Mobility of nanoscale zero-valent iron in quartz and carbonate sands

SUSANNE LAUMANN[1], VESNA MICIĆ[1], THILO HOFMANN[1,*]

[1]Department of Environmental Geosciences, University of Vienna, Vienna, Austria, susanne.laumann@univie.ac.at, vesna.micic@univie.ac.at, thilo.hofmann@univie.ac.at (*presenting author)

Abiotic dechlorination of chlorinated solvents by nanoscale zero-valent iron (nZVI) is an alternative remediation technology for deep aquifers or those underneath infrastructures. Its effectiveness depends on the nZVI properties and concentration, as well as concentration and distribution of contaminats. One prerequisite for a succesfull application of this technology is the delivery of nZVI particles to the contaminats [1]. Delivery is limited by nZVI mobility due to aggregation and deposition, all depending on water chemistry, nZVI properties, and aquifer surface properties.

Adsorbed anionic polyelectrolyte coatings provide electrostatic double layer repulsions between negatively charged nZVI particles [2], hindering their aggregation and also deposition on the negatively charged quartz surfaces (prevailing in aquifers). However, it is shown that the presence of surface charge heterogeneities in the aquifer, such as carbonates, effects the particle mobility [3].

Hereby we evaluated the mobility of commercially available nZVI particles in porous media that have different surface charges, namely quartz and carbonate sands.

Column experiments showed that the mobility of nZVI was reduced by ~45% in pure carbonate sand, compared to that in pure quartz sand. These results revealed substantially different attachment efficiencies of nZVI to these aquifer solids with different surface charges. The zeta potential varied from -40.6 mV in pure quartz sand to -13.6 mV in pure carbonate sands at pH value of 9.1 and 9.6, respectively. The results demonstrated the influence of surface chemistry of the two often encountered aquifer matrices on the mobility of nZVI particles. Further experminets are carried out aiming to evaluate the influence of other surface charge heterogeneities (such as presence of NOM and iron oxides) as well as of different groundwater chemistry on nZVI mobility.

[1] Tratnyek, P.G., Johnson, R.L. (2006), ***Nano Today*** **1**, 44-48. [2] Saleh, N. et al., (2007), ***Environmental Engineering Science*** **24**, 45-57. [3] Johnson, P. R. et al., (1996), ***ES&T*** **30**, 3284-3293.

The diversity of granitoids in the northern Kaapvaal craton records late-Archæan geodynamic changes

OSCAR LAURENT[1*], HERVE MARTIN[1], REGIS DOUCELANCE[1], JEAN-FRANÇOIS MOYEN[2] AND JEAN-LOUIS PAQUETTE[1]

[1]Clermont Université, Université B. Pascal, Laboratoire Magmas et Volcans (CNRS-UMR6524), BP10448, F-63000 Clermont-Ferrand, France. O.Laurent@opgc.univ-bpclermont.fr (* presenting author)

[2]Université Jean Monnet, Département de Géologie (CNRS-UMR6524), 23 rue Dr. Paul Michelon, F-42043 Saint-Étienne, France.

We studied the emplacement ages (LA-ICP-MS dating on zircons) and petrogenesis (major- and trace-elements, Nd isotopes) of granitoid rocks along a cross-section in South Africa, from the Murchison greenstone belt in the Kaapvaal craton to the Central Zone of the Limpopo mobile belt.

The ‘basement’ of the northernmost Kaapvaal craton is made up of deformed and variously migmatized granitoid gneisses of TTG affinity that emplaced as discrete events, in the time range of 3.20 to 2.85 Ga. The peraluminous biotite granites from the Turfloop batholith and Duiwelskloof area, located between the Murchison and Pietersburg belts, emplaced at ~2.78 Ga and have a crustal origin (TTGs, possibly metasediments). At the suture between the Kaapvaal craton and the Limpopo Belt, several metaluminous, high-K calc-alkaline granitoids intruded at ~2.69 Ga (Mashashane, Matlala, Matok, Moletsi). Their geochemical features indicate that they are composite complexes, whose genesis involved melts derived from both the reworked TTGs and mantle-derived intermediate to mafic material. Finally, the Bulai pluton (~2.59 Ga) emplaced in the Central Zone of the Limpopo belt further north. It shares unequivocal affinities with sanukitoids. It was generated by differentiation of primary monzodiorites [1], themselves deriving from a mantle source previously enriched by a sediment-derived felsic melt [2].

Therefore, while ‘classical’ Archæan petrogenetic mechanisms prevailed until ~2.85 Ga (protracted generation and recycling of TTG), the late-Archæan evolution is marked by a diversification of granitoid sources and crustal growth processes. In addition, whereas TTGs of all ages are randomly distributed throughout the whole area, younger magmatism shows a strict structural control: from south to north, emplacement ages decrease while mantle contribution increases.

This spatial and temporal evolution of granitoid magmatism in the northern Kaapvaal records fundamental geodynamic changes. In particular, while typical Archæan TTGs are only derived from meta-basalts at various depths [3], the magmas emplaced at the Archæan-Proterozoic transition involved a greater range of sources (from recycling of various crustal lithologies up to inputs of juvenile, mantle-derived material), thus resulting in a wide range of medium- to high-K granitoids. As the distribution, geochemistry and temporal evolution of granitoids in the northern Kaavaal recall those of post-Archæan late-orogenic settings, we propose that these rocks witness the progressive initiation of modern-style geodynamic processes.

[1] Laurent *et al*., *Precambrian Research*, submitted. [2] Laurent *et al*. (2011) *Lithos* **123,** 73-91. [3] Moyen (2011) *Lithos* **123**, 21-36.