Sulfide partial melting in the Himalayas: probable cause of As contamination in the Bengal basin

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Groundwater arsenic pollution in the Bengal basin has emerged as a major human health issue affecting millions of people in India and Bangladesh. Similar problems exist also in Myanmar, China, Cambodia and Vietnam [1]. Sediments from the Himalayas have been identified as the ultimate source of As [2] and bacterial reduction in the acquifers as the process of its release into groundwater [3]. However, the enrichment of As and its transport to the acquifers are poorly understood. We have documented sulfide ore partial melting at Rangpo, Sikkim, India, causing enrichment of As, Sb and Bi. This resulted in segregates of galena-tetrahedrite intergrowths associated with native Bi, arsenopyrite (FeAsS) and cobaltite (CoAsS) (Fig. 1A). Magnetite is associated with pyrrhotite being replaced by pyrite through greigite ($Fe^{2+}Fe^{3+}{}_2S_4$) (Fig. 1B).

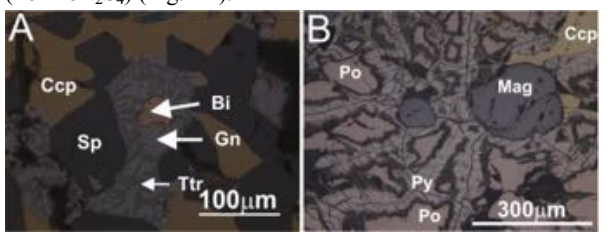

Fig. 1 Galena-tetrahedrite intergrowth with native Bi (A), pyrrhotite being replaced by pyrite and magnetite (B).

Experimentally, we have observed As_2S_3-melt reacting with pyrite/pyrrhotite producing metallic Fe, greigite and arsenian pyrite. Under reducing conditions, the release of As from arsenian pyrite may not be feasible, but As in greigite and magnetite that probably formed by the oxidation of greigite may be released. The high As encountered in the pore waters of reduced sedimentary layers in the Bengal basin [4] thus may be ascribed to the reduction of greigite and magnetite formed due to partial melting of Himalayan sulfide ores.

[1] Wang et al.,1993. *Bull Endem Dis*, **8**, 71–78. [2] Guillot, S. and Charlet, L., 2007. *J Env Sc and Health, Part A*, ***42***, 1785–1794. [3] Islam et al., 2004. *Nature*, ***430***, 68. [4] Harvey et al., 2002. *Science*, **298**, 1602–1606.