# A comparison of arsenic occurrence and geochemistry in two groundwater environments

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Arsenic occurrence and geochemistry in two distinctly different coastal aquifers has been investigated. The first, an unconsolidated sand and clay aquifer of eastern Australia, has been compared to groundwater composition contained within sand and gravel surficial deposits and bedrock of coastal Maine, USA. Both studies investigate the presence of natural arsenic in groundwater being used for potable supply.

The Australian aquifer, located in northern New South Wales, has been investigated in detail [1]. Dissolved arsenic concentrations are greater than 300 µg $L^{-1}$. Arsenic bearing stibnite deposits in the upper catchment have been fluvially eroded and transported over time to deposit an aquifer lithology elevated in arsenic. Current groundwater conditions are suitable for both arsenic mobilisation and immobilisation processes, producing a cyclic control on arsenic distribution. The redox state of the groundwater largely controls arsenic distribution. Reductive dissolution of iron oxyhydroxides releases arsenic into shallow parts of the aquifer (0-20m depth). As redox conditions become more anoxic with depth, the reductive dissolution of iron oxyhydroxides approaches completion and correlates with increased arsenic concentrations in groundwater. At depths of 25-30m, seawater intrusion draws increased sulfate concentrations into the fresh water aquifer and promotes reduction of sulfate and the subsequent precipitation of iron sulfides. Geochemical modeling and redox conditions support this hypothesis. Arsenic concentrations in groundwater signficantly decrease as iron sulfide minerals incorporate the arsenic into their mineral structure. Arsenian pyrite has been identified with an Electron Microprobe.

In comparison, the sporadic occurrence of arsenic in coastal Maine is proposed to derive from the oxidation of arsenical pyrite in fractured igneous and metamorphic bedrock of mid-coastal Maine [2]. Investigations continue in an extended area of coastal Maine to complement the work conducted by [2] and allow a detailed geochemical comparison to be conducted on two distinctly different coastal aquifers bearing similar aqueous geochemical signatures and associated health risk problems.

## References

[1] O'Shea B.M. (2006) *PhD Thesis.* University of NSW. Australia. [2] Sidle W.C., Wotten B., Murphy E. (2001) *Env. Geol.* **41**, 62-73.