

ON THE SALINITY OF GROUNDWATER IN SOUTH 24-PARGANAS DISTRICT,
WEST BENGAL, INDIA

P.G. ADYALKAR, P.C. GHOSH and B.C. MEHTA
Central Ground Water Board, Calcutta, India

ABSTRACT

The South 24-Parganas district of West Bengal comprises vast thickness of alluvial sediments deposited under different environmental conditions overlying the Tertiary sedimentary formations. Groundwater occurs under two well defined groups of aquifers ranging from 22-168 and 180-234 m b.g.l. The quality of groundwater differs in chemical types both in its vertical and lateral distribution.

INTRODUCTION

The study area is the part of the lower Ganga-Bhagirathi river basin. The flat deltaic alluvial plain is covered by the Quaternary sediments deposited by the Ganga river and its tributaries. The unconsolidated sediments mostly consist of the sequence of clays, silts, sands and gravels. Groundwater occurs under confined condition due to the existence of thick clay cover ranging from 15-76 m in the upper horizon. The paper discusses the nature of the quality variation and its possible interpretation.

MATERIALS AND METHODS

Nearly 80 water samples, collected from the tubewells sunk in the confined aquifers and from individual aquifer zones thereof during the packer tests performed at the time of well drilling operations, are considered in the preparation of the report. The major chemical constituents are determined according to the standard methods in vogue. The chemical types of water are based on the dominant cations and anions calculated as per cent reacting values. The chemical types of water from the deeper zones are portrayed in the diagram (Fig. 1). Bar diagrams illustrate the chemical constituents in equivalents per million, in some of the representative water samples. A north-south

section along the western part of the area depicted in figure 2 highlights the vertical distribution of the chemical types of groundwater.

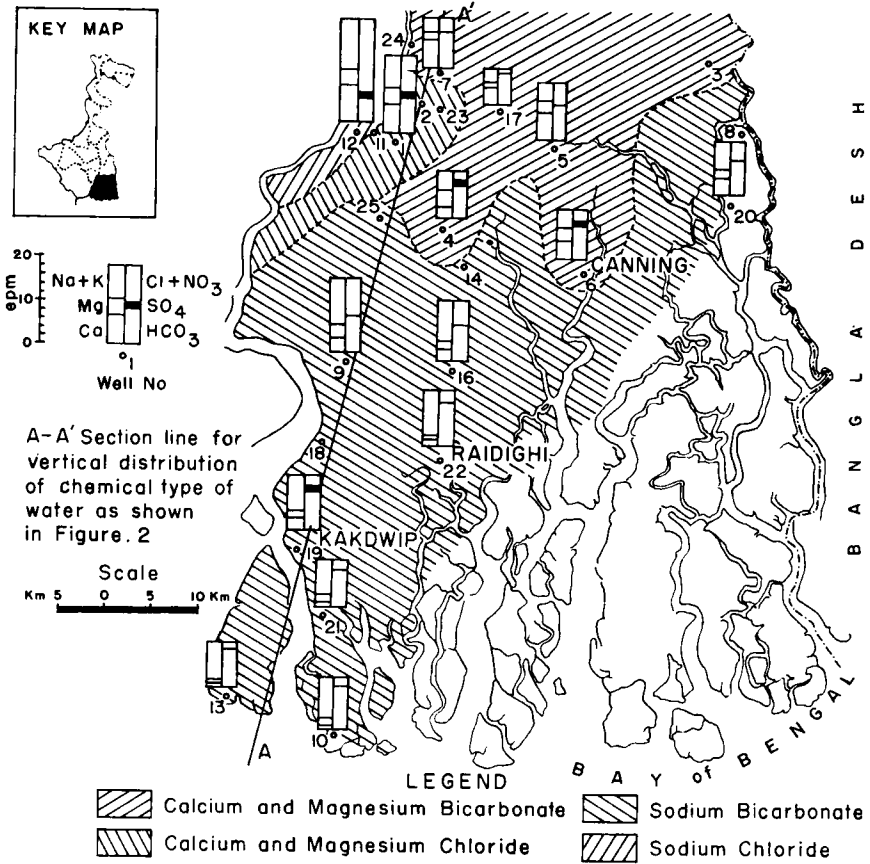


Fig. 1. Chemical character of groundwater in South 24-Parganas district, West Bengal, India

RESULTS

The chemical analysis results of some selected wells are given in Table 1. The groundwater in the northern fringe of the study area is predominantly of calcium and magnesium bicarbonate type (Fig. 1). The specific conductance and chloride values range from 700-1400 micromhos/cm at 25°C and 25-200 mg/l respectively. This is the recharge area. The aquifer materials are permeable in nature and the groundwater flows at a faster rate in its downgradient direction without much interaction with the hydrogeological environment.

