Analysis of nanoscale Zero Valent Iron particles upon arrival at a monitoring well

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Nanoscale Zero Valent Iron (nZVI) has received significant attention in recent years due to its ability to rapidly destroy numerous priority source zone contaminants in controlled laboratory studies. This has led to great optimism surrounding nZVI particle injection for insitu remediation. However, rapid nanometal settling and poor mobility has been encountered, reportedly due to the ferromagnetic attractive forces between particles leading to agglomeration [1]. Studies have proposed different methods to screen attractive forces between nZVI particles [2, 3, 4], thus protecting them from agglomeration and preventing rapid settling. Although analytical techniques used to characterize particles confirm that these methods yield high quality particles that are stable and readily reactive for extended periods of time in the lab, several important questions remain.
How well can nZVI particles travel through the subsurface?
What is their state when they reach target contamination?
Do current methods used to detect nZVI particles in the lab lend themselves to field application?

In this field study existing synthesis techniques [2] were scaled up and 800L of nZVI was injected into a contaminated utility corridor containing various chlorinated solvents. nZVI particles intercepted by monitoring wells were analyzed using transmission electron microscopy and dynamic light scattering that characterize their size. The zero valent iron content of the particles was also compared to nZVI immediately after synthesis to gain insight into the characteristics of nZVI being delivered to the contamination.

[1] Phenrat *et al*. (2007) *ES&T* **41** 284–290 [2] He *et al*. (2007) *ES&T* **41** 6216–6221 [3] Saleh *et al*. (2005) *Nanoletters* **5** 2489–2494 [4] Tiraferri *et al*. (2009) *J. Nanopart. Res*. **11** 635–645

Seismological constraints on an evolution of the Izu-Bonin intra-oceanic arc

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JAMSTEC has been conducting intensive active-source seismic surveys to cover the entire Izu-Bonin arc. New seismological constraints on formation and evolution processes of the arc crust are revealed from those data. For examples, a large volume of felsic-to-intermediate component crust having Vp of 6.0 - 6.8 km/s is predominantly observed beneath basaltic volcanic centers along the current volcanic front. We also discovered a similar along arc variation of the felsic-to-intermediate component crust in the rear-arc, which is proposed to be separated from the volcanic front after Oligocene. These findings suggest that the main part of the arc crust consisting of the felsic-to-intermediate component was created before the rear-arc has been separated from the volcanic front probably in Oligocene age. From recently obtained seismic data in the fore-arc, on the other hand, we found that the structure of the fore-arc region represents significantly different characters from that of the volcanic front. Petrological studies in the fore-arc region proposed a formation of oceanic crust associated with boninitic volcanism during an initial stage of subduction. The newly obtained seismic structures in the fore-arc strongly support this idea; i.e. the crust beneath the Bonin ridge in the fore-arc is remarkably thin (less than 10 km), and velocity-depth profiles in the fore-arc is almost identical to that of typical oceanic crust.