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Classification of deep ground water by using various graphical representation in the lower alluvial plains of *Narmada* valley between *Khalghat* and *Harinphal*, M.P.

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ABSTRACT

The present study deals with the classification of deep ground water by using various graphical representation in the lower alluvial plains of Narmada valley between Khalghat and Harinphal, M.P. In the present work, fifteen representative deep ground water samples were collected during premonsoon and postmonsoon period. The collected water samples were analysed with the help of standard methods proposed by APHA (1985). A variety of graphical representation methods like Colin's bar diagram, Trilinear diagram, Modified Trilinear diagram and Wilcox diagram have been used to classify the deep ground water into various geochemical facies. Plottings in various diagrams reveals that majority of the deep groundwater belongs to Calcium bicarbonate type without having any bicarbonate hazard

Key words: Water quality, geochemical facies, bicarbonate hazards.

INTRODUCTION

Water is the most important commodity for the agricultural production. The source of water for agriculture is either rainfall or groundwater. In Madhya Pradesh, Lower *Narmada* valley is the most important amongst the upland valley from the point of view of agriculture.

The most important and extensively developed rock formations in the area are the Deccan trap lava flows of Cretaceous-Eocene volcanic activity. Lower *Narmada* valley between Khalaghat and Harinphal is covered by the recent alluvial deposits.

MATERIAL AND METHODS

In order to classify the deep groundwater samples of the study area, in all fifteen representative period. The collected water samples were analysed using the standard methods suggested by APHA (1985).

In order to interpret the geochemical nature of water, a variety of graphical representation methods, proposed by various worker's from time to time are used. In the present study, Collin's bar diagram, Trilinear diagram, Modified Trilinear diagram and Willcox diagram after Collins (1923), Piper's (1944), Wilcox (1955) and Romani (1981) have been used to classify the deep ground water into various geochemical facies.

The concentration of major cations and anions have been converted into me/1 and percent reacting value of each ion has been computed and given in Table -1. The percent reacting values of deep ground water have been plotted in Collin's bar diagram. Trilinear diagram, modified trilinear diagram and Wilcox diagram. Plotting in these diagrams are shown in Fig. -1, 2, 3 and Tabular classification is given in Table -2.

Observations

When the chemical analytical data plotted in Collin's bar diagram, it reveals that the chemistry

Table 1 : Chemical Characters and Percentage Reacting values of Deep Ground water in the study area

			Premonsoon									monsoon								
			Chemical Characters			Percentage Reacting Values						Chemical Characters			Percentage Reacting Values					
S. No.	Name of the Village	Well No.	Lab. pH at 25°C	EC X 10^6 at 25°C	TDS	Na+K		Ca	Mg	CO_3+ HCO_3	SO_4	Lab. pH at 25°C	EC X 10^6 at 25°C	TDS	Na+K	Ca	Mg	CO_3+ HCO_3	Cl+NO_3	SO_4
1	Khalghat	4A	7.80	880	563	34	49	17	54	39	07	7.70	800	512	34	51	15	55	36	09
2	Ekalarakund	47A	7.90	840	538	54	28	18	53	37	10	7.80	800	512	54	28	18	52	37	11
3	Dewelra	57A	7.60	900	576	30	54	16	54	37	09	7.70	840	538	29	55	16	57	35	08
4	Mohipura	87A	7.60	930	595	29	43	28	52	38	10	7.70	870	557	29	46	25	54	37	09
5	Chhota Barda	93A	7.60	920	589	24	59	17	54	40	06	7.70	810	518	23	60	17	56	40	04
6	Chhota Barda	96A	7.70	920	589	21	69	10	45	52	03	7.70	870	557	21	69	10	47	47	06
7	Karoli	99A	7.60	900	578	33	46	21	52	44	04	7.70	840	538	31	52	17	50	44	06
8	Piplaj	120A	7.60	970	621	29	56	15	51	43	06	7.70	910	582	24	59	17	54	40	06
9	Piplaj	122A	7.80	1000	640	36	53	11	65	35	-	7.60	940	602	35	54	11	66	34	-
10	Kundiya	123A	7.70	980	627	39	47	14	51	43	06	7.60	950	608	36	45	19	55	39	06
11	Kalieri	124A	7.80	1100	704	27	51	22	49	44	07	7.60	1050	672	26	55	19	59	36	05
12	Barwani	131A	7.60	1150	736	33	49	18	41	53	06	7.70	980	627	38	47	15	51	43	06
13	Barwani	132A	7.70	1210	774	30	56	14	53	43	04	7.60	1070	685	32	55	13	62	37	01
14	Barwani	134A	7.80	1320	845	25	55	20	49	46	05	7.60	1050	672	26	55	19	59	36	05
15	Kalyanpur	141A	7.60	930	595	28	51	21	55	38	07	7.70	820	525	24	53	23	55	39	06
	Max.		7.90	1320	845							7.80	1070	685						
	Min.		7.60	840	538							7.60	800	512						
	Average		7.69	997	638							7.70	907	580						

