Trace Element Geochemistry of Groundwater in and Around Zaheerabad Town, Medak District, Telangana State, India

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***Abstract*-Fifty Groundwater samples collected in and around Zaheerabad town has been analyzed using ICP-MS, for trace elements like Fe, Co, Cu, Mn, Zn, Pb, Cd, Cr, As, Al, and Ni. The Lead concentration in the groundwater of the area ranges from 0.005 µg/l to 0.050 µg/l, out of which 48% of the samples exceed the permissible limit of 0.014 µg/l. The minimum and maximum concentration of Nickel is 0.006 µg/l to 0.259 µg/l, out of which 38% exceed the permissible limits of 0.02 µg/l. The minimum and maximum concentration of Iron is 0.066 µg/l to 0.520 µg/l, 100% exceed the permissible limits of 0.003 µg/l. The minimum and maximum concentration of Aluminum is 0.030 µg/l to 0.387 µg/l out of which 10% exceed the permissible limits of 0.2 µg/l. The permissible limits are as per the WHO 2004 guidelines.**

The study area has lot of Agricultural activity and crops like sugar cane, Ginger, Turmeric, Maize, Jowar and Cotton are grown using non-judiciously the fertilizers and lot of pesticides. However the high Iron and Aluminum concentration is due to the laterites present in the study area. As water is used for both drinking and irrigation purpose measures has to be taken to reduce to use of fertilizers and pesticides. It is better to go in for organic farming.

Keywords*- *Trace Elements; Groundwater; Manjra River Basin; Medak; India

I. INTRODUCTION

Agricultural activity with lot of use of inorganic fertilizers and pesticides invariably cause environmental problems especially with regard to groundwater contamination as observed in study area. Fifty groundwater samples were collected from the study area to analyse for trace elements like Fe, Co, Cu, Mn, Zn, Pb, Cd, Cr, As, Al, and Ni. Most of the locations cover groundwater irrigated lands in the study area. Most of the industries discharge their effluents to water courses.

Growing pollution levels remains one of the widely discussed topics in realm of earth and environmental science. Understanding the effects of pollutants on ecosystem has become a matter of societal urgency because geochemistry of surrounding environment affects the human health and growth of society [1]. Abnormal presence of elements/ compounds/ chemicals in the environment may be both natural and anthropogenic factors. There is a growing awareness of the relationship between animal and human health and the distribution of chemical substances in the environment, first demonstrated by [2] & [3]. With growing industrialization, concerns continue to focus on anthropogenic accumulations of potentially harmful elements (PHE) such as As, Cd, Hg, and Pb and on organic compounds such as DDT, PCBs and dioxins [4]. In last few decades, availability of local and regional-scale geochemical data of rock and soils, groundwater have demonstrated that in addition to pollution related to anthropogenic sources, vast stretches of land have high concentration of naturally occurring heavy metals or radioactive elements. Trace elements constitute a natural component of the earth crust and they are not biodegradable, hence persist in the environment. Both natural and anthropogenic activities are responsible for trace metal contamination of ground water. Natural sources include weathering of minerals, erosion whereas anthropogenic activities include urbanization, industrialization, transpiration indiscriminate use of fertilizer, insecticide, pesticide and improper disposal of sewage and solid wastes [5]. The present work emphasis the trace element geochemistry of groundwater in and around Zaheerabad town, Medak District, Telangana state, India.

II. STUDY AREA

The Study area cover Zaheerabad town and its surroundings of Medak District situated at a distance of 100 kms away from Hyderabad, the capital of Telangana. The study area 167 sq.km covers twenty villages. It lies between $17^{0}45'$ and $17^{0}\,50'$ of North latitudes and $77^{0}30'$ and $77^{0}40'$ of East longitude falling in Survey of India toposheet number 56 G/9 and 56 G/10 (Fig. 1).

