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HYDROGEOLOGY

GROUND WATER QUALITY ASSESSMENT OF JHARKHAND COAL FIELDS

Anil Kumar[1] Vipul Suman[2] and Kumari Anjali[3]

Key words : Quality Assessment, Lower Gondwana, Coal Seams.

For a study of Ground Water Quality Assessment of Jharkhand Coal Fields, ground water samples were collected from various places of the study area and analysed using standard analytical techniques. It is found that the majority of ground water samples are suitable for drinking purpose, their pH is normal to alkaline in nature but at some sites concentration of TDS, TH, Na, F, Cl are NO_3 are slightly higher than the desirable limit prescribed for potable water.

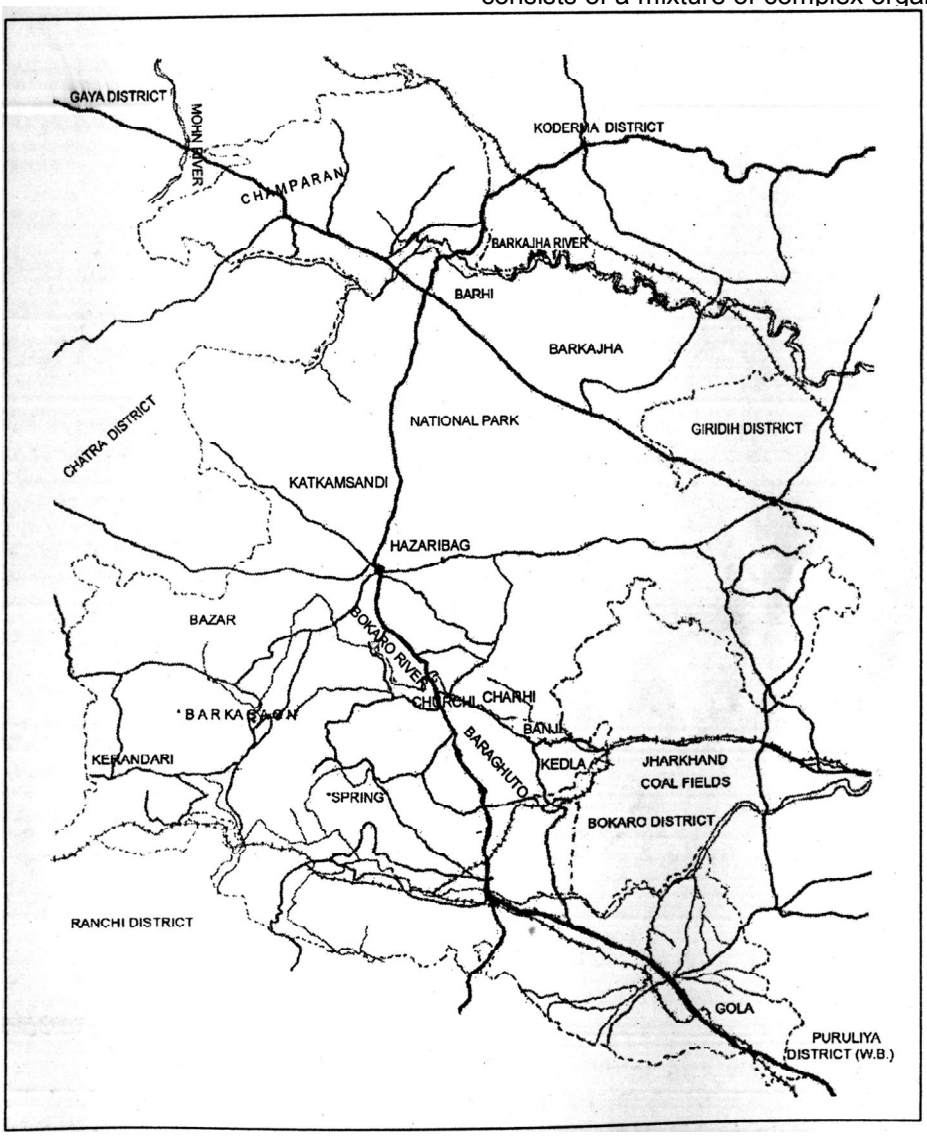
The study further indicates that extensive coal mining is affecting the ground water quality which has become a cause of concern for the health of local people inhabiting the area.