Underlying the top clay horizon ranging in the thickness from 15-76 m in different parts of the area, the granular zones upto an average depth of 150 m (ref. 1) contain mineralised water of sodium chloride type (Fig. 2). Sodium and chlorides are invariably the dominant cation and anion. High bicarbonate and low sulphate in some of the waters are indicative of production of carbondioxide from the carbonaceous materials and sulphate reduction phenomena in the

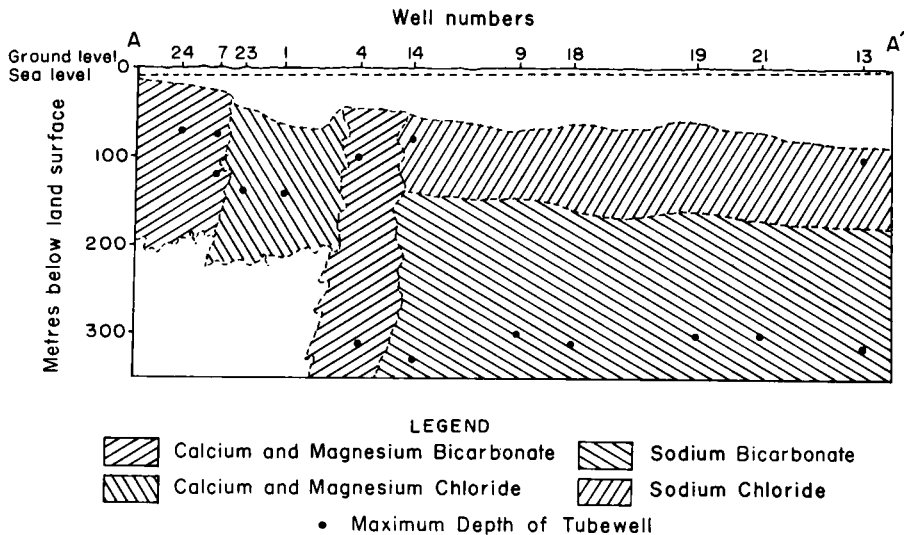


Fig. 2. Vertical distribution of the chemical types of groundwater in South 24-Parganas district, West Bengal, India

groundwater. Bromide in the saline water compares with the sea water diluted to the chloride content of the formation water.

Groundwater occurring in the lower aquifer zone of depth span between 180 and 434 m (ref.2), resting below a second layer of thick clay bed, is of sodium-bicarbonate type (Fig. 1 and 2). The specific conductance and chloride values range from 930-1650 micromhos/cm and 57-284 mg/l respectively. Groundwater is further conspicuous by the near absence of sulphate and containing high bicarbonate content. The production of carbon-dioxide due to the presence of carbonaceous materials in the sediments increase the calcium bicarbonate content. The base exchange reactions further change the composition to that of sodium bicarbonate type (ref. 3).

Calcium and magnesium chloride along with sodium chloride water occurs in the aquifer zone of depth range 75-200 m in Calcutta area. The mineralisation is considerably high. The chemical type has been formed as a result of the exchange of a part of the sodium ions of the saline water with the calcium and magnesium ions in the sediments through which the groundwater flows (ref. 4).

TABLE 1

Chemical analysis of water samples from South 24-Parganas district, West Bengal, India

Well No.	Location	Depth m b.g.l.	(in milligrams per litre)								T.H.	Sp. Cond µmhos/ cm at 25°C
			Ca	Mg	Na	K	HCO ₃	SO ₄	Cl	Br		
1.	Alipur	141	136	50	150	6.2	537	60	262	0.9	545	1757
2.	Beliaghata	150	162	55	129	4.3	439	23	376	1.4	630	1857
3.	Basirhat	52	104	27	55	1.8	549	3.3	25	-	370	985
5.	Bhangar	107	104	29	108	4.5	427	2.5	199	0.8	380	1300
8.	Dholtukri	114	80	71	644	-	409	5.0	1051	3.5	335	3817
13.	Gangasagar	320	13	9	175	3.9	479	Tr	57	-	65	930
14.	Goalberia-I	80	50	61	920	8.2	134	96	1602	5.6	110	4526
15.	Goalberia-II	342	56	33	114	6.4	470	29	78	-	275	1069
20.	Nezat	183	70	29	150	3.5	451	Tr	177	0.5	295	1238
23.	Sealdah	150	72	13	120	3.1	451	13	89	-	235	1003
24.	Sodpur	69	92	41	138	3.9	488	2.0	216	-	825	1399
25.	Thakurpukur	150	72	13	120	3.1	451	13	89	-	235	1003

CONCLUSION

Four chemical types of groundwater in the alluvial tracts of South 24-Parganas district of West Bengal in India are of calcium and magnesium bicarbonate, sodium bicarbonate, calcium and magnesium chloride and sodium chloride types. Possible chemical origin of the groundwater is due to the interaction of water with the hydrogeological

environment and sediment composition. The geological history of the deposition of the sediments, absence of saliferous beds, presence of bromide in equivalent quantities to dilute sea water, suggest that the saline water is indeed the remnant of the sea water diluted and modified at various stages.

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REFERENCES

1. A.K. Roy, Ground Water Resources of West Bengal, Tech. Bull. Series A, C.G.W.B., Government of India, 4 (1973)
2. G.C. Chatterji, A.B. Biswas, S.Basu and B.N. Niyogi, Geology and Groundwater Resources of Greater Calcutta industrial area, Bull. Series B, Geological Survey of India, 21 (1964).
3. Margaret D. Foster, The origin of the high sodium bicarbonate water in the Atlantic and Gulf coastal plains, *Geochemica et Cosmochimica Acta*, London, 1 (1950) pp. 39-45.
4. J.D. Hem, Study and interpretation of the chemical characteristics of natural water, second edition, Geol. Surv. W.S.P.1473(1970) p.136.