The biochemistry of unusual cytochromes isolated from acidophilic Fe(II)-oxidizing biofilms

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Acidophilic microbial communities found in the Richmond Mine at Iron Mountain, CA form abundant biofilms in extremely acidic (pH<1) and toxic-metal laden waters. Most of these biofilm communities are dominated by strains of *Leptospirillum* Group II (*Lepto* II), an acidophilic bacterium in the Nitrospira phylum. Biological Fe(II) oxidation is central to the metabolism of *Lepto* II, which allows it to grow autrophically in this extreme environment and generate the macroscopic biofilms observed at Richmond Mine. Environmental genomic and proteomic data has identified two novel *Lepto* II proteins expressed at very high levels in the many of these acidophilic biofilms. Purification of these proteins from the biofilms indicated they were cytochromes with unusual properties. Acid extraction of biofilm samples liberated one of these cytcohromes, a 16 kDa cytochrome with an a-band absorption at 579 nm (Cyt_{579}) localized to the periplasm of *Lepto* II cells. The second cytochrome also had an unusual a-band absorption, at 572 nm (Cyt_{572}), and was characterized as a multimeric protein complex bound to the outer membrane of *Lepto* II. Additional *c*-type cytochromes from *Lepto* II were identified by a combination of proteomic and biochemical techniques. Mass spectrometric investigations of these cytochromes have revealed post-translational modifications and sequence variation that correlate with distinct developmental stages in the biofilm lifecycle. These data have allowed us to propose a working model for Fe(II) oxidation by *Lepto* II, with Cyt_{572} as the initial Fe(II) oxidase and Cyt_{579} as the first electron acceptor. The *c*-type cytochromes may bifrucate electron flow to different complexes on the cytoplasmic membrane.

Geochemistry of host rocks and its implication on the genesis of orogenic gold mineralization within Sonakhan schist belt, Central India

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The late Archean-Paleoproterozoic Sonakhan schist belt belongs to Cerntral Indian Craton and preserves a complete greenstone-granite succession. Geochemical characteristics of the host volcanic rocks reveal iron enrichment signifying the tholeiitic character. Major element geochemistry of the Sonakhan mafic volcanics show signatures varying between an island arc to back-arc basinal tholeiites. The trace element data suggests that the mafic volcanics to be of oceanic tholeiites. Compared to MORB, chondrite and primordial mantle, these mafic volcanics are highly enriched in LILE and depleted in HFSE, which is one of the important characteristic features of arc related magmas. They show intermediate nature between MORB and island arc basalts. Negative Eu anomaly in mafic and felsic rocks reflect plagioclase fractionation. Thus, as a whole, volcanic rocks belong to oceanic tholeiites, show LILE enrichment and HFSE depletion.

Gold mineralization within Sonakhan schist belt has been studied in terms of its mode of occurrence, structural association, metamorphic setting, metal association, geochemistry of host rocks, nature and source of ore fluids, hydrothermal alteration and tectonic setting. Most of these evidences are very much similar to the gold mineralization of the orogenic belts [1, 2,3,4,5,6,7].

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