An Apprisal of Geological Resources For Rural Development In Bamanghati Area, Mayurbhanj District,Odisha,India

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Abstract- *Intelligent and sustainable use of geo-resources to the advantage of humanity requires management based on rules and experiences. Resource development and conservation of groundwater reserves on the one hand and securing human living space and restoring the natural balance on the other are areas of geosciences that are increasingly gaining in importance and that can provide critical contributions for the future of humankind. Bamanghati Subdivision is a high land of Mayurbhanj district. Mineral resources which are found in Bamansghati Subdivision are:1. Iron Ore 2. Manganese Ore 3. Asbestos Ore 4. China Clay.Typically red soil is found mostly in the Bamanghaty subdivision, as the underlying rock is rich in iron ore. . Soils of Bamanghati Subdivision are mainly influenced by the high relief, parent rock type and climate and the natural vegetation cover. As the most area of Bamanghati subdivision situated on Granitic rocks, underground water is very low as Granitic rocks have low porosity and permeability. But some amount of groundwater is also available in weathered and fractured zone of Granite. As mostly hard rocks are present in the Bamanghati subdivision on a plateau like area the underground water.*

Keywords- Geo-resources, Sustainable, Mineral Resources, Bamanghati, Groundwater.

I. INTRODUCTION

Geo-Resources encompasses all resources except for solar energy that serve as a foundation for life of modern human society and whose comprehensive use involves humans intervention with the system Earth. This includes in particular, natural resources (water, soil, mineral, raw materials, energy raw materials, geothermal energy) and areas of application (living, agriculture, industry , business, traffic, disposal) as well as, in a wider sense, also climate and atmosphere. The intelligent, sustainable use of geo-resources to the advantage of humanity requires management based on rules and experiences. Such management also includes taking into account and limiting potential consequences of unavoidable natural disasters (earthquakes, volcano eruptions, flooding, tsunamis) in densely populated areas, as well as human intervention into the system Earth (environmental and climate changes.) Resource development and conservation of groundwater reserves on the one hand and securing human living space and restoring the natural balance on the other are areas of geosciences that are increasingly gaining in importance and that can provide critical contributions for the future of humankind. Many workers have carried out research work on various aspect of geology and mineral resources of odisha Ravindra, K. (2015) , Krishnan , M.S (2011) , Mahalik, N.K. (1994) Sarkar, A. and Paul, D.K (1998) , Mahalik, N.K. (1994) , Bose,M.K. (1979, Ramakrishnan ,M , Nanda JK, and Augustine,P. F. (1998) , Nanda, J, K.andPati, U.C. (1989) , Gupta , S.(2004), Mohapatra,S.K. andSarangi, S.K. (2006) Sahu ,C K ; Nandi ,D. and Kant ,J. (2014), GSI(2012)' The literature available on groundwater resources related studies was reviewed in detail. Choudhury et. al. 2010[1], Deepika et. al.2013[2], Dinesh et al.2007[3], Jaiswal et. al.2003[4], Jesiya et. al.2015[5], Magesh et. al.2012[6], Reddy et. al.2003[7], Saud2010[8], Shaban et al.2006[9], Sharma & Ray2015[10], Suja Rose &Krishna(2009[11] and Tweed et al.2007[12] have emphasized on utilization of remotely sensed data in conjunction with co-lateral data in GIS platform in delineation of groundwater potential zones. Ballukraya 2001[13], Janardhana Raju et. al.1996[14], Kumar & Srinivasan 2016[15], Mahala et. al.2013[16] and Selvarani et. al.2016[17] have described in their study, the application of geophysics in targeting groundwater in hard rock areas. Sahu 2017[18] and Sahu 2017[19] in his study highlighted on the integration of geological, geophysical and remote sensing data for sustainable development and management of groundwater in hard rock terrain

Bamanghati Subdivision is one of the four subdivisions of Mayurbhanj, the biggest district of Odisha(Figure 1).The other subdivisions are Panchpir, Kaptipada, and Baripada with their headquarters at Karanjia, **U**dala, and Baripada respectively. The headquarter of Bamanghati subdivision is Rairangpur. Bamanghati is situated to North

West of Mayurbhanj. It is a terminal part of Chottanagpur Plateau.The subdivision extends between 85°55'E to 86°30'E longitude and 22°.0'N to 22°35'N latitude. It is bounded by Singhbhum district of Jharkahnd in North and West, Panchpir Subdivision in South and Baripada Subdivision in the East.The Bamanghati Subdivision is divided into Seven administrative units called blocks. These blocks which exists sequentially from North to south of the subdivision are: 1.Tiring, 2.Bahalda, 3.Jamda,4.Rairangpur,5.Bijatala, 6.Kusumi7.Bisoi.

