

Presence of U and Th in Cox's Bazar paleobeach aquifer, South-Eastern Bangladesh: Geological and hydrogeological controls

A.A. SEDDIQUE^{1*}, H. MASUDA², Y. KON³,
K. M. AHMED⁴, M. R. SHAIBUR⁵, S.N. ALAM⁶,
M. RAHMAN¹ AND A. HOQUE⁷

¹Dept. of Petroleum & Mining Engineering, Jessore University of Science & Technology (JUST), Bangladesh
(*aseddique@yahoo.com)

²Dept. of Geosciences, OCU, Japan (harue@sci.osaka-cu.ac.jp)

³Geological Survey of Japan, Japan (yoshiaki-kon@aist.go.jp)

⁴Dept. of Geol. DU, Dhaka (kazimatin@yahoo.com)

⁵Dept. of EST, JUST (shaibur75@yahoo.com)

⁶Dept. of Chemical Engineering, JUST (moni@jstu.edu.bd)

⁷Marine Fisheries & Technology Station, Cox's Bazar
(ashrafbfri@yahoo.com)

Cox's Bazar paleobeach (backdune area) and its surrounding area have been extensively utilizing pumped water from the subsurface aquifers to meet the demand for thousands of tourists along with domestic, aquaculture and agricultural purposes. A total of 105 groundwater drinking water samples collected from different depths of tubewells and analyzed using ICP-MS. Geochemical and mineralogical investigations were also carried out on the continuous core sediments (up to 18.9m depth).

Results show that shallow tubewells within the depth range of 25m waters are contaminated with radioactive heavy metals with the maximum concentration of 9.70ppb of U and 127.10ppb of Th. It appears that about 4% of studied tubewells exceed the WHO (1998) guideline 2.0ppb of U, but Th does not have WHO health-based drinking water guidelines. U and Th rich groundwater occurred in the high Eh (0.35-0.5V), and found in pH (6.6-7.5) and (8.0-8.5) respectively. U and Th are correlated with alkalinity (1.24-13.12 meq/l), Ce (0.01-9.89ppb) and an inversely with Pb (0.03-80.40 ppb). Elevated levels of total U (1.1-33.4mg/kg) and Th (6.3 -202.3mg/kg) are found in core sediments, which are also enriched with monazite (2.36wt.%) and zircon (3.28wt.%) found in organic-rich fine to very fine-grained sand sediments (up to 1.2m depth). In addition, monazite and zircon itself resulted to relatively rich in Th (3395.9-3937.5mg/kg) and U (850.7-990.6mg/kg), and Th (275.5-318.4mg/kg) and U (256.3-290.5mg/kg) respectively. Results of environmental stable isotopes ($\delta^2\text{H}$ and $\delta^{18}\text{O}$) indicate the rapid infiltration and recent recharge of surface water without significant effects of evaporation in groundwater.

Studies suggest that solubility of U and Th bearing minerals by carbonate complexation and predicted that successive recoils of U and Th. It is possible that the causes of the high level of Th and U in groundwater are leaching from naturally occurring radioactive monazite and zircon. Landuse changes, and the resulting changes in the hydrological conditions in soils and aquifers, might adversely influence to release the Th and U levels in groundwater in the area studied.