Geology of Study Area**:** The study area is represented monotonously by a single formation known as Deccan basalts and lateritic formations comprising nearly horizontal lava flows. In the present study, geological mapping has been done with IRS-1C, LISS-III satellite images, using ERDAS software for better exposition of hydro-geological features (Fig. 2).

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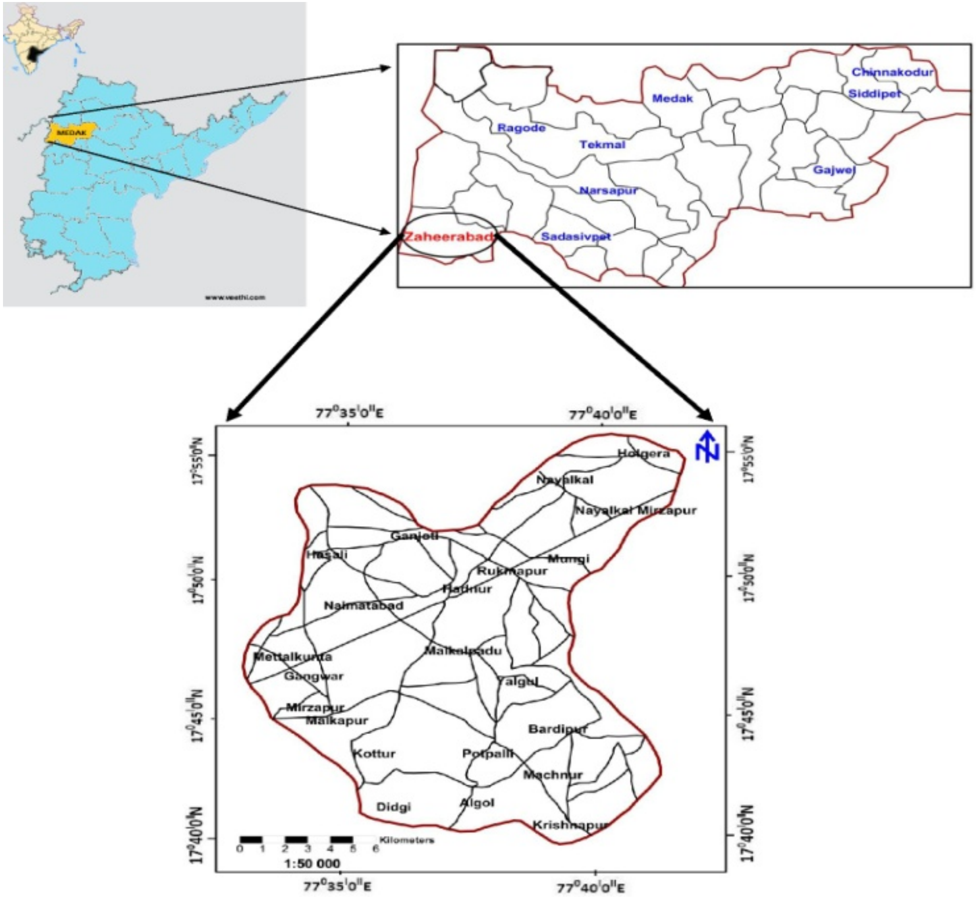

