Biogeochemical responses to gamma irradiation treatment of Alberta oil sands fluid fine tailings

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Exploitation of the oil sands in Alberta has created large volumes of waste materials termed fluid fine tailings (FFT). These materials are stored in large settling basins to allow adequate separation of the oil sands process water and the FFT. The separated water in these holding areas are used either for future processing or it is allowed to settle before reclamation into functional wetlands and end pit lakes. A major concern is the presence of Naphthenic Acids (NA); these are a toxic, recalcitrant group of carboxylic acids naturally released from bitumen during the extraction process. An unexplored treatment option to promote or speed the degradation process and reduce *in situ* effects of NA's is gamma irradiation. In this study we examined the development of chemical REDOX gradients; and kinetic responses of indigeneous microbes inoculated into irradiated FFT material using laboratory microcosms.

The systems will be set up using representative young and aged FFT material in both oxic and anoxic environments. Temporal changes to porewater and headspace water geochemistry was tracked along with *in situ* microsensor profiles and microbial community succession patterns. These results will have implications in development of a model framework to optimize treatment based on biogeochemical responses to waste type.

Closed system vs. open system degassing: a combined textural and geochemical approach

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Eruptive styles of volcanoes span a wide range of dynamic, from effusive to explosive. They depend on the magma composition, the volume of ejected magma and the magma ascent conditions in the conduit, from the reservoir to the surface. Magmas with the same composition and pre-eruptive conditions can generate different eruptive styles (eg. multistyles eruptions) evidencing the dominant effect of the ascent conditions of magmas. Understanding the behavior of the volatile phase in relation with the rheology of the magma (viscosity) during magma ascent is one of the main stake.

A detailed study of the textural characteristics (vesicularity, microcrystallinity) of the products of explosive eruptions associated to their composition and volatile content (pre-eruptive and residual) allow to better define the relations between the magma behavior in the upper part of the conduit and the eruptive style. In low-viscous basic magmas, pre-eruptive volatile content is low (2-3 wt%) and bubbles move independantly in the melt, with a higher ascent velocity. Their coalescence forms large bubbles that blow up at the surface: the explosivity is low (strombolian eruptions). On the contrary, in high-viscous differentiated magmas, the pre-eruptive volatile content is high (up to 5-7 wt%) and bubbles display generally the same ascent velocity. The magma reaches the surface with a large proportion of bubbles (up to 75vol%) as an unstable foam, the fragmentation of which generates a high explosivity (plinian to vulcanian eruptions). In some cases, with similar magma composition and volatile content, part of the volatiles may escape through permeable conduit walls generating a bubble flattening and melt microcrystallisation, which in turn increase the magma viscosity, decreasing its ascent rate. At the vent, this magma is partly degassed with a very low explosivity potential (dome-forming eruptions), excepting some particular cases. All intermediate eruptive style exist between high and low explosivity, depending of the behavior of the magma during its ascent in the conduit.

We'll discuss all these cases including the extremes and inusual cases as basaltic plinian eruptions or explosive dome-forming through several examples taken in recent eruptions.

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