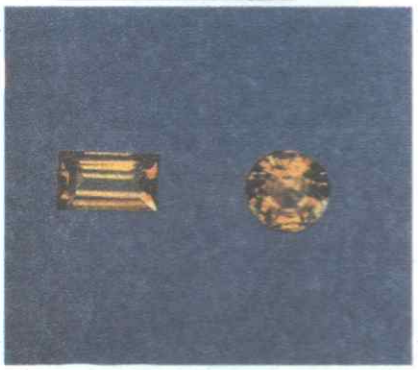
- **Fluorite:** - Can easily be separated by its single refraction, R.I-1.43 and strong fluorescence under ultraviolet light.
- **Apatite**: - It has Sp.gr.-3.18, R.I-1.63 to 1.64 and typical spectrum at 5780,5840 A^{o}.
- **Hiddenite**: -(Lithium aluminium silicate) Pale green to bluish green colour having Sp.gr.-3.17 to 3.19, perfect cleavage, R.I-1.66 to 1.67, needlelike inclusion, fibrous form and orange yellow glow in ultra violet light.
- **Green Tourmaline:** - It is strongly pleochroic having a higher Sp.gr. (3.05) and R.I (1.62 to 1.64) compared to emerald.
- **Onyx:** - It differs from emerald by its crypto crystalline nature, lower Sp. gr. and R.I-1.54 to 1.55.
- **Aventurine Quartz:** - Having Sp.gr. close to emerald but R.I-1.53 to 1.54 and glittering effect due to inclusion of fuchsite mica.
- **Dyed Crackled Quartz:** -Quartz having a network of fine cracks with green colour concentration.

differs from emerald in having Sp.gr.-2.65 and R.I-1.54 to 1.55.

- **Composite Stones**: - These may be two quartz pieces glued back together with green resin or small piece of emerald with green beryl etc.

Among the synthetics glass imitations are common.

HESSONITE



It is also called Grossularite or Gooseberry garnet a calcium aluminium garnet that sometimes resembles the gooseberry fruit. Astrologically it represents the planet Rahu(Dragon's head) which corresponds to secret services, spying, espionage, secret underhead dealings, religious and spiritual learnings.

GEMMOLOGICAL PROPERTIES

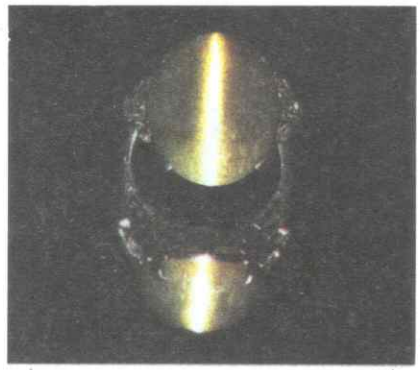
Hessonite crystallizes in cubic system. Colour is honey yellow, light yellow to brownish yellow. Hardness is 6-7; Sp.gr. varies from 3.65 to 3.70. It is single refractive with R.I ranging from 1.73 to 1.76. This has a greasy lustre, and fused appearance, remains inert to ultraviolet light. No characteristic absorption is seen. Microscopic study reveals clusters of tiny crystals & clouds of mineral dusts.

SIMULANTS: -

- **Almandine Garnet:** - The common natural simulant is brown coloured almandine garnet that has the typical three bands of spectrum at 5050, 5270, & 5760 A^{o}. Other characters being same as hessonite garnet.

Among the synthetic, glass is the common imitations, characterized by low hardness, Sp.gr. and R.I.

CAT'S EYE



This is the name given to yellow, yellowish green or grayish green variety of chrysoberyl which displays the phenomenon of chatoyancy because of the inclusion of numerous fine, parallel crystal needles. Due to its value and hardness, it is also known as "Noble Cat's eye". From Astrological point of view it corresponds to the shadow planet, Ketu. It saves its wearer from the bad effects of accidents, unexpected diseases, and financial losses and business cheatings.

GEMMOLOGICAL PROPERTIES :-

Cat's eye crystallizes in orthorhombic system. The chemical composition is berrylium aluminium oxide. Hardness is 8-9, Specific Gravity – 3.71, Refractive index- 1.747 to 1.750 & lustre is vitreous. Under spectroscope a broad absorption band is seen around 4440 A^{o}.

SIMULANTS: -

There are a number of low priced natural stones simulating Cat's eye.

- **Quartz Cat's eye-** the stone has hardness 7, Sp. gr.-2.65 & R.I-1.54 to 1.55.
- **Apatite Cat's eye-** It can be identified by its low hardness (5), Sp.gr.-3.18 & R.I-1.63 to 1.64.
- **Nephrite Cat's eye-**Though these stones have a close resemblance with cat's eye;they have Sp.gr.-2.95 & R.I-1.62 and fibrous mineral inclusions.
- **Synthetic** – A fibre optic glass showing sharp. Cat's eye is readily identified under microscope by its honeycomb structure, low Sp.gr. & R.I.

PEARL

Pearl popularly known as Mukta in Sanskrit and Moti in Hindi is among the highly priced organic gems. Despite its low hardness and chemically reactive nature, Astrologically it corresponds to the cool planet, moon which is essentially considered to the mind and the intellect of the individual.

GEMMOLOGICAL PROPERTIES :-

The chemical composition is calcium carbonate. These are globular, sometimes pear, egg or bean shaped or display more pronounced irregularities consisting of protuberances. Pearls have a hardness of 3-4, Sp.Gr.-2.7, show strong glow under ultraviolet light, have a pearly lustre , sometimes with iridescences colour and concentric growth structures. Colour is silvery white, light pink, often with faint tints of blue, brown etc.

IMITATION :-

- **Glass and plastic beads: -** Glass spheres, mother of pearl spheres and hollow glass spheres filled with wax are given a lusturous outer coating by dipping them in a preparation called assenced orient, which is a paste made from the scales of a fish. These can be detected by inspecting the edges of the drill hole.
- **Shell:**
  Though they have a resemblance with pearl, effervesces with dilute HCl, can be separated from pearl by their flame like structure on the surface and higher specific gravity.

RED CORAL

An organic gem that has been used since antiquity as an ornamental material comes from the calcareous skeletons of the colonies of marine organisms, Corallium rubrum. It is used for Mars, a firey planet of brown red colour.

Astrologically it gives courage and self-confidence to the wearer, removes all types of fear and purifies blood. It also brings victory over enemies, increases stamina of body and will power of the mind.

GEMMOLOGICAL PROPERTIES

The main constituent calcite crystallses in trigonal system. Hardness is 3-4, Sp gr varies from 2.6 to 2.7. Two distinctive features for identifying corals are the organic structures like wavy parallel fibrous structures and strong effervescence on contact with a drop of hydrochloric acid.

SIMULANTS:-

- **Glass paste**: These have longitudinal striations similar to those of coral, but do not react with HCl and very often have air bubbles.
- **Jasper:** Though have a resemblance with coral does not effervesce with acid.
- **Synthetic coral**: It consists mainly of calcite, so react with hydrochloric acid as natural coral but has low specific gravity and show an uniform striations as compared to natural ones.

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PROSPECTS OF TITANIUM MINERAL INDUSTRY IN ORISSA

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ABSTRACT

Coastal strech of peninsular India has rich potential of beach sand minerals consisting of ilmenite, sillimanite, garnet monazite etc. Three major proved deposits so far are located at Chhatrapur Rushikulya, South of Gopalpur and north of Rushikulya river, of orissa . the deposit around chhatrapur is being worked by Orissa Sand Complex (OSCOM) of Indian Rare Earths (Limited). Besides mining of beach sand the plant processed to recover various heavy minerals associated. Ilmenite is found to be the major one. So far no metallurgical industry for titanium has been established while there as scope for value addition, to ilmenite. There are two processes already developed for this i.e titanium slap process established in South Africa and Heubach process developed at Ankleswar Gujrat in pilot plant scale. While the former is well established, it being power intensive may not be ideally suitable for high cost of power. The later process can easily be attempted with the availability of infrastructure Orissa has advantages for future development of titanium industry in the state.

