

**Microbes and minerals in permafrost: Quantifying  
microbe mineral interactions using positron  
emission tomography coupled to soft X-ray  
spectroscopy of psychrotrophic bioremediation in  
permafrost soils.**

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Recent advances in gamma detector technology, now make it possible to image microbial distribution and activity, at the millimetre scale throughout intact field soil cores. Improved positron emission tomography (PET) detectors can now be coupled with improved, sample preservation and co-registration techniques to optimize soft X-Ray spectroscopy of soil samples. Using PET and soft X-Ray spectroscopy, we evaluated how a novel biostimulatory solution promotes in situ bioremediation of hydrocarbon polluted permafrost soils. We characterized microbial distribution, activity, gene expression, metabolism, and composition in 15 different boreholes collected from the permafrost microbial community. Using the SGM beamline at the CLS, we then linked PET derived microbial activities to soft X-Ray characterization of mineral distribution within the soil core. Active microbial communities were linked with specific mineral complexes occurring in the soil surfaces. Future work will confirm that mineralogical changes occurring at the field scale can be observed at the milli and micrometer scale.