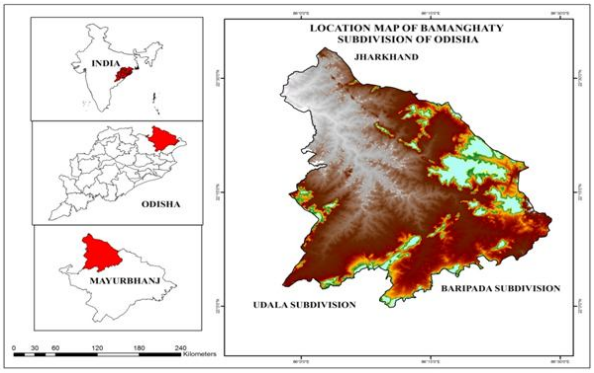

Figure 1. Location map of the study area

II. METHODOLOGY

Methodology is the process of work involved in a research problem.Generally it includes the sample/area of the study, tools and techniques and the procedure of data collection, data analysis and finally the interpretation of data. In the present study the investigator has taken Bamanghati subdivision of Mayurbhanj district as the area of investigation for Geo resources evaluation .Tools and techniques relates to the method for collection of data..Here Remote sensing approach is made to prepare lithology and geomorphological map. Field work at different locations such as Badampahar, Suleipat, Gorumahisani, Bahalda, Bisoi,Jamda etc.is carried out in the study area to correlate the remote sensing data with filed data. Also some data such as different rock types, textures and structures associated with them, variation of soil types with rocks types, category of Iron and other ore Minerals were taken. The investigator visited the mining office situated at the district headquarter Baripada and collected data about the important minerals of Bamanghati Subdivision which includes Iron Ore, Manganese Ore, Asbestos Ore, China Clay and Quartzite rock. Information about these resources was presented systematically in tabular forms. Further data about soil type of Bamanghati Subdivision was also collected from District Soil Chemist office, Baripada. Data about soil characteristics was also presented in tabular form with regards to Bamanghati Subdivision. Finally the investigator analyzed all data collected from different sources primarily from field, remote sensing map and by using different techniques. Combination and correlation of different data were made to understand the Geo potential Resources of Bamanghati subdivision in a better way.

III. RESULTS AND DISSCUSSION

Different Georesources of Bamanghati subdivision which are considered here are Mineral Resourcse, Soil Resources, Water Resources, Building Material Resources. Mineral resource is a mineral concentration which is known, estimated and interpreted from specific geological evidence and knowledge and with reasonable prospects for economic extraction. Such types of mineral resources which are found in Bamansghati Subdivision are:1. Iron Ore 2. Manganese Ore 3. Asbestos Ore 4. China Clay.

Iron ores are minerals from which metallic iron can be economically extracted within two blocks i.e. Rairangpur Block and Kusumi Block..The places of rich deposit of iron ore are located in Gorumahisani, Badampahar and Suleipat areas over a stretch of 40km (Table 1).

(a) Gorumahisani area (220 20':860 17'): Gorumahisani is connected by a broad gauge railway with Tatanagar(Figure 2). The ore bodies which comprise of detrital and massive hematite occur mostly on the northern foot hills and slope of Gorumahisani (Δ 2,964'). The main ore bodies are mostly lenticular in shape and are believed to have been formed by secondary enrichment. The main rock types of the area include dolerites, granites, ferruginous shales, quartzites, banded iron silica rocks, phyllites and epidiorites belonging to Iron Ore Super Group. The types of iron ores include:

i. Hard massive ore
ii. Laminated and biscuity ore
iii. Shaly ore
iv. Lateritic iron ore
v. Maghemite
vi. Gruneritic iron ore (iron rich amphibole)

(b) Badampahar (220 04':860 07') : Badampahar is the terminus of the Tatanagar-Badampahar broad-gauge railway. The area is represented by basic intrusives, granurites and iron ore group of rocks such as shales, quartzite, B.H.Q and B.H.J. The upper portion of the iron ore formation is lateritised.