Key Word:Coastal Stretch, OSCOM, Ilmenite

1. INTRODUCTION

Large reserves of strategic and economically important heavy minerals such as Ilmenite, rutile, leucoxene, zircon, monazite, garnet sillimanite are mostly located in the costal streches of peninsular India except a few in land placer deposits like terisand deposits of Tamilnadu & Ranchi – Purulia riverine placer of Bihar & West Bengal. Ilmenite is the largest constituent of Indian beach sand deposits, followed by sillimanite and garnet.

India accounts for about 16% of world reserves of ilmenite out of which beach sand deposits are considered to be highly potential for future growth of titanium industry. In this context the beach sand deposits of coastal Orissa draws attentions.

2. GEOLOGICAL FORMATION,

The formation, accumulation and concentration of heavy minerals on the beaches of interior coastal region are the result of the following continuous process.

- Deep weathering action of the rocks due to tropical / sub tropical climate.
- Well developed river system.
- Long shore currents, waves and tides.

Due to deep weathering action on the rocks as a result of tropical climate, minerals are liberated from the parent rock. As the unstable silicate minerals are first weathered and removed, the

stable and resistant minerals like ilmenite , rutile, zircon, monazite, sillimanite and garnet get enriched. The well developed river system transports these heavy minerals to the coast. The coastal geomorphology, consisting of bays, barrier beaches & sea cliffs, act as a suitable location for accumulation of the minerals. The long shore currents play a major role in transporting these minerals to the above mentioned lacales. The waves and tides facilitate further concentration of these on the beaches. The details of reserves of ilmenite and other associated heavy mineral in India is in table – 1.

Table – 1

RESERVES OF ILMENITE AND OTHER ASSOCIATED HEAVY MINERALS IN INDIA

ZONE	STATE	** Reserve in Million Tonnes					
		Limonite	Rutile	Zircon	Monazite	Garnet	Sillimanite
Eastern	Orissa & AP	111*	3.98	4.93	2.64	63.91	51.25
Tamilnadu	Tamilnadu	87	4.46	7.63	1.34	21.52	18.78
Kerala	Kerala	75	4.85	5.22	1.13	0.97	12.09
Others	Maharastra, Bihar, & Bengal	5	0.20	0.47	1.44	---	1.74

- Ilmenite reserves of Andhra Pradesh 73 milion tones and Orissa 38 million tones.

- Geoligical / Insitu reserves, Mineable reserves are 30% less due to various losses such as mining loss (10%), processing loss (5%) and areas not actually available for mining due to socio-economic legal conditions (15%).

3. DEPOSITS OF ORISSA STATE

The major deposits situated in the southern coast of Orissa are as follows:

SL.No.	Name of the sector	Ilmenite Resources Million tonnes
1.	OSCOM (Rushikulya – Gopalpur)	20
2.	North of Rushikulya (Bajarkot-Palur-Rushikulya)	10
3.	South of Gopalpur	8

Orissa Sands Complex of Indian Rare Earths ltd. located at Chatrapur is the only mine in operation. IREL is holding mining lease for the operation of the unit, but there are more areas within the lease area yet to be exploited. The preliminary survey of these deposits are available. The average heavy mineral content in the lease areas of IREL varies from 20% - 25% and in other areas, from 12% -14%. Industrial Development Corporation of Orissa Ltd (IDC) is having two mining leases in north of Rushikulya and south of Gopalpur. These deposits have been proved to be economically rich deposits. There are proposals by few private enter preneurs to develop mine and establish processing plants to recover heavy minerals for further value additions along with titanium industries.

The composition of heavy minerals in the mining areas are as follows:-

	OSCOM Deposit	Deposit North of Rushikulya
Ilmenite	9%	5.5%
Garnet	6%	3.5%
Sillimanite	3.8%	2.2%
Rutile	0.4%	0.25%
Zircon	0.5%	0.32%
Monazite	0.3%	0.18%

4. MINING OPERATION (Dredge & wet concentrator plant)

The raw sand deposit along the coast varies a few meters to 15 meters from the surface to the water table. It is in the form of sand dunes and the concentration of heavy minerals is highest in the surface. The concentration gradually decreases with the increase of depth and becomes uneconomic to mine at a variable depth below mean sea level. The average heavy mineral content is 20 %, having the following composition.

Ilmenite	-	9%
Garnet	-	6%
Sillimanite	-	3.8%
Rutile	-	0.4%
Zircon		0.5%
Monazite	-	0.3%

The mining plant comprises of dredge unit, the surge bin and the concentrator unit. The floating units are interconnected with one another by flexible hinged joints. All these units float in a pond which is artificially created by excavating at a suitable location. As the dredge advances in a predetermined dredge path, the dredge pond gradually moves in the direction of cutting.

The cutter-ladder is mounted on the front part of the dredge hull and is lowered or raised hydraulically to allow the cutter to cut at any desired depth under the water. A high capacity dredge pump mounted on the dredge pontoon sucks the slurry mixture and pumps the same through a long pipe to the processing plant for separation of heavy minerals.

The dredged material is pumped to a surge bin unit which consists of a trammel screen. The dredged material contains lots of foreign materials like grass, roots, pebbles, stones etc. which are to be removed from the slurry before actual separation takes place. The trammel screen removes all these unwanted materials and allows only the desired size of minerals to the surge bin. The screened material is pumped to the concentrator unit for separation of the heavy mineral.

The concentrator unit consists of various equipments like pumps, spiral concentrators and tanks of various capacities to collect materials of different spiral circuits. Most important equipment of the concentrator plant is the spiral concentrators. Spiral concentrators use the gravity separation technique for separation of the heavy minerals from the rest of the sand mixture. A number of stage separation are necessary to obtain the desired grade of the product with higher recovery of heavy minerals.

The concentrate produced is collected in a concentrate bin and can be either pumped in a from of slurry or transported in trucks to mineral separation plant which will be located a few kilometers away from the mining area.

5. MINERAL SEPARATION PLANT:

The mineral separation process comprises of the following:

- Mining of beach sand and concentration of the heavy minerals.
- Separation of individual minerals based on their physical properties.

The heavy mineral concentrate obtained from dredge and wet concentrator plant is fed to the concentrator up-gradation plant (CUP), which consists of several circuits of spirals and wet tables for further up-gradation of heavy minerals to 95 to 97%. Thereafter the CUP concentrate is fed to MSP for separation of individuals minerals. The separation individuals minerals is done based upon their physical properties. The heavy mineral concentrate mixture which is fed to MSP has the following composition.

Ilmenite - 65-68%
Rutile - 2.5-3%
Zircon - 2.5-3%
Monazite - 1.5-2%
Sillimanite - 8-12%
Garnet - 12-16%

The physical chemical properties of the above minerals are as follows:-

Sl. No.	Name of the minerals	Chemical Composition	Specific gravity	Electrical properties	Magnetic properties
1.	Ilmenite	FeO, TiO_2	4.68	Conducting	Strongly magnetic
2.	Rutile	TiO_2	4.25	Conducting	Non magnetic
3.	Zircon	ZrO_2 SiO_2	4.7	Non-conducting	Non magnetic
4.	Monazite	(Ce, Ls, Y, T) PO_4	5.25	Non-conducting	Feebly magnetic
5.	Sillimanite	$Al_2O_3SiO_2$	3.25	Non-conducting	Non magnetic
6.	Garnet	Al, Fe, Mg, $Al_2O_3(SiO_5)$	4.1	Non-conducting	Moderately magnetic

The major separation equipment consists of high tension separators, Electro plate separators, Electr-screen separators, induced roll magnetic separators, highly induced roll magnetic separators, lift roll magnetic separators, cross-belt magnetic separators, attritions, conditioners, froth floatation cells, spiral concentrators, wet tables, air-tables and hydrocyclones etc. In addition, a number of dryers are provided to dliminate in feed concentrate and products from wet separators and also to heat dry solids before hige tension separators.

6. VALUE ADDITION OF ILMENITE

The ilmenite available in Orissa deposit has lower Titanium Dioxide content compared to other deposits of Tamilnadu and Kerala. The TiO_2 content is 50% having FeO-34% and Fe_2 O_3-12%. The process technologies for benefication of ilmenite for conversion to Synthetic Rutile with TiO_2 content of 92%-95% and titanium slag of TiO_2 content of 80%-85% are available, but are to be technocommercially evaluated for low grade ilmenite occurring in Orissa coast.

Based on the available data on different process technologies, both proven and developmental stage and commercial considerations, the following are most favoured technology options for processing of low grade Ilmenite.

