Trace Element Geochemistry in the Waters of Pulicat Lake, South India

Nagaraju, M., Dr., Atomic Minerals Division, Nagpur, India; Narasimharaao, K. L., Prof., Dr., S.V. University, Department of Geology, Tirupati 517 502, India; Gossmann, H., Prof., Dr., Albert-Ludwig-Universität, Institut für Physische Geographie, Werderring 4, 79085 Freiburg i. Br., Germany; Lacaze, B., Dr., Remote Sensing Centre, CNRS-CEPE, Route de Mende, BP 5051, 34033 Montpellier Cedex, France

ABSTRACT: The distribution of trace elements like Cu, Zn, Ni, Co and Mn in the waters of Pulicat lake has been studied in four aqueous environments - northern, central, southern and channel parts. It is observed that the concentration of the trace elements increase with increase of pH, chlorides and sodium in both monsoon and dry seasons. The concentration and the behaviour of the trace elements are controlled by adsorption, supplemented by organic reactions and by precipitation in sulphide-rich environments.

The geochemistry of the Pulicat lake (Fig 1) waters includes the study of major and trace elements. The major element geochemistry has appeared in an early issue of this journal (Nagaraju et al. 1990). Now in the present article the results of trace element study are put-forth which supplements major element geochemistry, and these together give a comprehensive picture of the geochemistry of the concerned lake waters.

For trace element analysis, 27 water samples from the lake and four from Buckingham canal were taken in two different seasons. The trace elements were analysed by atomic absorption spectrophotometry after complexing with APDC (Ammonium Pyrolidine Dithi Carbonate) and after extraction with MIBK (Methyl Iso Butyl Ketone, Brooks et al. 1967). Standards were made by spiking artificial sea water with known amounts of trace elements and extraction of those solutions. The results of the trace element data are presented in Tab 1. The average concentration of different trace metals in the waters from the different locations are given in Tab 2, to know the general variation as a whole in the lake water body. For comparison, the concentration of different trace elements in the normal sea water is also given in Tab 3.

Trace Elements

Copper

Copper solubility is generally lower in a reduced system than in an oxidized one. The concentration of Cu in the lake water ranges from 1.7 to 6.8 µg/l in monsoon season and 6.8 to 17.0 µg/l in dry season. When the concentration of Cu in the lake waters are compared with that of normal sea water (ie 0.9 µg/l, Slowey 1966), the lake waters of both seasons show higher concentration. In both the seasons waters in the northern part show higher concentration of Cu than in the remaining parts of the lake. During dry season the Cu concentration in the lake is higher than that of Bay of Bengal (4.9 µg/l, Analia and Sujata 1980), Arabian sea (4.9 µg/l, Sen Gupta et al., 1978), and lower than that of California brines (200 µg/l, Silvey 1967).

Zinc

Zinc is the most abundant trace metal present in the waters of the Pulikat lake. It ranges from 1 to 20.8 µg/l in monsoon season and 4 to 36 µg/l in dry season. There is not much variation in the lateral distribution of Zn in different parts of the lake. Regarding the vertical distribution, it is observed that the deep water samples contain more Zn than the surface waters. A similar observation was made by Nissenbaum (1977), in Dead Sea water. In dry season the lake water is found to contain more Zn than that found in the waters of the Arabian Sea (20 µg/l, Sen Gupta 1978). A comparison of the concentration of Zn, in lake water and normal sea water (5 µg/l, Slowey 1966), reveals depleted condition in monsoon season and highly enriched condition in dry season.
Nickel

Among the trace elements Ni is the second most abundant metal present in the waters of the Pulicat lake in both monsoon and dry seasons. It ranges from 0.5 to 7.0 µg/l in monsoon and 7 to 20.0 µg/l in dry season. The concentration of Ni, in Pulicat lake water is below that found in Dead Sea water in both the seasons. In dry season the concentration of Ni is above the concentration of

Tab 1 Trace element concentrations of waters of the Pulicat lake

Tab 2 Average concentrations of trace elements in waters of the Pulicat lake