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Study of Hydro Chemical Investigation ofTuppa Area, New Nanded, Maharashtra

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Abstract: *The 67 groundwater samples were collected from the basaltic aquifer of Tuppaarea, New Nanded, among these, 25 water samples from bore wells and 42 from dug wells. The collection of groundwater samples during pre-monsoon and post-monsoon seasons in three years (1997, 1998& 1999). The hydro-chemical investigations of the area werecarried out on the basis of Piper Trilinear diagram. The study shows that the dominance of alkaline element and secondary salinity particularly with dominance of $CaCl_2$.The Cl concentration of groundwater of study area has increased by Industrial pollution especially the discharge of HCl.*

Keywords*: Groundwater, Hydro-Geo-chemistry, Piper Trilinear diagram*

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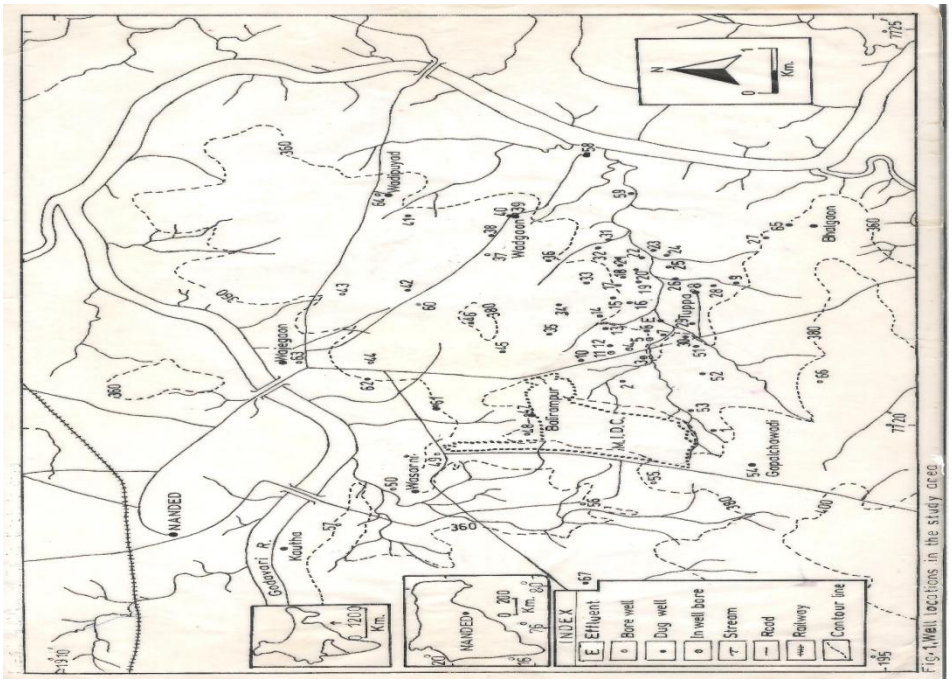
I. Introduction

The groundwater hydro-chemistry is controlled by the Industries, before 1990 the New Nanded are did not have the groundwater pollution problem. But after establishment of MIDC, this area facing the pollution problem.Several studies (Handa, 1975, Pawar 1993, Pawar et.al. 1998, SoroushModabberi2004)have reported the groundwater bodies becoming increasingly polluted of study area.

Study area

The Tuppa, NewNanded area covered by Latitude 18^0 16' and 19^0 55'N Longitude 76^0 55' and 78^0 20'E (Fig. 1). The population of Tuppa area is 55,650 and cattle population is about 19200. The study area is about 66km.^{2} ToposheetNo. 56E/8(Fig.1). In study area, the Industries are located on the flat elevated approximately 380 mt.MSL; with have gentile east, North Slope. The main rock type in this area is basalt. The occurrence of groundwater is mainly controlled by secondary porosity like joints, vesicle, cracks and fractures and in between lava flows (Pawar and Shaikh, 1995). In this area generally groundwater found at two levels a shallow aquifer and Deeper aquifer. In shallow aquifer, the rock type is weather amygdaloidal basalt and deeper, compact basalt.



II. Methodology

67 groundwater samples were collected from the study area, among these 25 from bore wells and 42 from dug wells during pre-monsoon (May) and post-monsoon (Dec.) twice in a year. The groundwater samples were collected in a one liter plastic can. Some parameters like EC. pH, and Tem. were measured immediately. The other parameters were determined in the laboratory. The titrimetric analysis procedure followed by APHA (1985).