6.1 TITANIUM SLAG PROCESS

The basic process involves reduction and smelting of ilmenite with reductant coal at temperature of 1700^0c in an electric smelter. The titanium slag and pig iron are tapped from the furnace intermittently. In the Richard's bay of South Africa, the same process is customized to suit ilmenite with 50% TiO_2 content. In Tinfos, Norway, ilmenite containing 50% TiO_2 is reduced prior to smelting in are furnance. This is done to reduce the power consumption the arc furnace. The process does not generate any waste. The major impurity iron oxide in the Ore is recovered in a valuable form as pig iron. Although the process viability depends on cheap

power but with the increasing demand for quality pig iron and good market price, this process is one of the option for Orissa ilmenite for value addition.

6.2 REPTILE'96 PROCESS (HEUBACH)

In this process, ilmenite is chlorinated under controlled conditions at a temperature of about 10000c with petroleum coke and oxygen to produce synthetic Rutile with TiO_2 content of 96%. The iron oxides are converted to iron chlorides and recovered in condenser / separator. The entire amount of chlorine used in the main chlorinator is found in the recovered ferrous chloride which is stored in storage hopper. The key feature of the new process is burning of this ferrous chloride with oxygen. The resulting chlorine gas is recycled into the chlorinator and the ferric oxide is recovered as a by-product, which could be used in iron smelters.

This process has been developed in a pilot plant stage by M/s Heubach Colour (India) Ankleshwar (Gujurat) and trials have been undertaken for different grades of ilmenite. The results are very encouraging particularly for low grade ilmenite which are available in Orissa coast.

7. LOCATIONAL ADVANTAGE OF ORISSA

The following are advantages for locating titanium based industry near the mineral deposit area.

- The mining areas do not have much population and hence minimum problem on rehabilitation.

- National Highway NH-5 is passing near to the deposit area, excellent road communication.

- The seasonal port at Gopalpur is being converted to all weather port which will help in export of finished products.

- Already a railway link has been provided from nearest Chatrapur Railway Station upto Gopalpur port & IRE's plant and the same could be strengthened / modified to cater to the requirement of the new titanium based industries.

- Since the existing unit of IRE' is operating for the past 20 years, sufficient trained manpower will be available for the new industrial units.

8. CONCLUSION

The large reserves of beach sand in the southern coast of Orissa is yet to be fully exploited. The mining areas have been well developed with good infrastructure for setting up of titanium mineral based industries. With the initiatives taken by the State Government to boost industrialization in the State, it is quite likely that future investments will be in this sector. It needs positive attitude with the policy makers of the state government.

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STUDIES ON SOIL QUALITY OF SOUTH KALIAPANI CHROMITE MINES IN ORISSA

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ABSTRACT

South Kaliapani Chromite Mine is as opencast mine of Orissa Mining Corporation (OMC). Soil samples at different locations of South Kaliapani were tested in the Environmental Research Laboratory, Department of Zoology, Utkal University, Vanivihar. It was observed that the lateritic soil supports typical dry deciduous forest. The soil of buffer zone is better for agricultural activities than the core zone of mining activities. Soil in buffer zone does not show any adverse impact caused by mining activities.

INTRODUCTION

The term `soil' is derived from the latin word `solum' which means the earthly material on the upper most part of Earth's crust anchored. Soil is a mixture of organic and inorganic materials necessary for growth of plants which also provides support for all terrestrial organisms.

Life forms i.e nematodes, insects, rodents etc. live within the soil. Constituting of unconsolidated weathered and clay minerals soil is formed by genetic and environmental factors over million years. They serve as a reservoir of nutrients and water for crops and vegetation.

Orissa accounts for 98% of chromite resources and nearby 100% at chromite production in the country. Sukinda valley in Jajpur district in the major chromite bearing zone of the state which gives 90% of the chromite production in the state. The mines of this area are opencast where by surface excavation the soil profile is disturbed and the area is disfigured. Further , besides deforestation mining activity has adverse impact as fauna, habitation and ecological balance.

The present study covers analysis of physicochemical characterstics of the soil types in and around South Kaliapani chromite mines of Orissa Mining Corporation (OMC) in Sukinda area in order to assess the environmental degradation in soil.

METHODOLOGY

The study area has been broadly divided into two imaginary zones such as Core zone and Buffer zone. The Core zone, being the area where mining activities, waste dumping, beneficiation etc are carried out i.e., approximately 40 sq.km area, where as the Buffer zone falls within 10kms. radius of it. Soil samples from six locations covering both the zones were collected in the year 2005 with the help of Ekman's dredge in post monsoon season. Before sampling the soil, the places were cleaned from vegetation and scum as well as the upper peaty layer over the soil sediment was scrapped off. About 1kg. of soil

from each place was collected and transported to the laboratory in polythene bags. The soil samples were air dried and made into fine powder and were mixed to prepare 6 composite sampler. The coarse grains were sieved and powdered for chemical analysis. The following physicochemical analysis were made.

DISCUSSION

The colour of 3,4, and 5,6 mostly brown to brownish red has clayey sand to sandy loam texture. The reaction pH of the soil is usually neutral. The soil is porous with good water holding capacity. The organic matter, chromium and phosphorous content is high in planted old dump area and new dump area. However, the sediment collected from effluent discharge is not showing high chromium content.

The colour of Buffer zone(1,2) soil having reddish brown to blakish brown colour, texture is sandy loam to sand. The pH of the soil is neutral. The soil is porous with good water holding capacity. In agricultural land, organic matter and phosphorus is sufficient to favour good plant growth. In barren land organic matter is high but phosphorus is very less. The soil type is laterite which supports typical dry deciduous forests.

CONCLUSION

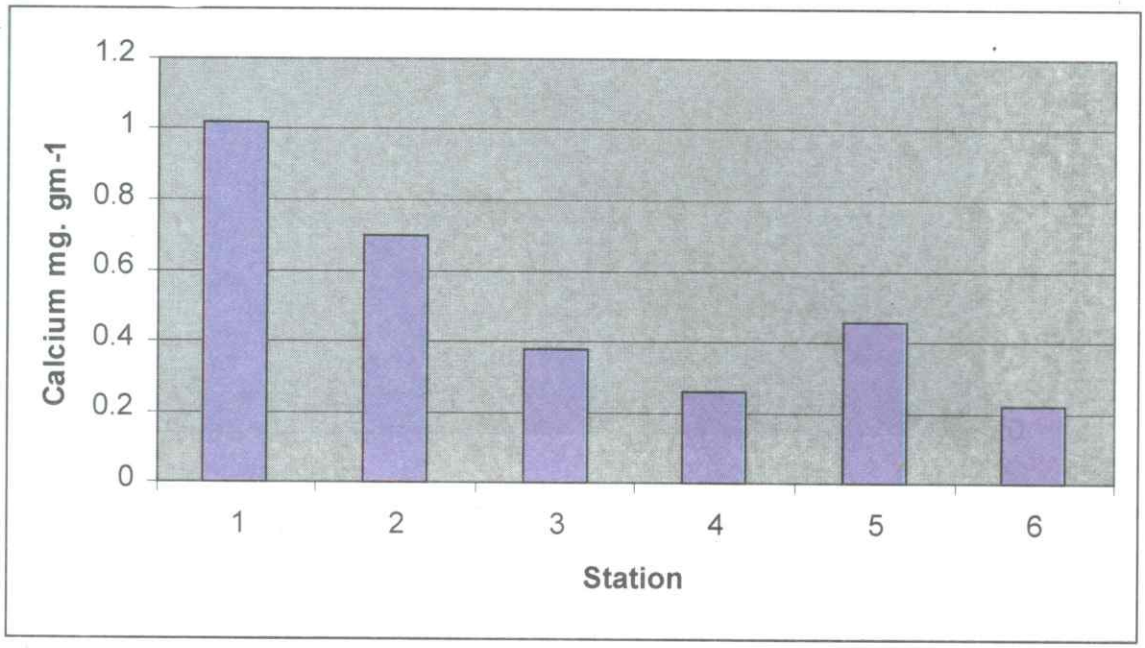
The analysis of this dissertation shows that the soil of buffer zone is better than Core zone for agricultural activities. There is a very less primitive and underdeveloped agricultural land within the Core zone because of topography. Previously the area's economy depended on rainfall and agriculture. In recent years with mining activities in the surrounding region, there has been diversification. Agricultural sector has improved with better standard of live of local people. However, the people of the area are still poor. The quality of Buffer zone soil does not shows any adverse impact of mining activities. However, this study further needs more attention and research to analyse environmental problems in this hot spot zone.