INTRODUCTION

Ground water has been considered free from contamination as it is contained in a well protected reservoir but this concept, of late, has changed due to deterioration of ground water quality on account of geogenic and mining activities.

The area under study is an extensive coal mining area known as Jharkhand Colliery (coalfields) near Kedla Coal Mining zone of Mandu Block of Ramgarh District in Jharkhand State. It lies in Chotanagpur plateau, surrounded by ridges and valleys. In the study area coal is taken out by open cast method and bituminous coal is mainly found here. There is rampant movement of heavy vehicles like dozers, dumpers, trucks, etc., in order to transport coal.

Coal is one of the chief "fossil fuels" or mineral fuels and is an important source of thermal energy. Chemically, coal consists of a mixture of complex organic compounds along with small amounts of inorganic mineral water and moisture. The elementary composition of coal consists of carbon, hydrogen and oxygen, along with small amounts of nitrogen and sulphur. The proportion of these elements is found to progressively increase or decrease with the advance of coalification process starting from vegetal debris, which gives the average composition of solid fuels (Ram and Sharma,1966).

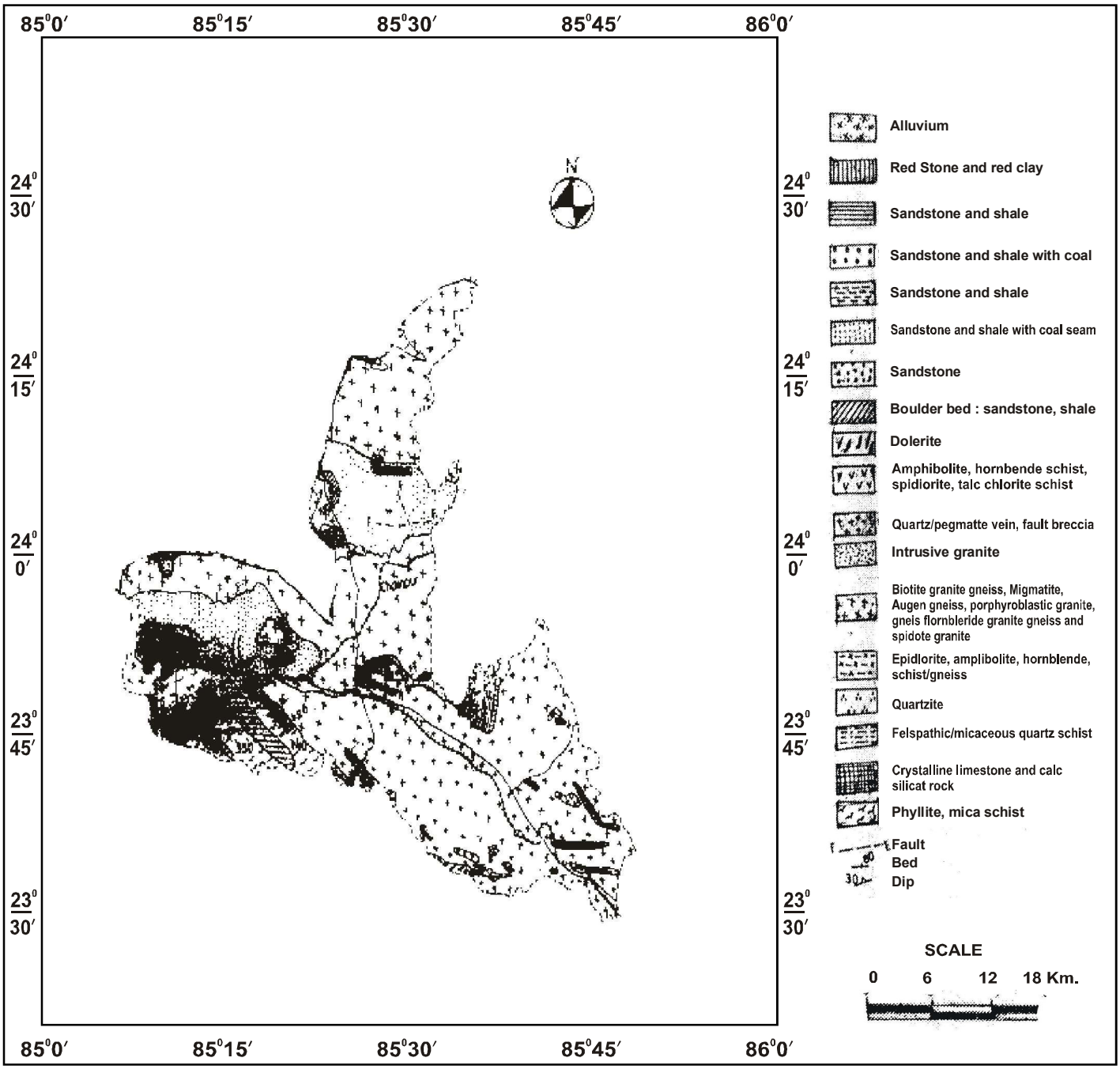


MAP-1 : LOCATION MAP OF JHARKHAND COLLIERY (COAL FIELDS OF MANDU BLOCK OF RAMGARH DISTRICT, JHARKHAND)

1. Associate Professor, Deptt. of Geology, Patna Science College, Patna Univerity, Patna, Mob. No.: +91-9835478855
2. District Co-Ordinator, Hydrogeology, Drinking Water & Sanitation Department, Govt. of Jharkhand, Ranchi
3. Additional Director, Geology, Deptt. of Mines & Geology, Govt. of Jharkhand, Ranchi

Geology of the Area

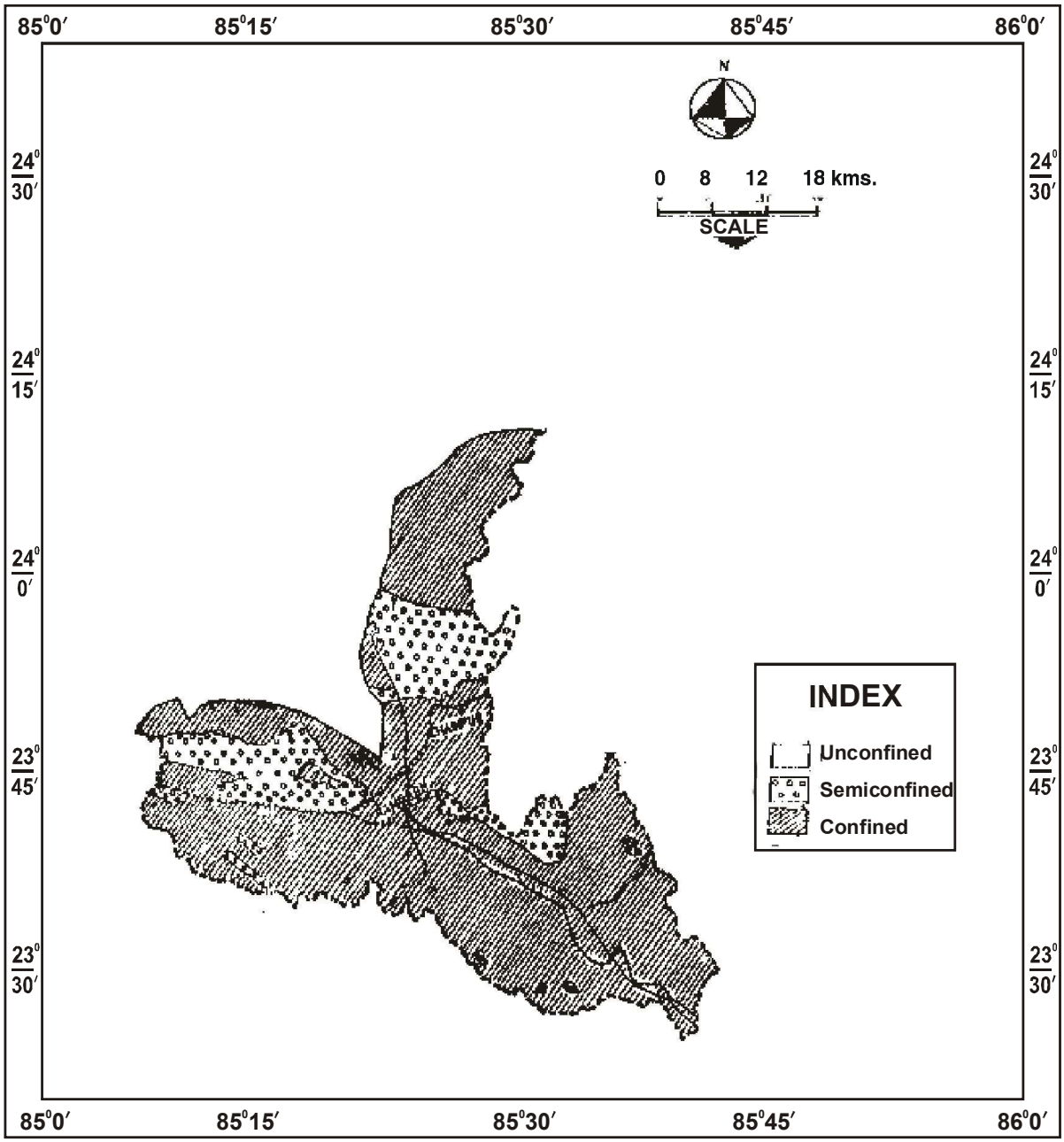
Jharkhand coal fields contain a number of thick and thin coal seams of barakars. Usually the barakar are represented by sandstones, shales, carbonaceous shales and coal seams while the barren measures by sandstones and shales only. Geologically other parts of the Ramgarh district consist of Biotite granite gneiss, Migmatite Augen gneiss, Porphyroblastic granite gneiss, Hornblende granite gneiss and Epidote granite of Pre-cambrian age. At few places Felspathic/ micaceous quartz schist, phyllite, mica schist, crystalline limestone and calc. silicate rock, Boulder bed sandstone, shale, dolerite, Amphibolite, horn blende schist, epidiorite, talc and chlorite schist are also exposed in different parts of the district.