Fig. 1 Study area map

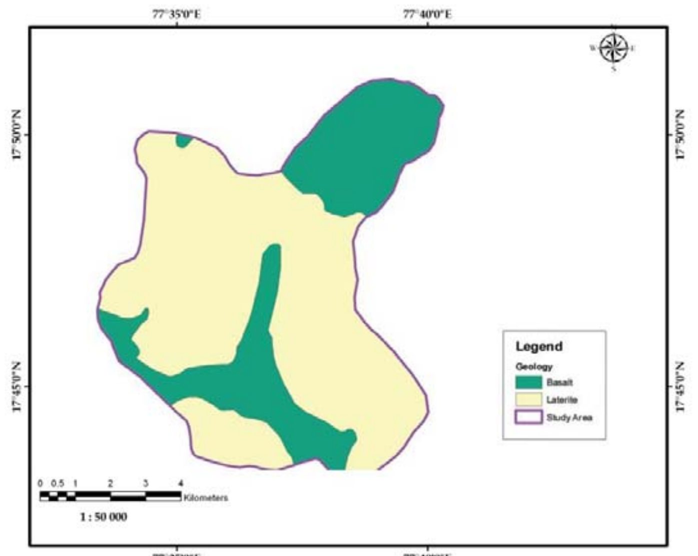

Fig. 2 Geological map of the study area

III. METHODOLOGY

Perkin Elmer SCIEX, model ELAN DRC II Inductively Coupled Plasma Mass Spectrometer (ICP-MS) was used for trace element analysis of groundwater. Filtered samples were directly introduced into ICP MS instrument by conventional pneumatic nebulisation, using a peristaltic pump with a solution uptake rate of about 1 ml/min. The nebulizer gas flow, sample uptake rate, detector voltages and lens voltage were optimized for sensitivity of about 50,000 counts/s for 1mg/ml solution. Calibration was performed using the certified reference material SRM NIST 1640 (National Institute of Standards and

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Technology, USA), for trace elements in natural water, to minimize matrix and other associated interference effects. Certified reference material for trace element in river water SLRS-4 (National Research Council, Canada) was analyzed as an unknown to check the precision and accuracy of the analysis. Blank were analyzed along with the samples and correction were carried out accordingly. The relative standard deviation (RSD) was found to be better than 6% in majority of cases, which indicates that the precision of the analysis is reasonably good.

RESULTS AND DISCUSSION: Links between the natural environment and human health have been suggested for centuries. In ancient India and China, minerals were understood to have healing as well as potentially deleterious properties. During last century the links between some of the elements are well studies and illustrated, for example an excessive intake of fluoride and arsenic through groundwater result in fluorosis and arsenicosis, whereas iodine deficiency in younger age may lead to mental retardation and brain damage. Similarly elements such as Be, Cr, Co, Ni, Cd, Hg, Rn, Ti, Pb, U, Po etc are recognized as cancerogenic and continuous exposure may prove lethal. May studies have pointed towards an inverse correlation between water hardness and cardiovascular disease and the associated mobility of metals in soft waters may also be a contributory factor [6].

The quantity of trace elements (Al, Cr, Fe, Ni, Co, Cu, Zn, As, Cd, Pb) observed in 20 villages of Medak district have been summarized and compared with [7] (Table 1). The element wise distribution in the study area is discussed as follows:

TABLE 1 TRACE ELEMENT ANALYSIS

S.NO	Analytic	Min(µg/l)	Max(µg/l)	Average	% of Samples exceeding WHO limits (2004).	WHO Guidelines (2004) (µg/l)
1	Al	0.03	0.387	0.109	10%	0.2
2	Si	0.054	1.818	0.345	100%	0.00005
3	V	0.002	0.182	0.029	100%	0.00002
4	Cr	0.005	0.062	0.012	2%	0.05
5	Mn	0.003	0.119	0.18	NIL	0.5
6	Fe	0.066	0.52	0.141	100%	0.003
7	Ni	0.006	0.259	0.032	38%	0.02
8	Co	0	0.002	0	NIL	-
9	Cu	0.005	0.093	0.02	NIL	2
10	Zn	0.019	0.427	0.096	NIL	3
11	As	0	0.004	0.001	NIL	0.01
12	Se	0.005	0.035	0.008	NIL	
13	Rb	0.001	0.067	0.005	NIL	-
14	Sr	0.001	0.788	0.214	NIL	-
15	Mo	0	0.104	0.005	2%	0.07
16	Ag	0	0	0	NIL	-
17	Cd	0	0.02	0.002	NIL	0.003
18	Ba	0	0.054	0.013	NIL	0.7
19	Pb	0.005	0.05	0.014	48%	0.01

Aluminum: In the study area concentrations of Aluminum ranges from 0.030 µg/l to 0.387 µg/l and 10% of the samples are exceeding the permissible limits of 0.2 µg/l [7]. This was observed at Metalkunta, Naimathabad, Algol and Krishnapur villages. The distribution of aluminum in the study area is shown in (Fig. 3). The parent rock in the study area basalt which, under the favorable conditions results in Lateralization of the parent rock. Basalt yields a residual product with relative or absolute enrichment of iron and aluminum along with titanium, accompanied by complete extraction of alkali, alkaline earth and silica along with other mobile elements.