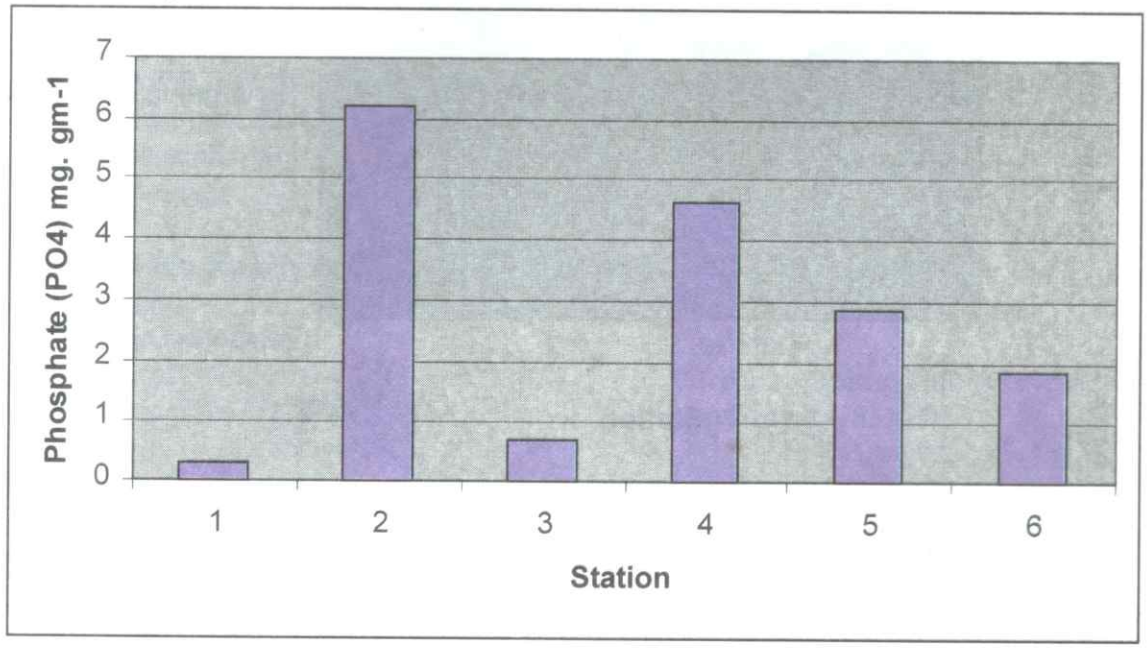
OBSERVATIONS

Soil Analysis Report of Sukinda Chromite Mines :

Stations location :
1. Southkaliapani, OMC : Barren land
2. Southkaliapani, OMC : Agricultural land
3. Southkaliapani, OMC : Old dump area
4. Southkaliapani, OMC : Mine discharge nalah
5. Southkaliapani, OMC : New dump area
6 . Southkaliapani, OMC : Damsal nalah sediments after mine discharge

Sl. No.	Location code/ characteristics	1	2	3	4	5	6
1.	Color	Reddish brown	Blakish brown	Brownish red	Brown	Brown	Brown
2.	Texture	Sandy lome	Sand	Sand	Sandy lome	Clayey lome	Sandy lome
3.	Moisuture contents (%)	6.7	22.1	4.3	14.3	8.1	17.6
4.	pH	7.25	7.21	7.46	7.26	8.82	7.60
5.	Waterholding capacity (5)	35.6	35.0	25.1	26.1	31.6	26.4
6.	Bulk density	1.37	1.12	1.63	1.77	1.47	1.68
7.	Porosity (%)	49.43	59.93	38.49	33.20	44.53	36.45
8.	Calcium mg. gm^{-1}	1.02	0.7	0.38	0.26	0.46	0.22
9.	Organic carbon (%)	2.33	2.78	1.22	1.52	1.56	0.26
10.	Organic matter (%)	4.03	4.81	2.12	2.62	2.70	0.46
11.	Phosphate (PO_4) mg. gm^{-1}	0.31	6.21	0.71	4.64	2.86	1.86
12.	Iron (Fe) mg. gm^{-1}	0.01	0.00	0.08	0.05	0.06	0.06
13.	Manganese (Mn) mg. gm^{-1}	34.40	44.70	18.90	1.02	0.06	0.55
14.	Chromium (Cr) mg. gm^{-1}	1.346	1.626	28.22	0.519	7.73	0.416
15.	Potassium (K) mg. gm^{-1}	0.10	0.072	0.035	0.020	0.021	0.018


1.2
1
0.8
0.6
0.4
0.2
0
Calcium mg. gm-1
1
2
3
4
5
6
Station


7
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Phosphate (PO4) mg. gm-1
1
2
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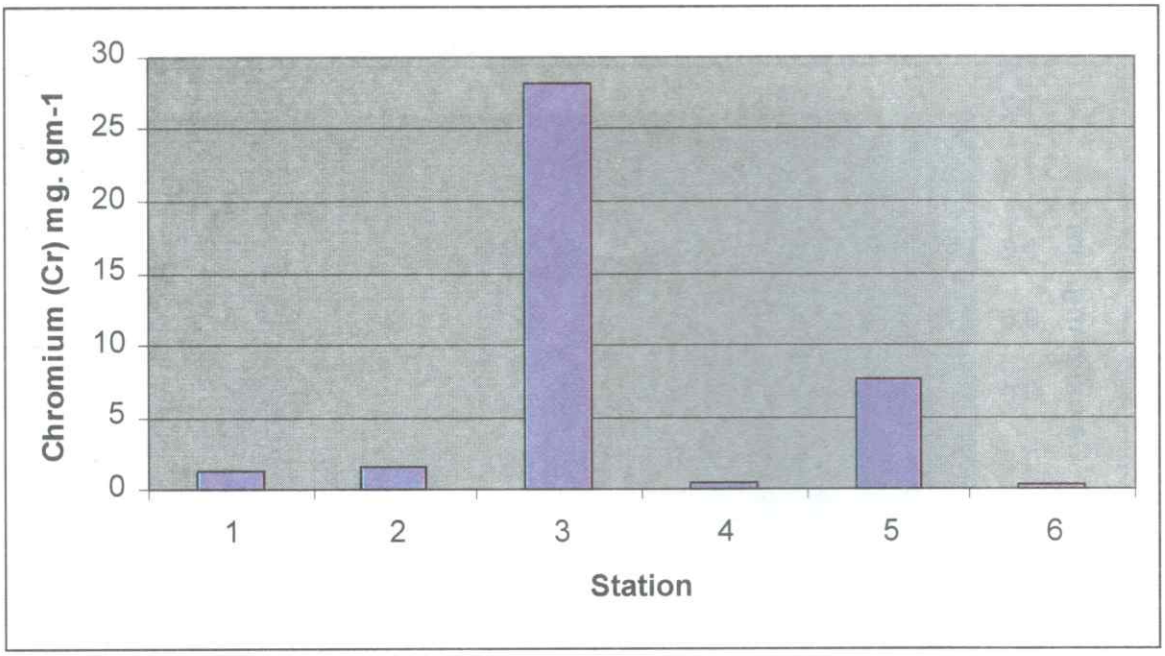
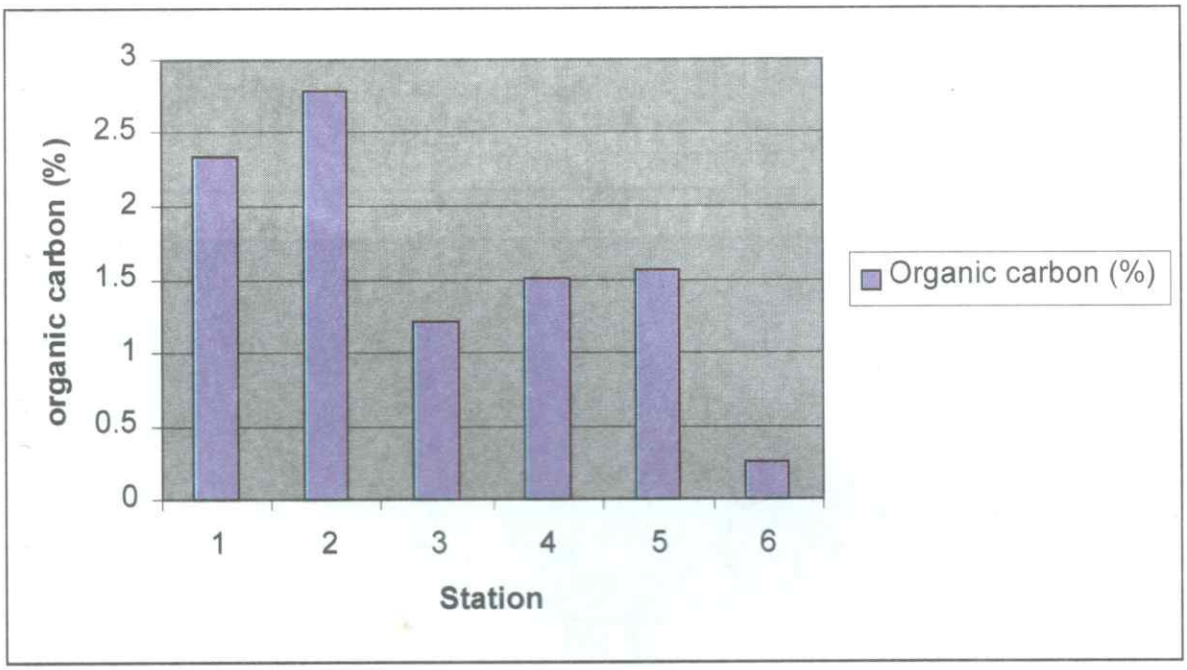
Station