III. Discussion

Hydro geochemistry:

The physicochemical analysis, result of groundwater from dug wells and bore wells are given in Table 1. The physicochemical parameters determined include pH, Temp. EC. TDS,Cl, TH, Ca, Mg,TA (HCO_3), Na, K,& SO_4(Table 1) The electrical conductivity (EC), values ranges from 326.78us/cm to 13893.20 us/cm in pre-monsoon. 634.82 us/cm to 16845.24 us/cm in post-

Table 1. Minimum, maximum and average values of all parameters.

		Pre-monsoon			**Post-monsoon**		
Parameters	Year	Min.	Max.	Average	Min	Max..	Average
Tem.	1997	25.00	32.00	29.00	21.00	33.00	26.99
	1998	27.00	35.00	29.00	18.00	33.00	26.43
	1999	26.90	33.00	29.00	19.00	33.00	27.20
pH	1997	6.75	7.00	6.99	5.95	7.81	7.10
	1998	6.00	7.20	6.83	6.76	8.50	7.40
	1999	6.00	7.98	6.54	6.02	7.98	7.32
EC	1997	1032.51	11935.69	2796.70	634.82	9074.04	2854.34
	1998	326.78	13893.20	3020.53	919.80	16845.24	3977.06
	1999	1118.80	10931.35	2606.80	1886.45	14076.37	5396.60
TDS	1997	660.80	7638.84	1782.77	406.28	5807.38	1826.32
	1998	209.14	8891.64	1944.77	932.29	10780.95	2537.12
	1999	716.03	6996.06	1668.34	1207.32	9008.83	3453.83
Cl	1997	110.76	2850.00	492.40	66.74	2170.00	468.66
	1998	90.00	3200.00	599.37	113.66	3210.00	585.44
	1999	150.00	2875.50	501.30	200.00	3535.00	1020.73
TH	1997	143.00	3375.00	717.80	120.00	2320.00	713.36
	1998	140.00	3400.00	664.62	120.00	3260.00	739.60
	1999	100.00	3350.00	784.45	42.00	3080.00	1o43,83
Ca	1997	68.13	1060.00	174.75	24.04	945.88	160,82
	1998	24.00	785,56	152.50	40.04	721.44	161.93
	1999	64.12	1334.66	171.28	48.09	569.13	164.02
Mg	1997	22.21	650.55	137.00	13.18	685.68	177.80
	1998	17.14	949.41	196.66	06.59	1392.85	234.70
	1999	04.81	404.45	93.36	26.37	949.41	364.32
TA	1997	11.00	610.00	309.92	38.00	900.00	355.56
	1998	85.00	900.00	219.82	110.00	1300.00	666.70
	1999	135.00	990.00	368.55	235.00	1200.00	502.60
Na	1997	19.00	714.00	95.24	9.00	78.00	36.00
	1998	4.00	92.00	30.51	23.00	484.00	170.24
	1999	37.00	350.00	140.40	18.60	226.00	129.04
K	1997	0.00	3.95	1.11	0.20	1.60	0.61
	1998	0.20	1.80	0.62	0.90	10.90	2.52
	1999	1.00	4.50	1.84	0.90	21.40	3.20
SO_4	1997	68.00	650.00	272.04	77.50	500.00	241.10
	1998	74.80	400.00	218.69	50.00	500.00	296.10
	1999	31.00	410.00	109.46	150.00	900.00	349.62

EC in micromohs/cm; Temp. In degrees and other values in mg/l

Monsoon. The concentration of Ca is ranges in 24.00 mg/l to 1334.66 mg/l in pre-monsoon and 24.04mg/l to 945.88mg/l in post-monsoon, as well as the concentration of Mg, ranges from 17.14mg/l to 949.41 in pre-monsoon and 6.59mg/l to 1392.85 mg/l in post-monsoon seasons. The data plot on the standard Piper diagram (Fig. 2 a, b, c, e, d, e &f)). The Piper- Trilinear diagrams are very use full in highlighting the chemical relationship of groundwater in more define terms than possible with any other plot (Walton, 1970). The Piper, (1944, and 1953) Trilinear diagram has three distinct field and an intervening diamond shaped fields. Piper-Trilinear diagram has been used extensively for classification of quality and to assess trends in water quality for group of samples. It is a basic to understand water quality (Back, 1960: Ophori and Toath, 1989;Sikdar et.al. 1993; Saha et al. 1997). The diagram uses quadrilinear variation in dominant ions using rhombohedral fields to classify hydro-chemical facies.