MAP-2 : GEOLOGICAL MAP OF JHARKHAND COLLIERY OF MANDU BLOCK OF RAMGARH DISTRICT, JHARKHAND

Hydrogeology of the Area

The type of aquifer formation is mainly of semi confined or semi consolidated type. Water occurs in the porous granular colluvial material and weathered mantle as well as joints, fissures and fractures (CGWB, 1990). The consolidated formation of the district consists mainly of Pre-Cambrian formation where groundwater occurs either in the inter-connected joints, fissures and fractures or in the weathered zone of alluvium.



MAP-3 : HYDROGEOLOGICAL MAP OF JHARKHAND COLLIERY OF MANDU BLOCK OF RAMGARH DISTRICT, JHARKHAND

MATERIAL & METHODS

Systematic sampling was carried out for analytical study of ground water quality. The ground water collected from Dug well, Tube well and Hand Pumps were used as samples in the area under study.

The electrical conductivity and pH value of the samples were analysed with the help of a portable water-analysis-kit. Titration method was used to determine the concentration of bicarbonate (APHA, 1992). For heavy metal analysis, 100ml samples were acidified with $HN0_3$ and preserved separately. Fluoride and nitrate were estimated through spectrophotometer. Major cations (Ca, Mg, Na, K) were measured by Flame photometer. Analysis of Fe and Pb was done by AAS.

DISCUSSION

The hydrogen ion concentration (pH) is a very important chemical parameter. The pH value of various sampling stations ranges from 6.8 to 7.9 which exhibit slightly alkaline nature of ground water. Total hardness varies from place to place depending upon metallic contents dissolved in water samples. Here the value of total hardness ranges from 407 to 527 mg/l.

Electrical conductivity is the measure of current carrying capacity in water. Increased concentration of dissolved salts increases the conductivity which increases the pollution level. In the study area electrical conductivity value ranges from 1012.28 to 1510.04 micro Siemen/cm at 25°C. Total dissolved solids (T.D.S.) is one of the important parameters essential for the survival of living organisms. It causes gastrointestinal irritation due to its higher concentration. The value of T.D.S. in the study area is 419 to 859 mg/l.

High value of alkalinity can cause bitter taste of water. Here the value of alkalinity'ranges from 60 to 205 mg/l.

The presence of calcium depends upon the rock types present. The value of calcium ranges from 95.11 to 131.12 mg/l while the value of magnesium ranges from 25.63 to 45.17 mg/l. The value of sodium ranges from 32.00 to 65.00 mg/l whereas the value of potassium ranges from 3.09 to 6.14 mg/l. Higher values of chloride can make the water salty in taste. Its value ranges from 52.61 to 117.11 mg/l. The excessive amount of fluoride causes mottling of teeth and further it causes dental and skeletal fluorosis in extreme cases.