Laterite usually occurs as capping over the iron ore formations, the thickness of which varies from 3 to as much as 8 m. It also occurs as irregular patches along cracks and bedding planes of ore bodies.

The iron ore occurrences in this area are confined to two main zones, namely the Badampahar (Δ2,730') comprising the peak and Osirmunda hill on the east, separated by quartzites. The types of ore that occur in Badampahar include :

i. friable,
ii. laminated,
iii. limonitic,
iv. lateritic and
v. hard massive ore which occurs at places in bouldery form.

The other deposits include Purunapani , Ghusuria, Maharajpur and Ekdalpahar

(a) Suleipat area (220 09':860 14') : Sulaipat is connected with Badampahar-Tatanagar railway by a broad-gauge line. The rocks that are found in the area include newer dolerite, granite, B.H.Q, B.H.J, ferruginous shale and quartzite. A large portion of the area is occupied by altered doleritic rocks. The entire iron ore group of rocks in Suleipat area is surrounded by granite almost in all sides, which can be traced towards SW up to Badampahar. The iron ore series of Suleipat is in the form of a long narrow roof pendant striking NE-SW over the great mass of granite body. The NE portion of Suleipat is possibly bounded by a fault. The iron ore deposit of Suleipat is associated with banded iron sillica rock. Considerable reserves of hematite containing 66-68% iron have been mined from this deposit. A total resource of 35.250 MT (Source-Mineral Resource of Odisha as on July-2013) of iron ore including 28.250 MT in different lease holds and 7 MT in free holds has been assessed in Mayurbhanj district.

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Figure 2. Gorumahisani Iron ore mine of the study area

Table 1: The location wise details of reserve

Location (Leasehold areas)	Proved	Probable	Possible	Total (in MT)
Asanbani	-	-	1.400	1.400
Badampahar	-	-	0.396	0.396
Bhitarmda	-	-	0.960	0.960
Ghusura	-	0.260	0.240	0.500
Gorumahisani	-	-	5.000	5.000
Kasiabera	-	0.057	-	0.057
Maharajpur	-	0.840	-	0.840
Nangalsila	-	-	0.342	0.342
Purunapani	-	-	0.100	0.100
Sulaipat	-	-	18.655	18.655
Small & Scattered (Free hold areas)	-	-	7.000	7.000
Total				**35.250**

Titaniferous And Vanadiferous Magnetite: Deposits of titaniferous & vanadiferous magnetite occurring in association with gabbro-anorthosite suite of rocks in north Odisha of Mayurbhanj district are distributed in three belts viz. (I) Bisoi-Rairangpur, (ii) Bisoi-Jashipur, (iii) Baripada-Udala. Besides, there are several smaller deposits scattered around the Similipal Basin. The state Directorate of Geology had taken of detail assesment of the reserves and grade of these deposits. The vanadiferous and titaniferous magnetite ore composed essentially of magnetite and illmenite with minor amount of haematite, limonite, rutile, coulsonite {(FeV) $_3O_4$} and sulphides, occurs as disseminations with stringers, lenses and pockets. The mineral coulsonite accounts for vanadium in the ore.