Table - 2: Tabular representation of chemical analysis data of deep groundwater of study area

S. No.	Field/water classes	PRE MONSOON			POST MONSOON		
		Distribution of Well Nos	NOS	%	Distribution of well nos	NOS	%
1. TRILINEAR DIAGRAM							
1	1,3,5	4A,57A,87A,93A,96A, 120A,122A,123A,132A,141A	10	66.66	4A,57A,87A,93A,120A, 122A,123A,124A,131A, 132A,134A,141A	12	80
2	1,4,9	99A,124A,131A,134A	4	26.67	99A	1	6.67
3	2,3,9	47A	1	6.67	47A	1	6.67
4	1,3/4,5/9	-	-	-	96A	1	16.67
2. MODIFIED TRILINEAR DIATRAM							
A. CATION - ANION TRIANGLE							
1	C_1-A_1	57A,93A,120A,122A, 132A,141A	6	40.00	4A,57A,93A,120A,122A, 132A,134A,141A	9	60.00
2	C_4-A_1	4A,96A,123A	3	20.00	87A,123A,131A	3	20.00
3	C_3-A_1	47A	1	6.67	47A	1	6.67
4	C_1-A_4	124A,134A	2	13.33	99A	1	6.67
5	C_1-A_3	99A	1	6.67	-	-	-
6	C_4-A_3	131A	1	6.67	-	-	-
7	C_7-A_1	87A	1	6.67	-	-	-
8	C_1-A_4/A_1	-	-	-	96A	1	6.67
B. CENTRAL SQUARE FIELD							
1	GROUP I	4A,57A,87A,93A,96A, 99A,120A,123A,124A, 131A,132A,134A,141A	13	86.67	4A,57A,87A,93A,96A, 99A,120A,123A,131A, 132A 134,141A	13	86.67
2	GROUP II	47A,122A	2	13.33	47A,122A	2	13.33
C. WILCOX DIAGRAM							
1	CLASS II GOOD TO PERMISSIBLE	ALL SAMPLES	15	100	ALL SAMPLES	15	100
3. U.S. SOIL SALINITY DIAGRAM							
1	C_3S_1	1 to 15	15	100	1 to 15	15	100

of deep ground water shows considerable variation in their quality from place to place and from premonsoon to postmonsoon period (Fig. -1).

Piper's Trilinear diagram (1944) has been extensively used to understand problems regarding the geochemical evolution of groundwater. When the chemical analyses data of deep groundwater plotted in Piper's Trilinear diagram, it is observed from Fig. -2, Table -2, that about 67% and 80% of deep groundwater samples fall in the field No. 1, 3 and 5 during premonson and postmonsoon

periods. As per the Piper's classification, the hydrochemistry of deep groundwater is dominated by alkaline earth, weak acids and carbonate hardness exceeding 50% which is of temporary nature.

A Modified Trilinear diagram has been proposed by Saleem Romani (1981). It is a modification of Hill-Piper Trilinear diagram. In the proposed diagram, instead of equilateral traingles, right angle isoceles triangle have been used for