The data on chemical analysis of the ground water samples from the present study are plotted on the Piper-Trilinear diagram are given in Fig. (a-f). The different types of water identified in study area are given in

the Table. 2 (a & b) and variation in percentage of wells in each fields of Piper diagram are given in Fig.2 (a- f). It is seen that in pre-monsoon season 94.44; 100; and 84.30% of well water samples fall in the Field-1,ie. alkaline Earth(Ca+Mg) exceeds alkaline $CaCl_2$ is the dominant component in the Field -1.

In the pre-monsoon season of 1997 and 1998, strong acids also are seen to be dominant with 96.30% and 100% wells falling in the Field-4. In 1999, however, weak acids and strong acids proportion is almost equal with 50.47% and 49.01 % samples being in these Fields respectively. It is also seen that the
Pre-monsoon season of 1997 and 1998 exhibit non-carbonate hardness (secondary salinity) and in 1999 only 39.20 % of wells shows secondary alkalinity and 29.41 % of wells have CaCl2 dominance.

Most of the post-monsoon samples also fall in the Field-1, (1.93; 88.32; & 100%). Among the sub-division of Field-1 CaCl2 is a dominant shows year wise

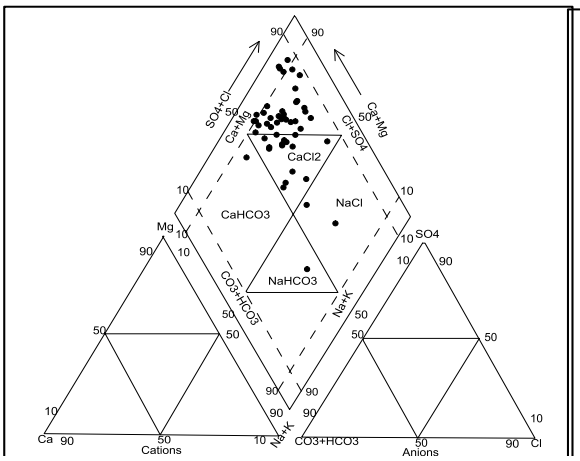
Table 2. (a) Percentage of wells in each fields of Piper Trilinear Diagram (pre-monsoon)

Year	Field-1	Field-2	Field-3	Field-4	Field-5	Field-6	Field-7	Field-8	Field-9	Field-9
1997	94.44	5.55	3.70	96.30	1.85	72.22	3.70	0.00	20.37	1.85
1998	100	00.00	00.00	100	00.00	44.44	00.00	00.00	5.55	00.00
1999	84.30	15.70	50.47	49.01	39.21	15.68	3.92	1.96	29.41	9.80

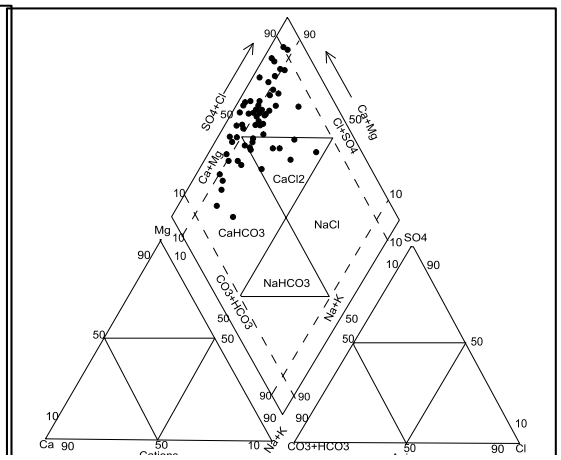
Table 2. (a) Percentage of wells in each fields of Piper Trilinear Diagram (post-monsoon)

Year	Field-1	Field-2	Field-3	Field-4	Field-5	Field-6	Field-7	Field-8	Field-9	Field-9
1997	96.03	0.00	17.90	82.10	18.00	71.63	0.00	0.00	10.44	0.00
1998	88.32	11.66	34.99	69.99	31.66	9.99	8.33	0.00	46.66	3.33
1999	100	0.00	6.55	93.44	6.55	54.10	0.00	0.00	39.34	0.00

