On the peculiarities of Australian and Venezuelan pink diamonds: Influence of the geologic settings

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Pink diamonds have a heterogeneous color that typically is restricted to lamellae formed by plastic deformation oriented along {111}. Pink diamonds from Argyle in Australia and from Santa Elena in Venezuela show distinct visual and spectroscopic features compared to diamonds from other localities. Their pink color is prominent and has a banded pattern, sometimes wavy, interlaced with smaller bands of colorless areas. The birefringence indicates that the plastic deformation is located mostly inside the colorless areas for Argyle and Santa Elena diamonds, and inside the pink areas for other diamonds. Cathodoluminescence (CL) images show that plastic deformation features cut across the growth patterns of the diamonds. They quench partially the CL in colorless areas, while the pink areas retain growth sectors, as delineated in CL images by H3 and N3 centers. For other pink diamonds, the colored lamellae contain H3 and 405.5 nm centers. It is possible that for Argyle and Santa Elena diamonds, a pre-existing pink color was partially quenched during a later episode of plastic deformation. Conversely, diamonds from other localities apparently acquired their pink color from a later stage of plastic deformation. The geological settings of diamonds from Argyle in Australia and Santa Elena in Venezuela are similar, forming underneath Proterozoic cratons (and not the typical Archean cratons), that experienced high thermal events in their early histories.

Potential for widespread microbial liberation of structurally-coordinated iron from common clay minerals in marine sediments

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Clay minerals are the most abundant materials found at the surface of earth and they are the primary constituents of marine sediments. Iron, a limiting nutrient in many marine settings, is a common constituent of clay minerals. Recent *in vitro* experimental evidence has shown that lab cultures of Fe-reducing bacteria are able to utilize structurally-bound Fe from the crystal lattice of nontronite, an uncommon and particularly Fe-rich smectitie (>12wt.%). Reduction of structurally-coordinated Fe results in liberation of Fe(II) to solution, where it is available for other biotic processes, and the transformation of smectite to illite. However, it has remained unclear: 1. whether or Fe-reducers are able to access structurally coordinated Fe found in low wt.% in common clay minerals; 2. if naturally occuring populations of Fe-reducers are able to reduce structurally coordinated Fe as some lab strains are; and 3. if this process is significant in the marine Fe-cycle. In order to address these questions, we combined *in vitro* experiments using a suite of clay minerals with iron contents ranging from low (0.8 wt.%) to high (13.9 wt.%) with high-resolution analyses of sediment cores from the Santa Monica Basin, a location noted for a high benthic flux of Fe(II) from the sediments. Experimental evidence clearly indicates that, under *in vitro* conditions, Fe(III) bound in common clay minerals is available for reduction by the lab strain *Shewanella oneidensis* MR-1 as well as by naturally-occuring consortia of Fe-reducers cultured from the San Pedro and Santa Monica Basins. Analyses of sediment cores suggest that structural Fe bound in illite-smectite mixed layer clays (~3.0wt.%) of the Santa Monica Basin is bioavailable. Depth of smectite-illite conversion (<20cm) suggests that Fe may be liberated on the timescale of decades to ~200 years, contributing to the flux of Fe(II) from the sediments. Our findings suggest that common clay minerals may represent a large and previously unrecognized pool of bioavailable Fe in the world ocean that contributes significantly to biogeochemical cycling of Fe and C.