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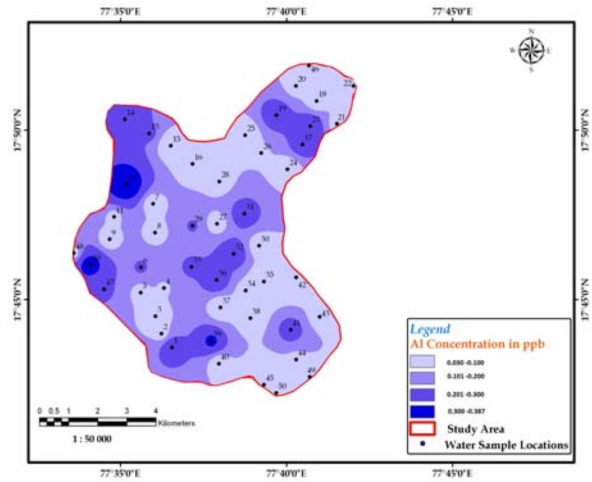

Fig. 3 Distribution Map of the Aluminum

The litho log in the study area has shown that the top Ferric crust is followed by Ferruginous lateritic and mixed aluminous lateritic pockets. There is little indication that aluminum is acutely toxic by oral exposure despite its widespread occurrence in food, drinking-water, and many antacid preparations [8], [9] observed symptoms of nausea, vomiting, diarrhea, mouth ulcers, skin ulcers, skin rashes and arthritic pain, when water containing increasing level of alumina was given.

Iron: In the study Iron concentration ranges from 0.066 to 0.520 µg/l. All the samples in the study area are exceeding the permissible limits [7]. The distribution of iron in the study area is shown in (Fig. 4). The high Iron concentration is due to the Iron rich laterites present in the study area.

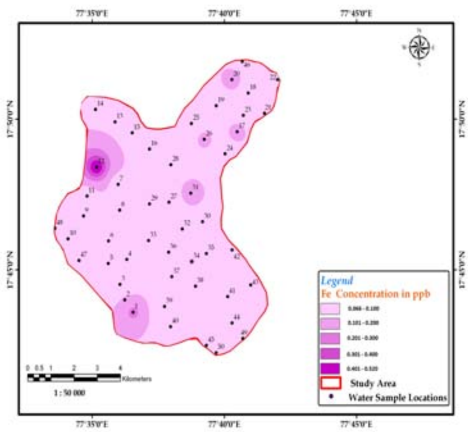

Fig. 4 Distribution Map of the Iron

Nickel: The Nickel concentration is high in western part of the study area, and the concentration ranging from 0.006 to 0.259ug/, of which 38 % exceed the permissible limits of 0.02 ug/l [8]. This was observed in villages of Didigi, Metalkunta, Namitabad, Malkalapahad, Yolgol, Nyalkal Mirzapur, Algol, Holgera and Bardipur. The distribution of nickel in the study area is shown in (Fig. 5). The primary source of Nickel is also released into the environment from various anthropogenic activities, like smelting, vehicle emissions, fossil fuel burning, disposal of household and, municipal, application of fertilizer and organic manures. The higher values in ground waters of the study area could be due to the use of phosphate rich fertilizers [10].