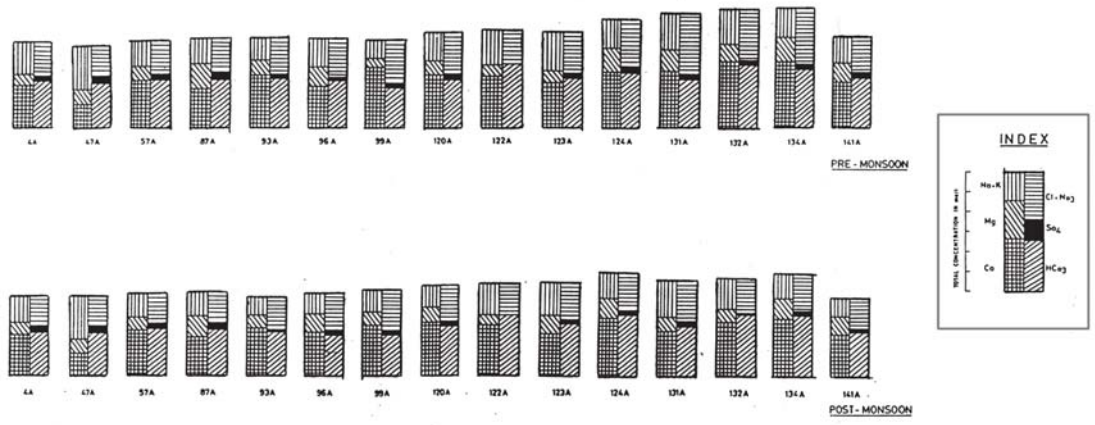

Fig. - 1: Collin's bar diagrams showing analysis of deep groundwater between Khalghat and Harinphal (M.P.)

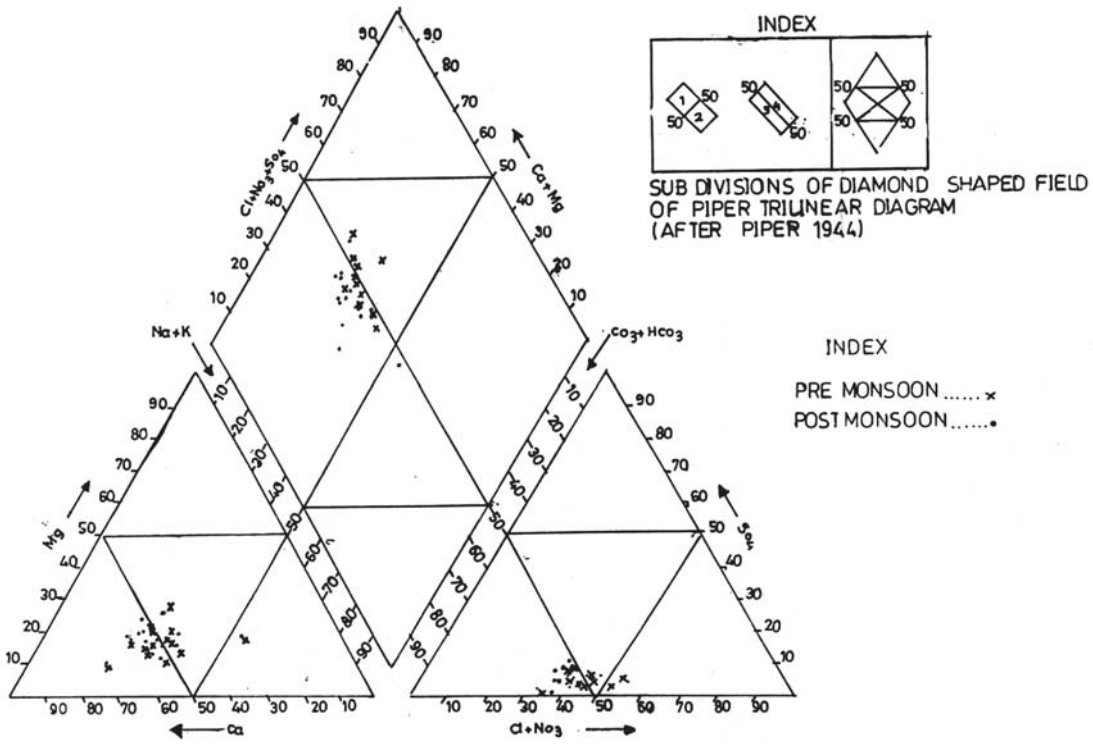

Fig. - 2: Piper's trilinear diagram representing chemical characters of deep ground water

