Uranium in lake sediments – a report on Didwana Salt Lake, Nagaur District, Rajasthan

Surficial uranium accumulations are reported from a number of countries the world over[1], which are associated with valley fill calcretes, gypcretes, ferricretes and lake sediments in playa environment. Surficial occurrence in sediments of Lake Maitland and Lake Raeside in Australia due to precipitation from ground waters led to small tonnage low grade uranium deposits[1]. Similar occurrences are known from areas of semi-arid to arid climates bounded by latitudes 26°S and 29°S and are of recent (<1 m.y.) origin. In India, similar climatic conditions[2–6] exist in the state of Rajasthan bounded by latitudes 26°N and 29°N. Studies for surficial uranium occurrences are being carried out for the last two decades in Rajasthan[7] with limited success. However, recent studies in Nagaur district[8,9] have resulted in locating significant uranium values in soft chalky calcrete at Lachhri (27°32′51″N; 74°41′43″E) as well as in carbon phyllites of Delhi Supergroup near Indola ki Dhani (27°23′09″N; 74°32′36″E) to the SSW of Didwana. Follow up regional hydrogeochemical surveys indicated a uranium halo extending over 30 sq. km in a NNE–SSW direction and encompassing the above two areas. This uranium halo incidentally also encompasses the Didwana salt lake (Figure 1), which is one of the prominent salt playas of Rajasthan[10–12] and extends over 10 sq. km. It has a recorded sediment thickness of 20 m. This playa once supported large scale salt production but at present it has declined. There are a few pools of stagnated water during rainy season but otherwise, the lake surface is generally covered by a sheet of white salt for most part of the year. Systematic sampling of Didwana lake sediments (from open wells/well dumps) was carried out as it encompassed the uranium halo defined by water samples and also because the whole lake is underlain by phyllites/carbon phyllites which recorded uranium values up to 210 ppm on the western periphery of the lake.

Samples were collected from the dumps of open wells spread over >2 sq. km, which were sunk for drawing subsurface water for salt production. These wells were generally lined and during the surveys, one newly dug well was available for sampling. This well (Figure 2) is about 5 m deep and exposes 1 m thick wind blown sand/salt followed by 3–4 m thick dark grey coloured clay/silt rich in carbonates, which in turn is followed by 1 m thick calcretized grey/dirty white siliciclastic material of fluvial origin. All the units show calcite veining and also record 2–3 times background radioactivity.

Uranium values of samples collected from well section (9 to 16) and from nearby well dumps (1 to 8) are given in Table 1.