In a standard drinking water, fluoride is commonly found in ground water as a result of rough weathering of primary silicates and other associated accessory minerals (Kulshreshtra *et al.,* 2002). In the study area the values of fluoride and sulphate range from 0.14 to 1.30 mg/l and from 28.00 to 64.00 mg/l respectively.

The value of nitrate in the study area ranges from 0.07 to 16.01 mg/l. It is often seen that in ground water the presence of nitrate is very common due to aerobic decomposition of nitrogen from the organic matter found as pollutants. The chief sources of nitrate in the study area are industrial effluents present which show higher concentration at some sites above the desirable limit. The values of Fe,Pb and Mn are within permissible limits prescribed for drinking water.

CONCLUSION

The concentratian of Na+ in ground water is due to the presence of biotite granites gneiss and hornblende granite neiss in this area. Concentratian of anions like CI present in groundwater is due to calcification of coal beds. These anions separated from the stratified decaying vegetatian are dissolved in ground water. Concentratian of nitrate at some sites in the study area may be attributed to coal, local industries, mining,etc. (Environmental Chemistry, Dey,1986).

The chemistry af ground water is dominated by hydrochemical facies in coal mining area of Jharkhand coal fields (Tewary, 2009). Weathering of rock forming minerals and anthropogenic contributions related to mining are the major factors affecting water chemistry (Kumar,1992).Coal mining activity is unfortunately making a notable impact on the groundwater resources of the study area with nature and amount of minerals present in coal and associated rocks present there. The quality assessment shows slightly higher value af TDS, TH, Na, F, CI and NO^{-}_{3} at some sites in the Jharkhand coal fields or Jharkhand colliery of Ramgarh District, which make them unsafe for drinking purposes. This type of water can only be used after proper treatment.

It is recommended that efforts should be made to reduce the discharge of toxic and objectionable effluents from coal washaries and related industries to surface water bodies, ground water aquifer or usable land to minimum whereever possible.

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* Additional references were also consulted.

ANALYTICAL RESULT OF GROUND WATER SAMPLES OF MANDU BLOCK OF RAMGARH DISTRICT, JHARKHAND

Sl. No.	Location	pH	Total Hardness mg/l	EC in micro Siemen/cm at 25°C	TDS mg/l	$H CO_3$ mg/l	Ca^{++} mg/l	Mg^{++} mg/l	Na^{+} mg/l	K^{+} mg/l	Cl mg/l	F mg/l	SO_4 mg/l	NO_3 mg/l	Fe mg/l	Pb ++ mg/l	Mn mg/l	As mg/l
1	J1	7.5	407	1012.28	475	60	114.03	25.63	32.00	4.61	98.56	1.20	30.00	12.19	0.04	0.01	0.02	BDL
2	J2	6.8	483	1113.06	621	80	117.09	32.10	44.00	5.09	72.58	1.10	28.00	10.07	0.22	0.02	0.01	BDL
3	J3	7.6	476	1310.12	617	185	111.10	30.11	38.00	4.05	48.46	1.30	31.17	11.01	0.12	0.03	0.00	BDL
4	J4	7.1	447	114.39	704	205	95.11	28.14	31.00	5.03	52.61	1.20	64.00	18.41	0.10	0.02	0.02	BDL
5	J5	7.4	451	1021.82	513	85	117.06	34.10	35.00	8.13	57.10	0.34	55.12	16.01	0.01	0.03	0.00	BDL
6	J6	7.8	487	1336.92	727	190	119.11	30.12	65.00	5.16	88.14	0.55	37.10	12.21	0.32	0.01	0.01	BDL
7	J7	7.5	461	1284.49	419	90	117.06	31.05	36.00	6.00	96.05	1.10	34.05	10.61	0.04	0.02	0.02	BDL
8	J8	7.9	491	1418.43	731	195	121.17	39.11	45.00	4.00	98.14	1.00	36.11	11.59	0.02	0.01		BDL
9	J9	7.6	510	1510.07	447	97	125.14	41.02	41.00	4.17	121.00	1.20	41.23	14.50	0.15	0.03		BDL
10	J10	7.2	527	1016.43	859	85	131.12	45.17	58.00	6.14	117.11	0.85	39.06	12.10	0.1	0.05		BDL