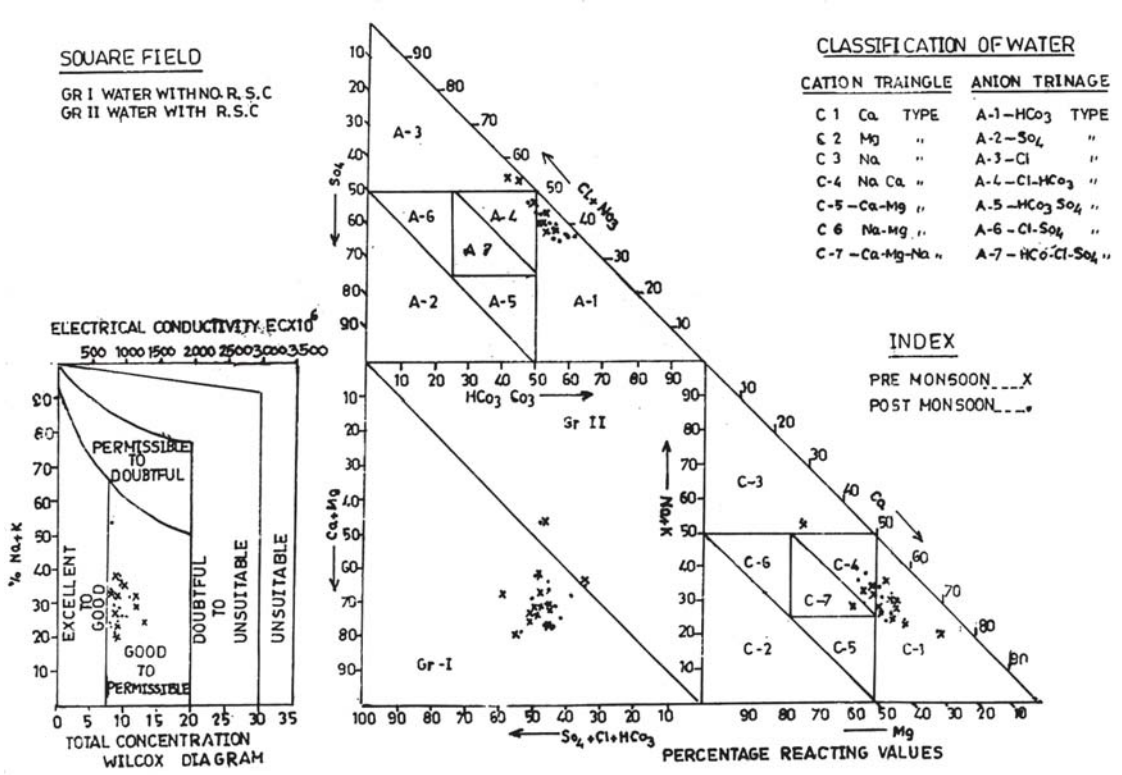

Fig. - 3: Deep groundwater analysis data in modified trilinear diagram

plotting the cations and anions. When the chemical analyses data plotted in Modified trilinear diagram. It is observed from Fig. -3, Table -2 that 60% and 67% of the deep groundwater samples collected during premonsoon and postmonsoon periods, fall in the field C-1 in cation triangle, which revals that deep groundwater is of calcium type, while 27% and 20% of tubewell water of premonsoon and postmonsoon periods fall in C-4 field which reflects that they belongs to sodium-calcium type. In addition to this 74% and 87% of tubewell water during premonsoon and postmonsoon falls in field A-1, which indicates that these water are of Bicarbonate type, while 13% and 17% of the tubewell water during premonsoon period fall in A-4 and A-3 fields in anion triangle which indicate that these waters belong to chloride-bicarbonate type and chloride type respectively.

In the proposed classification except water from tubewell No. 47A and 122A during premonsoon and postmonsoon periods, rest of the deep groundwater samples (87%) fall in Gr. 1 of Central square field which indicates that the water does not have bicarbonate hazard if used for irrigational purposes. When the central square field plotting are extended in Wilcox diagram, it is found that all the deep groundwater samples fall in good to permissible range and are thus good for irrigational purposes.

Conclusions

On the basis of chemical characters and graphical representations of hydrochemistry of deep groundwater in Collin's bar diagram, Piper's Trilinear diagram and Modified Trilinear diagram, it can be concluded that the deep groundwater exhibit both spatial and temporal variation in their quality, they are dominated by calcium-bicarbonate type and they do not have bicocarbonate hazards. As per Wilcox diagram incorporated in Romani's diagram the deep groundwater belongs to good to permissible range. Hence, the groundwater can be applied fruitfully for irrigational purposes.

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