Bisoi-Rairangpur-Kumardubi Belt: In- situ ore bodies and float ore occupy an area of 0.25 sq. Km. in this belt. Ten ore bodies have been delineated in this area. The pure ore band occurs inter banded with disseminated ore or with the basic rock. Distinct gradation is also noticed from pure band of ore to pure gabbroic rock with all sorts of gradations. The belt extends over a length of 15km. Important depositsof the area are located at Kumardubi (22° 17' 00": 86° 19' 00"), Betjharan (22^0 15' 20":86^0 19' 00"), Nua Pahari (21^0 54' 00":86^0 34' 00"), Hatichar (22^0 13' 00":86^0 26' 00"), Basantpur (21^0 55' 30":86^0 07' 00"), Amdabera (22^0 14' 00":86^0 19' 00"), Kaduani (22^0 17' 00":86^0 20' 00"), Kasipenth (22° 17' 00": 86° 21' 00"), Kunjakocha (22^0 13' 00":86^0 23' 00"), Batichar (22° 12' 00": 86° 25' 00"), Bhargapahar (22° 13' 00": 86° 24' 00"), Gargari (22^0 12' 30":86^0 22' 30") and Tuarburu (22^0 06' 00":86^0 21' 00"). Besides 16 large and small segregated vanadiferous magnetite bodies occur in the area. The ore bodies strike E-W and its thickness varies from 3 to 36m. An extensive float zone surrounds the main ore body. The main ore body around Hatichar occurs as a ridge and extends over a length of 265m with varying width of 15-20m.

Manganese Ore: Manganese ores are mainly **pyrolusite and psilomelane .** They occur as stray pockets in Budharajpahar. Total manganese reserve inferred by the Directorate of

Geology is of the order of 0.043 million tonnes. The Mn% varies from 30.75 to 41.45%.

Asbestos Ore: The asbestos deposits of this subdivision are of tremolite variety and are reported to be high in calcium and iron. The mineral occurs as cross and slip fibres and in anastomising veins cutting through talc schist, the country rock. Such deposits are found near Nandabasa (Rairangpur Block)

China Clay: The china clay occurs as huge pockets in decomposed granites and granite gneisses under a thin capping of laterite. It occurs beneath an overburden of 3.5 to 4.5m. China clay mined from these deposits are gritty, iron contaminated, plastic to non plastic variety.These are used in ceramic, pottery, cement, textile, paper, rubber and paint industries. They are mainly found in Jamda (Jamda Block) and Hizli (Bisoi) Block.The characteristics of this deposit are as follows:

- Al_2O_3: 33.36%
- SiO2: 48.87%
- Loss of ignition: 12.86%

Soil-Resources: Typically red soil is found mostly in the Bamanghaty subdivision, as the underlying rock is rich in iron ore. Some places where the granitic rocks are exposed the soil is mostly clay loam soil. Also the places covered by some forest are characterized organic soil . Red soil is suitable mainly for paddy, millets, sabai grass and other minor crops. Average Concentrations different nutrients (elements) in soils of different blocks are given below. Soils of Bamanghati Subdivision are mainly influenced by the high relief, parent rock type and climate and the natural vegetation cover. Following types of soils are mainly observed in Bamanghati subdivision(Table 2).

Red soil: Most part of the subdivision is covered by Red soil. The main features are coarse texture, single grained to weakly granular structured (The soils have angular or sub angular blocky structure) surface soil, highly porous with low available water holding capacity as the clay fractions (kaolinites & illites). of these soils is more. These put severe limitations for rain fed farming. These soils are non saline and do not contain any lime kankar or free carbonate. The red color is due to presence of iron oxides, which indicates higher proportions of iron content of this subdivision These soils are moderately acidic and are generally deficient in nitrogen, organic matter and molybdenum. Boron deficiency symptoms have been observed in vegetable crops.

Laterite Soil: Lateritic soils are characterized by compact vesicular structure and rich in hydrated oxides of iron and aluminum with small amounts of manganese, titanium and quartz. Degraded late rites are honey combed structure. These soils are loamy sand to sandy loam in the surface having hard clay pan in the subsoil, crusting is its problem in upland literate. Presence of higher amount of exchangeable aluminum and manganese results in slightly acidic to strongly acidic soil with pH ranging between 4.5 to 5.8.These soils are poorly fertile with low organic matter. Available nitrogen and phosphate are low and potash is medium. Nitrogen is lost due to leaching and phosphate becomes unavailable due to fixation by Fe and AI oxides.

