Seawater pH records from a fringe coral reef in southern Hainan Island, the Northern South China Sea: Implications for ocean acidification

GANGJIAN WEI[1], LUHUA XIE[1], WEIZHONG WU[1], WENFENG DENG[1] AND MALCOLM T. MCCULLOCH[2]

[1]State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China
[2]School of Earth Environment, The University of the Western Australia, WA 6009, Perth, Australia

The observations for seawater pH time-series have been conducted since 2008 in Luhuitou coral reef, fringed to Sanya in the southern Hianan Island, the northern South China Sea (SCS). Diurnally cycles are the most significant variations for seawater pH on coral reef, with amplitudes up to 0.3~0.6 in general. High pH generally occur at noon (12 am ~ 2 pm), while low pH generally occur at mid-night (0 am ~ 2 am). The pH variations are highly correlated to those of dissolved inorganic carbon (DIC) and dissolved oxygen (DO) concentrations in seawater, as well as $\delta^{13}C$ of DIC and sea surface temperature (SST). This suggests that such seawater pH changes are mainly controlled by photosynthesis and respirations of the bio-mass on coral reef. Seasonal seawater pH variations on this coral reef are of ~0.3, and an ~0.1 pH decrease trend from 2008 to 2010 can be figured out. Such variation patterns apparently correlate to changes in atmospheric CO_2 concentration, but the variation amplitudes are significantly larger than that contributed from the increaseing pCO_2. Ecosystem decline on this coral reef possibly resulted from rapid urbanization in this region may account such seawater pH decrease.

A seasonal-resolution seawater pH record from 1980 to1996 has also been recontructed by the $\delta^{11}B$ of a *Porites* coral rom this reef. No decline trend of seawater pH has been observed during this period. Periodical variation with an apparent 10-yr period is clearly presented in this record, which is similar to that from the Great Barrier Reefs of Australia [2]. This indicates that natural variations for seawater pH with large annual amplitude (0.1~0.3) are generally observed on coral reefs in the west Pacific. Such variations are comparable to the predicted ocean acidification trend in the following centary (0.3~0.4 for global ocean: [1]).

[1] Caldeira and Wickett, 2003 *Nature*, , **425**:365. [2] Wei *et al*., 2009 *Geochim. Cosmochim. Acta*, , **73**:2332–2346

Deltaic landforms and stratigraphic controls on groundwater arsenic

B. WEINMAN[1]*, S.L. GOODBRED[2], A. VAN GEEN[3] AND A.K. SINGHVI[4]

[1]Univ of Minnesota, St. Paul, MN 55108, USA (*correspondence: bweinman@umn.edu)
[2]Vanderbilt Univ., Nashville, TN 37235, USA
[3]Lamont Doherty Earth Observatory, Pallisades, NY 10964, USA
[4]Physical Research Laboratory, Ahmedabad 380-009, India

Sediment deposits can have physical (hydraulic conductivity and anisotropy) and chemical (diagenetic) effects on biogeochemical cyclings. In Asian deltas, our sedimentological work shows that groundwater arsenic heterogeneity can be explained by an aquifer's depositional history. In Bangladesh, variable thicknesses of the floodplain's mud-capping (0-13m) allows for differential flushing in the shallow aquifer [1]. In turn, this allows for differential groundwater arsenic concentrations over 10's of meter distances, supporting more of a physical (flushing) control on arsenic by the sediments. In Vietnam, there is a more "chemical" type of sedimentary control, with higher groundwater arsenic sourced in Holocene sands, while lower arsenic is seen in water from Pleistocene units. This is different than the more "physical" sedimentary control observed in Bangladesh, indicating more of a reactive-transport or chemical (weathering) control by the sediments [2, 3].

Despite these differing chemical and physical effects on groundwater arsenic by their host sediments, one commonality between these and other arsenic-prone regions is that abandoned-channel facies consistently serve as local depocenters for muds and/or Holocene sand units, which both correlate to higher groundwater arsenic. This raises an ancillary concern about hydroelectric and other river-diverting projects, which can leave downstream areas starved for both sediments and water [4,5]. In the case of groundwater arsenic, we see these types of diversions as potentially mimicking the natural waning associated with the abandonment by a river, leaving a potential for new landforming events favoring higher arsenic concentrations in the groundwater.

[1] Weinman *et al*. (2008) *GSA Bulletin* **120**,1567-1580. [2] White & Brantley (2003) *Chemical Geology* **202**, 479-506. [3] Davis *et al*. (2004) *Eos* **85**(44), 449,455. [4] Vorösmarty *et al.* (2009) *Bull. Atomic Sci* **65**(2), 31-34. [5] Khalequzzaman (1994) *Nat Hazards* **9**, 65-80.