Mitigation of geogenic arsenic bearing groundwaters: Assessing the importance of risk substitution arising from waterborne pathogens

DEBAPRIYA MONDAL[1,2], DAVID A. POLYA[1]*, A.K. GIRI[2], M. BANERJEE[2,1], A. HEGAN[3,1], L.RODRIGUEZ-LADO[3], W. BRADFORD[1], N.BANERJEE[2,1], M. KUNDU[2,1] AND B. GANGULI[4]

[1]SEAES, University of Manchester, M13 9PL, UK (*correspondence: david.polya@manchester.ac.uk)
[2]IICB, Kolkata, India
[3]formerly European Commission, IES-JRC, Ispra, Italy
[4]Department of Statistics, Calcutta University, India

Concerns have been raised [1,2] that certain mitigations of geogenic arsenic-bearing groundwater (use as drinking water in many Asian countries) may result in increases in waterborne-pathogen-related health risks. The importance of such risk subsitution is disputed.

We report here a small study of on a geogenic arsenic-impacted area, Chakdaha Block, West Bengal. Mitigated supplied water and end-user household water were collected and analysed for both As and thermally tolerant coliforms [TTC] The method of Howard [2] was used to estimate key pathogen abundancies and attributable diarrhoeal disease DALYs; and that of Mondal [3,4] was used to calculate arsenic–attributable health risks for various sequela.

TTCs in supplied water was found to be a poor predictor of TTCs in end-user water, confirming the conclusion of Esrey [5] that sanitation and hygiene is of far more importance than improved water supply in determining diarrhoeal health risks. Improvements are required to our data and risk model, nevertheless, our results suggest that robust treatment of waterborne pathogens should be integral to any groundwater arsenic mitigation.

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Origins of the magmas parental to the chromitites

SISIR K. MONDAL*

Nordic Center for Earth Evolution, University of Copenhagen, Øster Voldgade 5-7, DK-1350, Denmark (*correspondence: skmondal@snm.ku.dk)

Major chromite deposits are genetically related to ultramafic-mafic magmatisms that are restricted to specific period of time and have specific tectonic settings. For example: (1) stratiform and discordant chromitites of sill like ultramafic intrusions within greenstone belts are genetically linked to widespread komatiitic magmatism representing major crust building processes of Earth through Archean; (2) stratiform chromitites of large layered intrusions of intracratonic rift settings representing widespread boninite-norite magmatism during the Neoarchean-Paleoproterozoic after the formation of a supercontinent and reflecting a period of global-scale mantle upwelling or enhanced plume activities and (3) stratiform and discordant chromitites of ophiolites are genetically linked to boninites of the convergent margin settings representing orogenesis in Phanerozoic. The chemistry of chromites of different tectonic settings strongly depends on parental melt compositions. Therefore, the process of magma generation is vital for the formation of the different types of chromite deposits in time. Osmium and O isotopic studies of Archean chromites within greenstone belts indicate that the parental magmas were crustally uncontaminated komatiite or boninite derived from the sub-continental lithospheric mantle (SCLM). In case of large layered intrusions e.g., the Bushveld complex, isotopic characters require that the parental noritic or boninitic magmas were contaminated in a lower staging chamber before to emplacement in a shallow crustal chamber. Alternative theory is that the Bushveld magmas were derived from the convecting mantle and interacted with the overlying Kaapvaal SCLM before to emplacement in the crust. Geochemical characters of the boninites parental to the ophiolitic chromite deposits are thought to reflect incompatible trace element enrichment of a depleted upper mantle by a subduction-derived fluid or melt before remelting, typically at low-pressure (<50 km) within supra-subduction zone settings.