Bicarbonate alkalinity effect on the fluoride removal efficiency of activated alumina

S. SANJAY[1]*, B .D. TURNER[1] AND S. W. SLOAN[1]

[1]Centre for Geotechnical and Materials Modelling, Civil Surveying and Environmental Engineering, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia
(*correspondence: soumyamenon2006@yahoo.com.au)

Activated alumina is an effective adsorbent of fluoride from contaminated groundwater. However, there is ambiguity in the literature as to how the presence of bicarbonate alkalinity influences the removal of fluoride. For example, Schoeman *et al.* [1] established that the single imperative factor affecting the fluoride removal efficiency of activated alumina is the presence of bicarbonate alkalinity and this was apparent at pH > 7. The ad hoc Working group [2] determined that the effect of bicarbonate ions on fluoride removal by alumina remains negligible even at very high levels (over 4 g/L). This ambiguity in the literature is clarified through laboratory adsorption experiments using alumina.

Alkalinity batch tests were carried out using 33.42 mg/L and 334.2 mg/L initial fluoride concentration with 0, 500 and 2000 mg/L of bicarbonate ions (as H_2CO3). These tests were carried out for various pH range (pH6.5-9.5) for an alumina only system as well as for combination system containing 80:20 (w/w%) alumina and calcite.

The maximum bicarbonate alkalinity was obtained between pH 8-9 for all the tests. Observations show that the fluoride removal efficiency of activated alumina is not significantly affected by the presence of bicarbonate ions with only a slight (± 4%) difference in fluoride removal with increasing alkalinity for both 33.42 mg/ and 334.2 mg/L initial fluoride concentrations. However, at the same pH range the % fluoride removal for the alumina:calcite (80:20%) system at various equilibrium alkalinity proved to be significantly different. Adding 2000mg/L bicarbonate ions significantly reduced the % fluoride removal (±30%) for a system with 334.2 mg/L initial fluoride concentration compared to ±7% for 33.42 mg/L stock. The higher fluoride concentration will require more Ca^{2+} dissolution into the solution for fluorite precipitation. However, presence of high CO_3^{2-} alkalinity will prevent further Ca^{2+} dissolution for maintaining the system equilibrium thus inhibiting fluorite precipitation.

[1] Schoeman *et al.* (1987) *Water SA*, **13**(4) 229-234. [2] Ad Hoc Working Group technical report (2006)

High ^{3}He emanation observed in a forearc region and seismic tomography in SW Japan

YUJI SANO[1]*, AYANO KAMEDA[1], NAOTO TAKAHATA[1], JUNJI YAMAMOTO[2] AND JUNICHI NAKAJIMA[3]

[1]Ocean Research Institute, The University of Tokyo, Nakanoku, Tokyo 164-8639, Japan
(*correspondence: ysano@ori.u-tokyo.ac.jp)
[2]Institute for Geothermal Sciences, Kyoto University, Noguchihara, Beppu 874-0903, Japan
[3]Research Center for Prediction of Earthquakes and Volcanic Eruptions, Tohoku University, Aobaku, Sendai 980-8578, Japan

The Japanese Islands are divided into two major blocks, Northeastern (NE) and Southwestern (SW) Japan by Itoigawa-Shizuoka tectonic line. NE Japan is considered as a well-define island arc system with a deep trench, a frontal arc, a volcanic arc, and a back arc region with a marginal sea. There is a clear contrast of $^3He/^4He$ ratios perpendicular to the trench axis, low-*Ra* in the frontal arc and high-*Ra* in the volcanic arc. This may reflect the presence or absence of magma with high-*Ra* in the shallow crust [1]. In SW Japan a well-defined island arc system features has not developed. The volcanic front is not as clear as in NE Japan except for Kyushu and heat flow values are relatively high in the trench region. These features are generally attributable to the subduction of the young and warm lithosphere of the Philippine Sea plate beneath the Eurasian plate. In addition the Pacific plate descends from east beneath the Philippine Sea and Eurasian plates. This has resulted in a complicated surface geology and lateral heterogeneity in the upper mantle structure of SW Japan. In the Kinki district of SW Japan, anomalously high-*Ra* was observed in the frontal arc region that was called “Kinki Spot” [2]. The high-*Ra* cannot be attributable to dehydration of the young slab. Since the high-*Ra* is located at much wider region from the volcanic front when compared with NE Japan, the melt generated below the Philippine Sea slab may penetrate into the fissure of the slab tear and may arrive at the shallow crust by upwelling flow. In order to verify the hypothesis, we have collected several gas and water samples in the Kinki district. We measure the $^3He/^4He$ ratios of these samples and discuss data together with seismic tomography obtained from dense regional high-sensitivity seismograph network (up to about 900 stations) in Japan.

[1] Sano & Wakita (1985) *J. Geophys. Res.* **90**, 8729-8741. [2] Wakita *et al.* (1987) *J. Geophys. Res.* **92**, 12539-12546.