Brown forest Soil : These are mainly brown colored, formed in association with forest growth. So mainly found in the forest areas of the subdivision The organic matter is moderate to high in these soils. These are fertile, slightly acidic. These are brown to gray brown in color, light texture and acidic in reaction. Organic matter and nitrogen content of the soils are medium to high. Phosphorus and potash content are medium. The contents of most of the micronutrient are high barring molybdenum. Under slopy terrain soil erosion occurs making lands barren. Shifting cultivation is regular practice causing land degradation.

Black Soil: These are formed due specific lithology or topography. These soils are formed due to weathering of basic rocks like dolerite where they are exposed in the subdivision. Some times black colour of the soil is due to presence of titaniferous magnetite as exposed in the Gorumahisani are of the subdivision.These rocksinvariably contain plagioclases in appreciable amounts, which on weathering makes the soil environment rich in calcium. A lime kankar zone at some depth in the profile and free carbonates are usually present. Soils exhibits deep and wide cracks in summer seasons. The texture is clay and the structure is angular blocky. The water infiltration in these soils is slow and erosion on upland situation is severe. Soils are low to moderate in nitrogen and potassium, rich in calcium and respond 10 nitrogen and phosphorus. Soils are moderately alkaline.

Table 2: Secondary and Micro-Nutrients in Soils of Bamanghati Subdivision

Name of Block	Ca 2+	Mg 2+	S	Fe	Mn	Cu	Zn	B
	C mol (P) / kg		ppm					
TIRING	7.06	2.03	20.36	66.24	20.34	3.05	1.05	0.44
BAHALDA	6.92	1.89	17.62	37.05	46.20	2.42	1.04	0.41
KUSUMI	5.77	1.51	12.38	27.93	36.62	2.67	0.94	0.46
RAIRANG PUR	4.54	1.31	8.27	30.70	47.34	2.34	1.02	0.47
BIJATALA	4.18	1.18	6.81	39.33	64.79	1.55	0.86	0.66
JAMDA	4.27	1.24	17.86	41.95	70.11	2.27	0.79	0.66
BISOI	8.09	2.06	7.29	20.27	39.35	1.77	0.47	0.58

Water Resources: Water resources are sources of water that are useful or potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. The majority of human uses require fresh water.97 percent of the water on the Earth is salt water and only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen freshwater is found mainly as groundwater, with only a small fraction present above ground or in the air.Fresh water is a renewable resource, yet the world's supply of groundwater is steadily decreasing, with depletion occurring most prominently in Asia and North America, although it is still

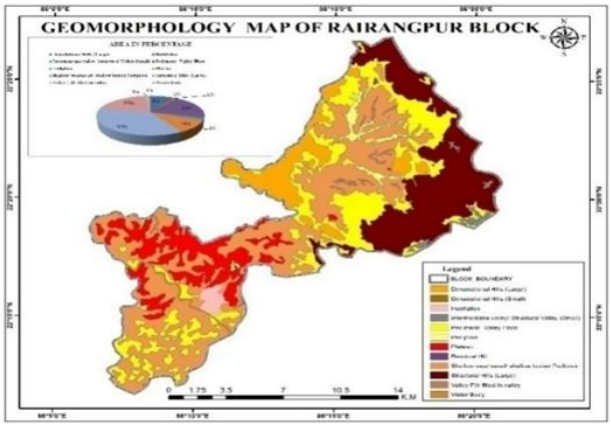

Figure3. Hydrogeomorphology of the study area

unclear how much natural renewal balances this usage, and whether ecosystems are threatened. The framework for allocating water resources to water users (where such a framework exists) is known as water rights**.** Groundwater condition is good in pediplain, alluvial valley and intermontane valley (figure 3)