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Nayak R.N., Mohapatra J.K., Patra

❖ New Members

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10 **Dr. Vinod Prasad Sinha**
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Corporate Centre, Mail Box -6-62
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❖ News About Members

- Dr. Ravi Narayan Bastia, a renouned geoscientist and member of the Society of Geoscientist and Allied Technologists, Bhubaneswar is nominated to receive the most prestigious award **"Padmashree"** in recognition to his scientific contributions in Oil Exploration, SGAT congratulate Dr. Bastia for his commendable achievement and wishes him all success in his life. Dr. Ravi Narayan Bastia is working at present as Senior Vice President (Exploration and Operations), Reliance Industries Ltd. at Mumbai.

- Dr M.M. Mukherjee, Dy. Director General (Retd.), Geological Survey of India and the Executive council member of SGAT has got this recognition of joining as visiting Professor in Dept. of Geology Bangal Engineering College. He is also a member of Exploration & Research Advisory Committee of Atmic Minerals Division, Govt. of India. He is also a member in Board of studies in Indian School of Mines, Dhanbad.

- Dr. S.K. Sarangi, General Secretary of SGAT has attended an International Conference on Mines 2006 at Lusaka, Zambia during 29th November to 2nd December 2006.

- Sri Santosh Kumar Misra, Former Deputy Director of Regional Research Laboratory (CSIR) and life member of SGAT, awarded the Degree of Doctor of Philosophy for the thesis **"Petrographic Investigations of Coal from Talcher Basin of Orissa, India"** in December 2006. He was working under the joint guidance of Prof. K.L. Pandya and Dr. R.K. Sahoo. SGAT congratulates him.

❖ SGAT News:

- Workshop in Reclamation, Resettlement and Rehabilitation (R,R&R) for Industry and Mining had been organized on 16th December'06 at Bhubaneswar. Padmabhusan Shri G.L. Tandon inagurated the Workshop More than one hundred participants representing various organization have deliberated on different aspects related to theme of the Workshop. A panel discussion by eminent scientists is followed after the deliberation. Shri Vivek Patnaik IAS (Retd.) delivered the valedictory address.

- SGAT conducted it's Annual General Body Meeting on 17th Decmber 2006 at Bhubaneswar. More than 100 members participated in this meeting and deliberated various issues of SGAT. General Secretary, Dr. S.K. Sarangi presented the annual report and Shri K.C. Pradhan, Treasurer presented the Balance sheet for the approval of members. Prof. Dr. Trilochan Pradhan, a reputed scientist delivered K.S. Mohapatra, Memorial Lecture on Nano Technology.

- SGAT had conducted the Final Mineral Development Quiz 2006 on 14 &15 October 2006 at Bhubaneswar, 22 students representing various institutions like Mining Engineering Dept. of IIT Kharagpur, NIT, Rourkela, Orissa school of Mining, Engineering, Geology/ Applied Geology Dept. of NIT, Rourkela, IIT, Kharagpur, Jadavpur University, Utkal University, Khalikote Autonoumus College and Metallugical and Materials Engineering, Dept. of IIT Kharagpur, NIT, Rourkela.have participated in the event, Participant of Calcutta University are adjudged as the winner.

- Zonal Events for Environment and Mineral Awareness Programme (EMAP)

2006 have been organized by SGAT. Final event is scheduled to be organized on 9-10 February 2007 at Bhubaneswar.

Book on Geology and Mineral Resources of Orissa

An updated and revised edition published by SGAT.

The book Released by Padmabhusan G.L. Tandon on 16th December 2006

The price of the book is Rs. 800/-. , 50 US$

Price of the Book for Member SGAT- Rs. 400/- , 25 US$
Each member of SGAT can purchase only one book on a concessional price Payment in favour of "**Society of Geoscientist and Allied Technologists**" payable at Bhubaneswar.

Contact: **General Secretary**
SGAT
267, Kharavel Nagar
Bhubaneswar-751001
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Tel: 91-674 2392080, 2390516.
Tel Fax: 91-674 2390687

Society of Geoscientists and Allied Technologists (SGAT)
jointly with
International History of Mining Congress, Australia
shall be organizing an
International Seminar on Mining History
during 13-16, December 2007 at Bhubaneswar.

THEME:

The proposed topics include:

A.	**Mining Technology & Engineering History**
	Geology & Mines Education Prospecting & Exploration
B.	**Mining & Sustainable Development**
	Mining & Mineral Processing Technologies
	Smelting & Refining
	Mine Safety & Health
	Environmental protection & reclamation
C.	**Mineral Legislation**
	National Mineral Policy
	State Mineral Policy
	Rehabilitation Policy
D.	**Industrial & Business History**
E.	**Socio-cultural History**
	Industrial Relation, Mining Communities, Migration
F.	**Archiving the Mining History & Heritage**

Call for Papers

- Submission of Abstract –15 May 2007.
- Acceptance of Abstract - 30 June 2007
- Submission of Full Paper - 30 October 2007

while the author(s) prepare(s) them. Use of 10 points Time New Roman/Arial Font for table is recommended.

References :

(a) References in the text should be with the name of the author(s) followed by the year of publication in parenthesis, i.e. Patnaik (1996); Patnaik & Mishra (2002); Nayak et al. (2001)

(b) Reference list at the end of the manuscript should be in alphabetical order, in the following format: Sehgal, R.K. and Nanda, A.C.(2002) Paleoenvironment and paleoecology of the lower and middle Siwalik sub-groups of a part of North-western Himalayas. Jr. Geol. Soc. Ind, vol. 59, pp. 517-529

(c) Articles from the books should follow the format given below:Windley, B.F. and Razakamanana, T. (1996) The Madagascar – India connection in a Gondwana framework. In:Santosh, M. and Yoshida, M. Eds.) The Archaean and Proterozoic terrains of South India within East Gondwana. Gond. Res. Group Mem. No.3, Field Sci. Publ., OSAKA, pp. 25-37

(d) Books should be referred to as:Sengupta, S.M. (1994) Introduction to Sedimentology. Oxford and IBH Publ. Co. Pvt. Ltd., New Delhi, 314 pp.

Submission of manuscript

Manuscripts strictly confirming to the above format should be mailed directly to Editor in his mailing address available in the bulletin. Manuscripts not conforming to the format of the journal will be returned.

All the manuscripts conforming to the standard format of the bulletin will be reviewed by specialist referees before publication.

Printed, edited and published at Bhubaneswar by Dr. S.K. Sarangi, General Secretary for and on behalf of the Society of Geoscientists and Allied Technologists (SGAT), 267, Kharavela Nagar, Bhubaneswar – 751 001. Printed at Reproprint (P) Ltd., N-5/49, IRC Village, Bhubaneswar – 751 015.