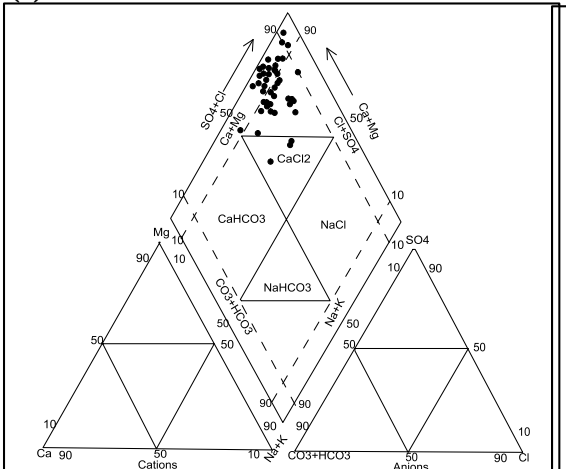
Increasing trend. It is also seen that for majority of samples strong acids predominate, over weak acids with 82.10; 69.99 and 93.44 % of wells being in the Field-4, among the sub-division of this Field also CaCl2 is dominant.



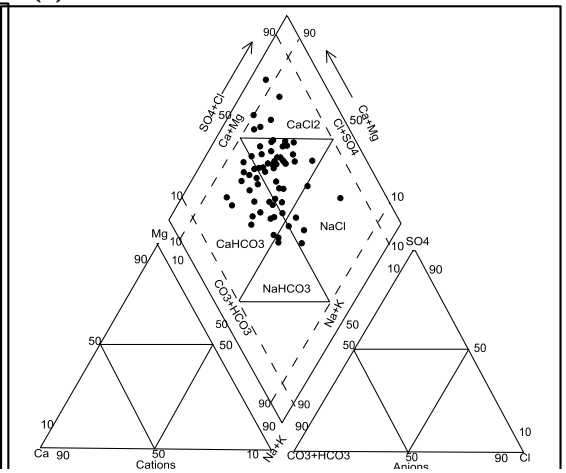
(a)Pre-Monsoon 1997



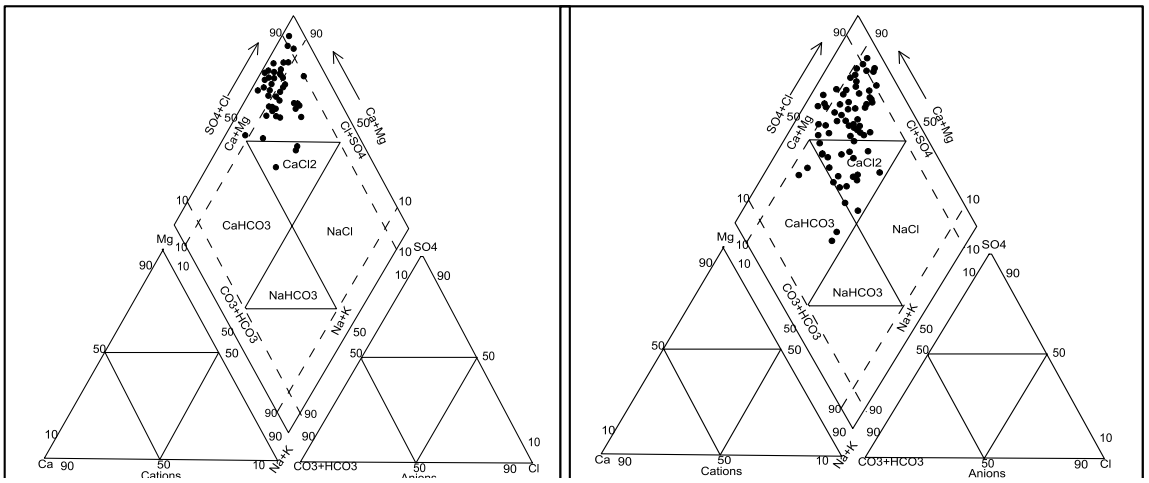
(b) Post Monsoon 1997



(c)Pre-Monsoon 1998



(d)Post Monsoon 1998



(e)Pre-Monsoon 1999 **(f)Post Monsoon 1999**

Fig. Piper Trilinear diagram showing water types in the study area.

Non-carbonate hardness (secondary salinity) is seen to be dominant in post-monsoon samples of 1997 and 1998. In 1998, on the other hand 31.66% of wells have secondary alkalinity and 46.66 % of wells show CaCl2 Overall, the groundwater from the study area shows dominance of alkaline earth, secondary salinity and dominance of CaCl2 in particular.

IV. Results And Conclusion

Considering the Hydro chemical facies (Piper Classification) in study area shows dominance of alkaline earth and secondary salinity particularly with dominance of CaCl2. The Cl concentration of groundwater of study area has increased because of industrial pollution especially the discharge of HCl.

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