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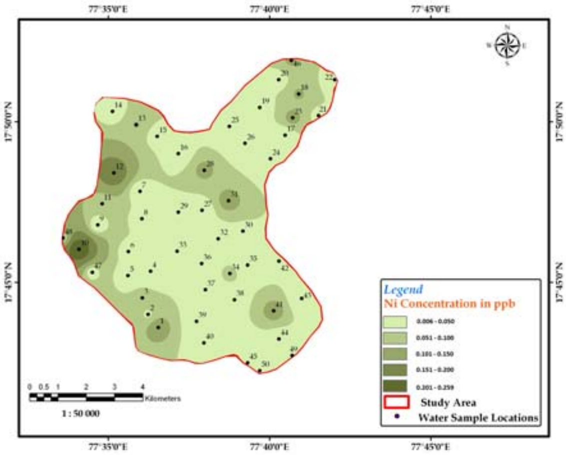

Fig. 5 Distribution map of the Nickel

Lead: In the study area the concentration ranges from 0.005 to 0.050 µg/l. The distribution of lead in the study area is shown in (Fig. 6). Forty eight percent of the samples are exceeding the permissible limits of 0.014 µg/l [7]. The study area has higher values. This was observed in Villages of Didigi, Kothoor, Namithabad, Gunjothi, Yolgol, Rejental, Algol, Machnur and Krishnapur. This is due to application of phosphate fertilizers in cultivation of sugarcane [11], [12].

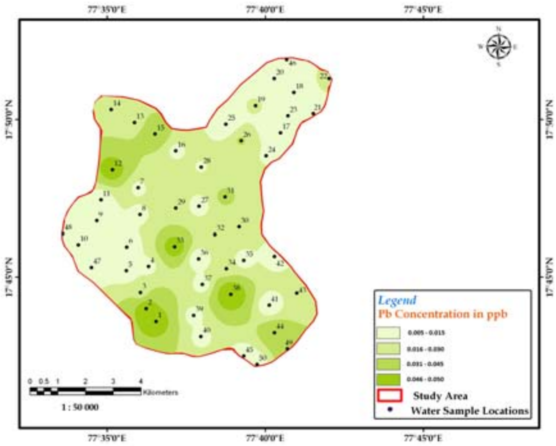

Fig. 6 Distribution map of the Lead

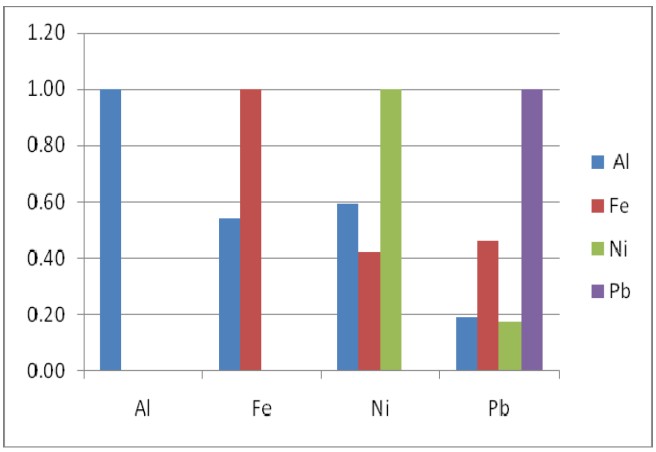

Fig. 7 Trace elements concentration

IV. CONCLUSION

The concentrations of the investigated trace elements like Fe, Co, Cu, Mn, Zn, Pb, Cd, Cr, As, Al, and Ni in the ground water samples of the study area, the higher concentration of Fe and Al is geogenic source as the parent rock is laterites, with regard to Pb and Ni the source is the non-judicious use of fertilizers and pesticides in the agricultural fields.

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The practice of using organic fertilizers and pesticides will solve the major problem of contamination and give the best quality agri products.

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TABLE 2 CORRELATION IN BETWEEN MAJOR ELEMENTS

	Al	Fe	Ni	Pb
Al	1.00	0.54	0.59	0.19
Fe		1.00	0.42	0.46
Ni			1.00	0.18
Pb				1.00

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