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SPECIAL ISSUES

1. SUMMARY OF PROCEEDINGS AND CONCLUSIONS of "Workshop on Industry and Mining Reclamation, Resettlement and Rehabilitation (R,R & R)" held on 16 December 2006 at Bhubaneswar

2. REPORT OF PROCEEDINGS, EMAP (2006-07), State Level Environment cum Mineral Awareness Programme (EMAP) held on 9 & 10 February 2007 at Bhubaneswar.

3. VIEWS OF THE SOCIETY OF GEOSCIENTISTS & ALLIED TECHNOLOGISTS (SGAT) ON "RECOMMENDATIONS OF THE HIGH LEVEL COMMITTEE TO REVIEW THE NATIONAL MINERAL POLICY AND TO RECOMMEND POSSIBLE AMENDMENTS TO THE MINES AND MINERALS (DEVELOPMENT AND REGULATION) ACT, 1957"

SUMMARY OF PROCEEDINGS AND CONCLUSIONS

of
Workshop
on
Industry and Mining
Reclamation, Resettlement and Rehabilitation (R,R & R)
held on 16 December 2006 at Bhubaneswar

The one day Workshop on **Industry and Mining - Reclamation, Resettlement and Rehabilitation (R,R & R)** was attended by 104 distinguished delegates from different parts of the country. The organisations represented include IBM, GSI, MOEF, OMC, Directorates of Mining and Geology, NALCO, Tata Steel, Vedanta Aluminium a number of other mining companies, senior officers of Government of Orissa among others.

2. A total of 10 papers were presented in two Technical Sessions. This was followed by Panel discussion and interaction with experts.

3. **Inaugural Session**

Dr. R.C. Mohanty, President in his address of welcome highlighted the importance of the topic of the Workshop in the present context.

Padmabhusan G.L.Tandon, an eminent mining engineer of the country graced the event as the Chief Guest. He highlighted the importance and contribution of the mining industry in socio - economic development. He cited the example of Neyveli Lignite mines which has contributed to development of agriculture by making available plentiful water in a very low rainfall and arid area. Shri Tandon advised the mining industry to be pro-active, publicise its importance and counter the negative propaganda vigorously. He called upon the mining community to pay special attention to welfare of workers, project affected people and protection of environment.

4. Particulars of papers presented are indicated in the Annexure.

5. **The following points emerged from the papers presented in Technical Session – I on Reclamation of Mined out Areas.**

5.1 Scientific Mining with simultaneous reclamation and rehabilitation of degraded area is the need of the hour.

5.2 It was noted that reclamation and rehabilitation has been successfully carried out in Bauxite (Panchpatmali mine of NALCO), Beach sands (OSCOM, IREL), Iron ore (Noamundi of Tata Steel), limestone (Dungri) among others.

5.3 In Chromite mines, reclamation has not been possible due to depth continuity of the ore bodies. However, it was pointed out that waste dumps have been successfully stabilized by use of coir mats, drainage control and plantation.

5.4 Mining from one end of a deposit is recommended to facilitate simultaneous reclamation.

5.5 It was emphasized that the apprehension about adverse impact of Bauxite mining on environment and reduction in flow of water in streams is totally unfounded. Adverse publicity against Bauxite mining projects has stalled development and it was suggested that such misconceived notions propagated by vested interests must be countered strongly and facts based on scientific data and field observations highlighted.

5.6 Noamundi Iron ore Mines of Tata Steel provides a good example of reclamation of mined out areas by progressive mine closure, conservation and restoration of native eco-system.

5.7 Small mines should have a collective approach for reclamation and this should be woven into Regional Plan.

5.8 The eco-system should not be damaged willfully on the assumption that it will be restored. Our approach should be for management of ecological sensitive landscape including restored systems and catastrophic events with establishment of green belt, wild life corridors, biosphere reserve among others.

5.9 Restoration of mined–out lands and green belt development should be managed by a separate Authority or Trust and not Government as in USA, Canada and Australia with funds contributed by the mining companies.

6. **Technical Session–II : Resettlement and Rehabilitation (R&R).**

6.1 It was pointed out that excepting coal, R & R as such is not a problem in other mines. In coal, it is a legacy of the past.

6.2 Most of the mines and mineral deposits are located in forest areas inhabited by tribals. With increasing mechanization, employment opportunities have dwindled and the tribals are apprehensive of losing their land and livelihood due to industrialization and loss of forests. Hence their opposition to mining.

6.3 Learning from the experience of the past and based on the guidelines of GOI, a comprehensive R & R Policy has been prepared by the Orissa Govt. with the help of UNDP and after consultations with various stakeholders. This is in place in 2006.

6.4 It was suggested that degraded forest lands should be made available for R & R.

6.5 While it is admitted that the 2006 R & R policy of the State Govt. is the best that could have been framed further improvement is possible through continuous dialogue with the affected people.

6.6 The project activities should start only after R & R issues are resolved.

6.7 It was noted that mechanism is in place for implementation of the Orissa R & R Policy 2006.

6.8 The Workshop recommends that the affected people should be made partners in the project so that they are fully integrated with the project.

6.9 It was noted that the Policy aims at rehabilitation of the land encroachers considering their tribal and poor status.

6.10 Part of the compensation amount may be kept as Fixed Deposit for generation of regular income for the displaced.

6.11 It was unanimously agreed that many NGOs indulge in spreading wrong messages and in cite violence. The State Government should counter such malicious activities sternly and ensure that the environment in the project areas is not vitiated by such groups and individuals with vested interest.

6.12 Representatives of Tata Steel informed that measures taken for R & R in Kalinga Nagar mark an improvement over the State Govt's 2006 Policy by providing additional benefits Policy and this has materialized after consultation with the stakeholders and the district administration.

6.13 The representative of Vedanta Aluminium outlined the various R & R package implemented by the company in the Lanjigarh Alumina- Aluminium Project which in many ways mark a distinct improvement over the package in the 2006 R & R Policy of the State Government. The benefits offered and their materialization have been possible by interaction with the local people, NGOs and the district administrations. VAL representative mentioned that the aspirations of the affected people would be taken care of.

6.14 Mining should be treated at par with Industry for consideration of benefit to project affected families.

6.16 Periphery area of an industry should be around 30 kms. radius and not the whole district.

7. **The following important points emerged in the Panel discussion and Valedictory address of Shri Vivek Patnaik.**

7.1 The sensitivity, culture, livelihood, apprehension and aspirations of the affected persons should be taken care of while finalising R & R package. In this regard, mining community and the media can play a major role. Instead of highlighting failures, the benefits that would accrue to the project affected people should be publicised.

7.2 It was agreed that the new R & R Policy should be given a fair trial. Agitations launched by individuals and interest groups asking for better deal for the tribals and negative propaganda by some of the NGOs should be sternly dealt with. As a matter of fact, incidents like blockade of a part of highway in Kalinganagar area should not be allowed to happen.

7.3 The Workshop was of the view that the mining industry is quite capable of appropriate reclamation of mined out areas by improved technological inputs, dump management, plantation, utilization of waste and use degraded forest lands and pragmatic legal system.

7.4 The Workshop took note of the fact with plethora of legislations, judicial activism, powerful media, the role of the regulatory authorities has become limited resulting in stalling progress of several developmental projects. In spite of these constraints we can move ahead once we convince the people that the projects will surely bring benefits and prosperity and the administrative set up changes its mindset and tune itself to the development process.

7.5 Development of industry cannot be done in isolation. It has to be integrated with Regional Plan encompassing infrastructure, socio – economic development, compatible EMP and acceptable R&R Package.

7.6 Winding up the deliberations, Dr. R.C. Mohanty, President, SGAT assured the participants that SGAT would diligently pursue with the concerned authorities for consideration of the various suggestions.

PAPERS PRESENTED IN THE WORKSHOP ON R, R & R

1. ***Shri D.Dash*** and ***Shri A.B. Panigrahi*** - IBM
   Reclamation of Mines with case Studies.

2. ***Dr. R.C. Mohanty***
   Reclamation and Rehabilitation in Bauxite Mines.