Surface Water Resource: From the drainage map it is clear that the area is drained by a combination pattern of radial and dendritic, which is also supported by the structure of the area (no faulting and folding, only presence of hill) and the lithology is uniform (granitic mostly). The maximum area of the subdivision is mainly drained by Kharkhai River, which starts from Similipal hills, flows towards north western side meets Subarnarekha River near Jamshedpur in Jharkhand. An earth dam has been constructed on Kharkhai River for irrigation purpose to supply water for cultivation in nearby area. That earth dam is situated in Suleipat, whose upstream side is towards South East and downstream side is towards North West. This Dam provides a good potential of surface irrigation in this subdivision. There is also another earth dam named Bankbal dam, which also provides a good potential for irrigation. The maximum area of the subdivision is mainly drained by Kharkhai River, which starts from Similipal hills, flows towards north western side meets Subarnarekha River near Jamshedpur in Jharkhand. An earth dam has been constructed on Kharkhai River for irrigation purpose to supply water for cultivation in nearby area. That earth dam is situated in Suleipat, whose upstream side is towards South East and downstream side is towards North West. This Dam provides a good potential of surface irrigation in this subdivision. There is also another earth dam named Bankbal dam, which also provides a good potential for irrigation.

Ground Water: As the most area of Bamanghati subdivision situated on Granitic rocks, underground water is very low as Granitic rocks have low porosity and permeability. But some amount of groundwater is also available in weathered and fractured zone of Granite. In lateritic area ground water potential is better than other area. But in average area the underground water table lies at very greater depth. So underground water is extracted by deep bore well. because the saturated zone lies at greater depth. As mostly hard rocks are present in the Bamanghati subdivision on a plateau like area the underground water potential is very low.

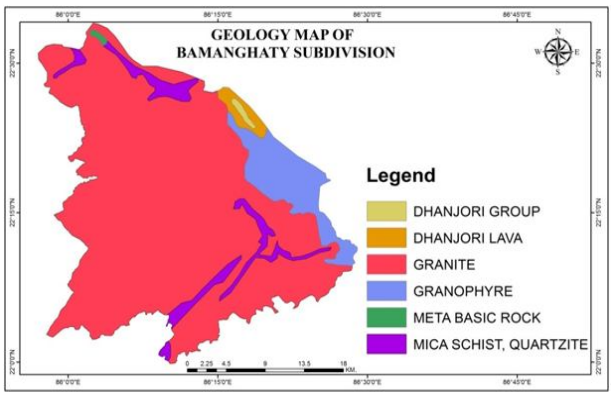

Figure 4. Lithology of the study area

Building Materials: Any material which is used for construction purposes. Many naturally occurring substances, such as clay, rocks, sand, and wood, even twigs and leaves, have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use,

some more and some less synthetic. The manufacture of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades, such as carpentry, insulation, plumbing, and roofing work. They provide the make-up of habitats and structures including homes**.** Quartzite (a metamorphic rock) is a highly resistant building stone, which is exposed in different areas of the Bamanghati Subdivision .Mining is also done in Pandupani, Tiringdih, Jadunathpur, Lupung & Hansdihi, Lupung & Hansdihi, Kuldiha localities .A large amount of Quartzite which has been exported to be used as building materials in buildings, to make flood walls nearby river side, to make roads. Some of the quartzites are used by local people to make roads, buildings etc.Granite (an igneous Rock) is also a highly resistant, tough and and characterised by high compressive strength. Small scale mining of Granite is done in different localities of Bamanghati Subdivision (Figure 4). Granites are also used by the people to make buildings, roads etc.

IV. CONCLUSION

Bamanghati Subdivision is a high land of Mayurbhanj district. It occupies nearly 17% of the total area of the district. Yet it is an important area of the district due to its rich Geo-Resources. It is a treasure house of Iron Ores, the percentage of Iron (Fe) is about 66% to 68% in the Hematite Ore minerals which are largely deposited in this subdivision with an amount of nearly 32,000 Million Tones. It was the prime supplier of Iron ore to the steel plant situated at Jamshedpur, since 1905.Manganese, Asbestos and Chinay Clay are also available in this area with a nominal amount. Next to iron ore Quartzite rock is the resource which is available plenty in this subdivision. So Bamanghati is a good supplier of building materials .Bamanghati Subdivision is characterized by the type of soil named as Laterite soil followed by other type of soils like Red soil, Brown Forest Soil and Black Soil. Though it is a high land yet a well drainage Dendritic pattern, exists in it due to the river Kharkhai and its tributary Bankabala.The rivers and nala are rainfed in character and emerged from similipal hills.

VI. ACKNOWLEDGEMENT

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