Kinetics of phosphorus adsorption on iron oxyhydroxide residuals

PHILIP L. SIBRELL[1*]

[1]U.S. Geological Survey, Leetown Science Center, Kearneysville, West Virginia, USA, psibrell@usgs.gov (* presenting author)

Experimental Research and Findings

We have investigated the use of iron oxide media generated from mine drainage residuals for the removal of oxyanions from waste water, with a special emphasis on phosphorus (P) [1]. The use of packed column or fixed bed sorption systems allows treatment of waste water without requiring subsequent solid-liquid separation, and has been the focus of our research. In these trials we used 2.5 cm diameter glass columns packed with air-dried iron oxyhydroxides for treatment of wastewater with a variety of influent P concentrations, flow rates and media particle sizes. We then used Adsorption Design Software from the Michigan Technological University [2] to model results, estimate test parameters and to predict future outcomes. Results of several fixed bed trials are shown in Figure 1, where the effluent P concentration (normalized by the influent concentration C_i) has been plotted as a function of treatment time. It is clear that early breakthrough of the P was experienced in many of the column tests. In the most successful test (Run 7), we removed over 96% of the P from the influent waste stream over a period of 46 days of continuous operation. We have also observed that performance was strongly related to the value of the surface diffusion modulus *Ed*, enabling prediction of column performance based on test conditions.

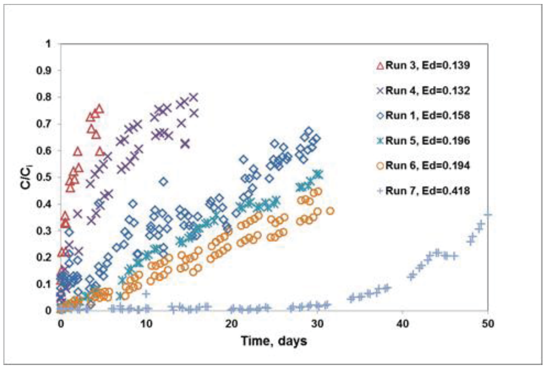

Figure 1: Fixed bed performance based on treatment time

Summary and Conclusions

Test results show that very good removal of P is possible using fixed bed columns packed with iron oxyhydroxide media. Conversion of test parameters into dimensionless forms enables prediction of the shape of the breakthrough curve based on the value of the surface diffusion modulus *Ed*. Preliminary batch tests with arsenic suggest that similar results may be possible for other metalloids as well, including arsenic and selenium.

[1] Sibrell *et al*. (2009) *Water Research*, **43(8)**, 2240-2250. [2] Mertz, K. A., *et al.* (1999) *Manual: Adsorption Design Software for Windows,* available at http://cpas.mtu.edu/etdot/

Zircon U–Pb, O and Hf isotope characteristics of granites emplaced during Cretaceous wrench to transtension in West Antarctica

CHRISTINE S. SIDDOWAY[1*], C. YAKYMCHUK[2], C. MARK FANNING[3], AND MICHAEL BROWN[2]

[1] Geology Dept., Colorado College, Colorado Springs, CO 80903, USA, csiddoway@coloradocollege.edu (*presenting author)
[2]Laboratory for Crustal Petrology, Department of Geology, University of Maryland, College Park, MD 20742, USA
[3]Research School of Earth Sciences, The Australian National University, Mills Road, Canberra, ACT 0200, Australia

The Fosdick Mountains in West Antarctica expose a migmatitic gneiss dome emplaced within a wrench setting during the Cretaceous dextral oblique convergence along the East Gondwana margin that affected both West Antarctica and once-contiguous New Zealand. Kilometer-scale, three-dimensional outcrop offers expansive views of a region of formerly melt-rich middle crust that responded to changes in strain during sequential wrench, transtension and oblique detachment [1]. Consistent with temperatures >800°C attained during metamorphism [2, 3], there is pervasive evidence for the prior presence of melt across a range of scales, including granite within foliation-parallel sheets and interboudin partitions, magmatic folds, and conjugate magmatic shear bands. Microstructures include euhedral to subhedral phases bordered by thin, delicate residual melt pseudomorph structures in interstices and on grain boundaries.

Based on SHRIMP U-Pb zircon and monazite geochronology for anatectic granites and residual migmatites, crustal melting, and melt transfer and accumulation occurred from c. 130 to 96 Ma, with the possibility that these processes were underway as early as c. 140 Ma [1, 3]. This previous work has revealed three phases of anatectic granite that occupy distinct structural settings. To evaluate whether there are distinctions in source for these three generations of granite, a Lu–Hf and O isotope study of previously dated zircon grains from 8 granite samples was undertaken. Taken together, zircons from Cretaceous granites show a comparatively large spread in εHf(t), with values from -14 to +5, and a wide range of δ^{18}O values between 6‰ and 14‰. In zircon of c. 120–99 Ma age, there is a trend toward higher δ^{18}O with greater homogeneity of zircon populations. An exception is one of the youngest granites, which has lower δ^{18}O values of 6.4 to 7.8. The isotopic characteristics of zircon from the three granite phases change with time. Zircon in c. 117–114 Ma granites, emplaced in steep foliation-parallel panels during *wrench* tectonics, has a wide range of δ^{18}O values from 6.2 to 11.6, reflecting a low degree of homogeneity of the zircon populations. Zircon in leucogranites that occur in subhorizontal sheets emplaced during *transtension* at c. 107–102 Ma, have elevated δ^{18}O values and more enriched εHf(t), attributed to a greater contribution of metasedimentary rocks in the source. Finally, zircon of c. 102 Ma age from a *detachment*-hosted granite records input from a source with more juvenile εHf(t) and δ^{18}O, which may mark the availability of a less-evolved, mantle-like source due to lithosphere thinning.

[1] McFadden et al. (2010) Tectonics, 29, TC4022.
[2] Yakymchuk (2012) this volume.
[3] Korhonen et al. (2012) J Metamorphic Geology, Early View.