3. ***Shri K.C.Das*** & ***Shri B.K. Das*** - Tata Steel
   Reclamation Practices in Sukinda Chromite Mines of Tata Steel

4. ***Shri M.C. Thomas*** & ***Shri Pankaj Satija*** – Tata Steel
   Reclamation a success story at Tata Steel Mines

5. ***Dr. A.B. Ota***, Tribal Research Institute, Govt. of Orissa.
Major Social Issues and Critical areas of concern in Mineral related projects

6. ***Shri P.K. Panda***, Vedanta Aluminium
Success story of Rehabilitation by Vedanta Aluminium

7. ***Shri T.S. Chakravarty***, Govt. of Orissa
R & R Policy, 2006 of Govt. of Orissa.

8. ***Dr. V.P. Upadhyay***, MOEF
Sustainable Development, the need of the hour.

9. ***Dr. S.K. Tamotia***
Resettlement and Rehabilitation – Industry Perspective

10. ***Shri Rajesh Chintak***, Tata Steel
R & R at Kalinganagar, Tata Steel

Chairpersons

Prof. Dr. G.B. Misra
Shri A.M. Garabadu
Shri B.K. Mohanty
Shri G.C. Das

Panel

Shri B.K. Mohanty
Prof. Dr. G.B. Misra
Dr. B.P.Das
Shri T.S. Chakravarty
Shri Khazan Singh
Shri M.V. Rao
Dr. S.K. Tamotia
Dr. R.C. Mohanty
Shri Vivek Patnaik, Chairman

REPORT OF PROCEEDINGS, EMAP (2006-07)

State Level Environment cum Mineral Awareness Programme (EMAP) Held on 9 & 10 February 2007 at Bhubaneswar

With the objective of spreading awareness about the need to protect our fragile environment and to highlight the important minerals in economic development, SGAT has been organising EMAP in the important mining areas of the state for the last 16 years.

The State Level EMAP held on 9 & 10 February 2002 had participation of students of the following 10 Higher Secondary Schools, winners of the respective mining areas;

	School		Mining & Industrial Area
1.	St. Mary's Convent School, Biramitrapur.	:	Biramitrapur – Gomordih-Lanjiberna – Rajgangpur (Linestone, Dolomite, Cement Refractory, Sponge Iron).
2.	Kalta High School	:	Kalta – Barsua - Khandadhar – Koira (Iron and Manganese ore, Sponge Iron)
3.	B.K. High School, Soso	:	Boula - Nuasahi – Bangur (Chromite)
4.	Atomic Energy Central School, OSCOM, IREL, Matikhal.	:	OSCOM- Berhampur (Mineral Sands and Granite)
5.	Rairangpur Govt. Boys High School.	:	Gorumahisani – Joshipur (Iron ore, China clay, Quartz).
6.	Belpahar Refractories English Medium School, Belpahar.	:	Brajarajnagar – Jharsuguda - Belpahar (Coal, Fire clay, Refractory, Thermal Power, Iron & Steel).
7.	DAV Public School, Noamundi	:	Noamundi – Barbil – Joda – Belaipada (Iron and Manganese ore, Ferro-Manganese, pig iron, sponge iron).
8.	Kalipani High School	:	Daitari – Bamnipal – Kaliapani Sukinda (Iron and Chrome ore, Fe Cr plant).
9.	DPS, Nalco Nagar, Angul	:	Talcher – Angul (Coal, Alumina, Thermal Power)
10.	DAV Public School, Unit -8, Bhubaneswar.	:	

The students were accompanied by their teachers.

2. **The Programme comprised the following items / activities :**

Visit to

Regional Science Centre
Pre-Historic Life Park
Mathematics Gallery

Regional Museum of Natural History
Planetarium.
Regional Plant Resources Centre (RPRC)

Identification of

Common rock, ore and mineral samples.
Plant Species
Photographs

Written Test
Oral Quiz

3. **DAV Public School**, Unit – 8, Bhubaneswar represented by **Souradipta Mishra** and **Paban Pius** was adjudged the overall best team. **Biswabandita Sahoo** of Kaliapani High School scored the highest marks in the Written Test.

4. The examiners of various tests were Prof. N.K. Mahalik, Dr. R.C. Mohanty, Shri Binod Patnaik, Shri R.N. Praharaj, GM (Mines), IMFA Group,) Shri Subhransu Misra and senior executives of RPRL.

The Oral Quiz was conducted by Ms Sunanda Satpathy (Sony); who regularly anchors a programme for ETV. Dr. Tilottama Basa of OMC and Shri Sujit Mohanty, of DOG were the scorers. Shri Subhransu Misra of DOG conducted the power point projection.

5. The event was largely attended. Besides the members of the Executive Council of SGAT, there were representatives from IMFA Group, Tata Steel, FACOR, GSI, Directorate of Geology, OMC, POSCO, MOEF, IBM, Silicon Geoscience, Geomin Group, Utkal University among others.

6. **Shri Khazan Singh**, Regional CCF of MOEF graced the programme as the **Chief Guest**. He commended SGAT for organizing such an innovative and important programme. He expressed happiness over the level of knowledge and performance of the students. Shri Khazan Singh distributed awards to the participating students and winners of the competition.

7. The programme was co-ordinated by **Dr. R.C. Mohanty**, President and **Shri B.K. Mohanty**, Adviser.

VIEWS OF THE SOCIETY OF GEOSCIENTISTS & ALLIED TECHNOLOGISTS (SGAT)

ON

RECOMMENDATIONS OF THE HIGH LEVEL COMMITTEE TO REVIEW THE NATIONAL MINERAL POLICY AND TO RECOMMEND POSSIBLE AMENDMENTS TO THE MINES AND MINERALS (DEVELOPMENT AND REGULATION) ACT, 1957

Government of India, Planning Commission constituted a High Level Committee under the Chairmanship of Shri Anwarul Hoda, Member, Planning Commission in September 2005 to review the National Mineral Policy, 1993, the Mines and Minerals (Development & Regulation) Act, 1957 and suggest changes needed for encouraging investment in exploration and exploitation of minerals. Besides, the terms of reference of the Committee include the following :

i. To review the existing procedures for granting RP, PL, ML and suggest way for their streamlining and simplification.

ii. To review the procedures for according clearance to mineral exploration and mining projects under Forest (Conservation) Act and Environment (Protection) Act 1986 and suggest ways for speeding them up.

iii. To prioritize the critical infrastructure needs of the Indian mining sector and make recommendations on ways to facilitate investment to meet these needs :

iv. To examine the implications of the policy of mineral rich States to make value addition within the State a condition for grant of mineral concession and make appropriate recommendations in this regard;

v. To examine ways of augmenting State revenues from the mineral sector; and

vi. To examine any other issue relevant for stimulating investment flows and inducting state of the art technology into the sector.

Secretary, Steel & Mines Department, Orissa was a member of the Committee. Besides Secretary, S & M, Chief Secretary also participated in the deliberations of the Committee on more than one occasion.

The Committee submitted Draft Report in August 2006. The representative of the State Government is a signatory to the report of the Committee.

Orissa and a few other State Governments have opposed several recommendations of the Hoda Committee as these are not in the best interest of the States. We may have a close look at some of the recommendations.

NATIONAL MINERAL POLICY AND MMDR ACT.

The Committee has recommended the following changes in the NMP.

(1) Export of minerals in value added forms to the fullest extent possible.

(2) Procedures for grant of Mineral Concessions shall be seamless and security of tenure guaranteed to the concessionaires.

(3) Private Sector to be assigned important role in reconnaissance and exploration.

(4) Search to locate additional resources of minerals should be intensified by adopting state of art techniques.

(5) IBM would maintain a database in accordance with the latest version of the UNFC. The database would comprise inventory of resources, details about greenfield areas, brown field areas and relinquished areas. The data would be maintained online

giving instant information to prospective investors on what is available for reconnaissance, prospecting and mining.

(6) Thrust should be given to exploitation of minerals in which the country is well endowed so that the needs of the domestic industry are fully met, keeping in view present and future needs, while at the same time exploiting the external markets.

(7) Mining should be treated as a distinct economic activity in its own right and not as an ancillary activity of the manufacturing industry.

(8) In order to be assured of uninterrupted supply of mineral raw material from domestic sources the user industry should develop long term linkages with the mineral producing units.

(9) For development of infrastructure facilities in mining areas (particularly road communication), private – public partnership should be encouraged.

(10) Induction of foreign technology and foreign participation shall be encouraged.