The average uranium content of 16 samples is around 60 ppm (samples

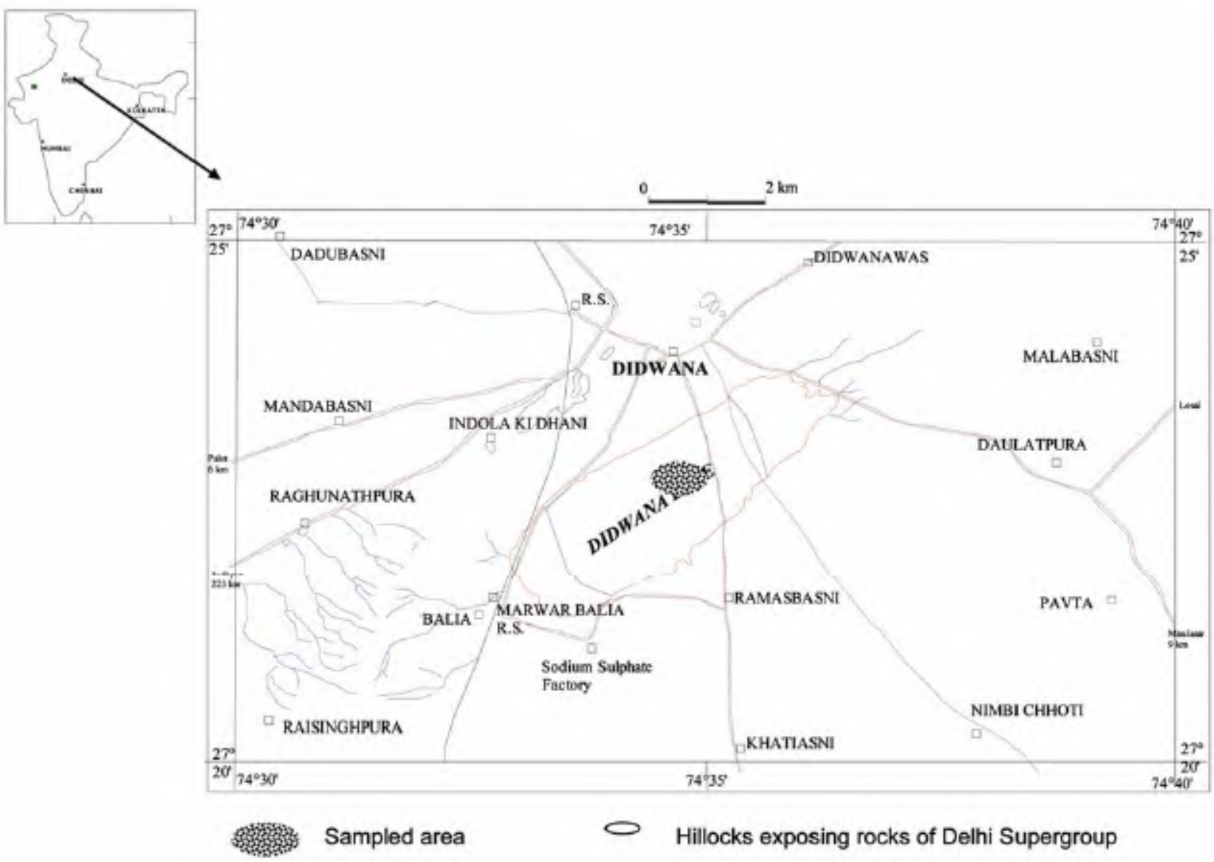

Figure 1. Didwana Lake, Nagaur district, Rajasthan (T.S. No. 45I/11).

Table 1. Uranium values of samples collected from well section (9–16) and well dumps (1–8)

Sl. no.	Sample no.	Rock type	Uranium (total) (ppm)	Uranium (leachable) (ppm)
1	DLUD-1	Clay/silt	74	71
2	DLUD-2	Clay/silt	32	24
3	DLUD-3	Clay/silt	67	66
4	DLUD-4	Clay/silt	10	7
5	DLUD-5	Calcretized siliciclastic material of fluvial origin	190	175
6	DLUD-6	Clay/silt	23	20
7	DLUD-7	Clay/silt	17	11
8	DLUD-8	Clay/silt	32	23
Average for 8 well dump samples			55	49
9	DLUD-P-1	Clay/silt	13	9
10	DLUD-P-2	Clay/silt	82	79
11	DLUD-P-3	Clay/silt	71	68
12	DLUD-P-4	Clay/silt	67	60
13	DLUD-P-5	Clay/silt	16	10
14	DLUD-P-6A	Calcretized siliciclastic material of fluvial origin	89	63
15	DLUD-P-6B	Calcretized siliciclastic material of fluvial origin	110	95
16	DLUD-P-7	Clay/silt	50	37
Average of 8 open well samples			64	55

Figure 2. ***a***, Calcretized siliciclastic material of fluvial origin at the bottom of pit. ***b***, Open well section of 5 m depth exposing 3–4 m thick clay/silt followed by sandy material of 1 m thickness towards bottom.

representing about 5 m thickness over 2 sq. km) of which 87% is leachable in acid. The leachability of this magnitude may be due to adsorption of uranium on clay/silt and/or due to uranium occurring as cementing material. Incidentally, lake water samples ($n = 5$) from these pits also show higher values of uranium (max: 2072 ppb; min: 244 ppb; av: 1039 ppb). The implications of these values both in lake water and lake sediments are being evaluated.

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