(11) Efforts would be made to grant mineral concessions to consortium of small scale miners (entrepreneurs) for a cluster of small deposits so that economies of scale are reaped.

(SGAT fully endorses the recommendations made in (1 to (11) and suggests that mechanism should be in place for implementation of the recommendations.)

(12) The current two – tier system of RP and PL be replaced by a three – tier system of RP, LAPL and PL.

(Earlier, it was PL and ML. It was made RP, PL and ML. The objective of the contemplated results can be achieved under the existing system)

(13) Regarding RPs, an "open sky" policy should be adopted by granting non-exclusive. RPs without any preferential or automatic right to a PL. Under the open sky policy, RPs can be granted for the same area to more than one applicant on non – exclusive basis.

(This is acceptable as otherwise, the State Govt. will have to wait for the results till the expiry of tenure of RP/PL which is 8 years. In the event of a particular RP holder indicating lack of promise in the area surveyed, the exercise of granting RP/PL to other interested parties has to be start afresh and lot of precious time would have lapsed.)

(14) Disposal of notified ore bodies should be done through a transparent tender/ auction process. The auction procedure would be dispensed with in case of Scheduled Areas where the existing provision under Section 11 (3)of the Act would be applicable. But in such case, full cost of exploration by the public agency should be recovered from the lessee.

(15) The duration of under RP / PL or RP/LAPL or LAPL will be maximum 8 years.

(16) **Area limit recommended.**

Limit for direct PL applicants	:	25 to 50 sq. kms.
In case of RP holder (with aerial survey)	:	Maximum area under PL in a State - to be increased from 25 to 500 sq. kms. to be brought down to 100 sq.kms.
LAPL	:	5,000 sq.kms. to be progressively. brought down to 500 sq.kms. after the 5th year and 100 sq. kms. after 6 years.
ML	:	50 sq. kms. (in a State) 100 sq. kms. (for LAPL / PL holders)

(17) A RP (non exclusive) holder should have an automatic right to PL on first – come – first – served basis with no exceptions or exemptions provided he fulfills all the eligible conditions.

(18) A LAPL / PL holder shall have the exclusive right to obtain a ML over any other person on fulfilling requisite conditions.

(The recommendations in paras (13) to (18) are in order except where LAPL is mentioned.)

(19) The provision of authority of the State to pre-empt minerals and to put restrictive conditions should be deleted.

(Many of the State Governments have objected to the recommendations and perhaps rightly so. The State Governments resort to this provision in rarest of rare cases. The provision may be retained with insertion of "specified public purpose.)

(20) Rule 34 of MCR authorizing the state to reduce or exclude an area from the entitlement of a PL holder to a ML should be deleted except in the case of specified public purposes.

(The State Govts have opposed the recommendation as it impinges on their authority. But with the proviso "specified public purpose", the recommendation should be acceptable).

(21) A Mineral Concession holder should have the right to renewal if he has met the obligations of his concession. As the renewal mean fresh grant in judicial parlance, the word "extension" be used instead of "renewal". Extension of the ML should be automatic until the exhaustion of the deposit or voluntary relinquishment of the area subject to the fulfillment of conditions of the lease.

(22) Eligibility criteria will be laid down in the MCR for all RP and PL applicants so as to ensure that only genuine and credible persons apply and speculators are kept out.

(23) A PL holder will have right to transfer his PL to a qualified person. What applies to PLs also applies to MLs.

(24) PSUs are to be treated at par with private sector companies in grant of Mineral concessions. The reservation provision for PSUs for explorations and mining should be deleted.

(25) In order to streamline procedures and minimize delays, all applications for mineral concessions should be received at the office of the Directorate of Mining and Geology. Decision on applications should be taken by Co-ordination cum Empowered Committees to be set up at the levels of State and Central Governments.

(26) Websites should be maintained both by DMG and Central Government indicating position of applications.

(27) The Committee has recommended the following time limits for disposal of MC applications by the State Government.

i. non – exclusive RP – 4 months.
ii. PL / LAPL - 10 months.
iii. ML – 13 months.

from the date of receipt of application. In case, the applications are not disposed of within the time limits prescribed, the aggrieved party may approach the Central Govt. to exercise its powers.

The Central Govt. will be empowered to take final decision in the matters and to revise any order made by a State Govt. after giving an opportunity to the State Govt. as well as the aggrieved party to put forth their views.

(28) An Independent Tribunal would be set up to take decision on revision cases. The Tribunal will have powers to revise the orders of the Central Government.

(The recommendations contained in paras 21 to 28 are in order and acceptable. However, some of the State Govts. have reservation in accepting recommendation in para 28.

(We are of the view that this provision will bring much needed urgency in timely disposal of MC applications by the State Governments and hence should be accepted.)

(29) **Forest (Conservation) Act**

Compensatory Afforestation charges should not be payable over and above chargeable NPV and Ground rent.

The NPV should be payable only in proportion to the land broken in accordance with the pre-submitted Mining Plan.

The Lessee should not be asked to pay NPV each time a lease is renewed.

The Co-ordination – cum – Empowered Committee at the Centre in case of Schedule. 1 minerals and at the State for non – Schedule minerals should be the final authority to accord approval under FCA. **However, the views of the MOEF will be binding on the committee.**

Processing of an application for obtaining clearance under FCA can start simultaneously with the lease application and application under FC does not have to wait till the ML is granted.

Once "in principles" approval is accorded by MOEF the second stage clearance may be given by the State Governments subject to the compliance of conditions stipulated in the "in principle" approval.

In case of renewal of existing leases where the MOEF has already given its approval under FCA, the renewal application need not be subject to further processing.

Arbitrary reduction in area applied for renewal under FCA resorted to by the State Government should not be done.

Diversion of forest lands for mining should be allowed for longer period on till the exhaustion of reserve.

CA charges may be fixed by the Central Govt. and payment of such charges should be staggered over the lease period collected on annual basis. There should not be differentiation in CA charges in the leases of low value and high value minerals.

The system of obtaining Transport permits from the Forest Department for movement of minerals in forest areas after payment of a fee should be done way with.

Processing of proposals for FCA at the State Govt. level should be limited to DFO, Nodal Officer and the Secretary, Forest Department.

(The recommendations are in order excepting that the stipulation in sub-para 4. "However, the views of MOEF will be binding on the Committee" runs counter to justice and fairplay).

AN APPEAL

WE ARE PLEASED TO INFORM YOU THAT SGAT HAS ALREADY GOT ALLOTMENT OF LAND MEASURING 90' X 45' IN IRC VILLAGE, NAYAPALLI AREA OF BHUBANESWAR. SGAT HAS ALREADY TAKEN THE POSSESSION OF THE LAND ON PAYMENT OF THE COST.

SGAT DESIRES NOW TO CONSTRUCT ITS OWN AUDITORIUM WITH OTHER UTILITIES COMPONENTS IN THE SAME PLOT. THIS IS ESTIMATED THAT AN AMOUNT OF ABOUT RS. 50.00 LAKHS SHALL BE REQUIRED TO COMPLETE THE FIRST PHASE OF CONSTRUCTION. IN VIEW OF THIS IT IS PROPOSED TO MEET THESE EXPENSES THROUGH DONATIONS FROM MEMBERS AND VARIOUS INSTITUTIONS. SGAT HAS ALREADY OBTAINED INCOME TAX RELAXATION UNDER RULE 80 – G VIDE NO. ITO(TECH.)/80G-12/06-07 DATED BHUBANESWAR THE 19TH OCTOBER,2006.

AN APPEAL IS, THEREFORE, MADE FOR A GENEROUS CONTRIBUTION TOWARDS BUILDING FUND OF THE SOCIETY. ALL PAYMENTS CAN BE SENT EITHER BY CHEQUE/DEMAND DRAFT PAYABLE AT BHUBANESWAR IN FAVOUR OF "SOCIETY OF GEOSCIENTISTS & ALLIED TECHNOLOGISTS" AND MAY BE SENT TO THE GENERAL SECRETARY, SOCIETY OF GEOSCIENTISTS & ALLIED TECHNOLOGISTS, 267, KHARAVELA NAGAR, BHUBANESWAR – 751 001, ORISSA.

YOUR GENEROSITY FOR THIS NOBLE CAUSE SHALL BE HIGHLY REMEMBERED.