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Bioinduced weathering in Swedish boreal forest soil investigated by mineral amendment

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The purpose of this study was to investigate how soil mineral amendment affects microbial composition and how different mineral composition and varied depth influence these changes. Apatite, biotite and oligoclase were placed at soil horizon interfaces in a podzole in Bispgården, central Sweden (63°07'N, 16°70'E), between the summer of 2009 and 2011. Continuous measurement of soil chemistry; pH, dissolved organic carbon (DOC) and low molecular mass organic acids (LMMOAs) was performed for the surrounding soil during the frost free months of the two-year incubation period. Mineral sample surfaces were investigated using scanning electron microscopy (SEM) pre and post soil incubation to give a visual verification of weathering effects.

Evaluating soil chemistry data and data received at the end of the incubation period, results show that the highest concentration of LMMOAs is found in the E horizon and that it corresponds with the highest total fungal activity in the bulk soil. Total microbial activity was found to be highest in the O horizon. Measurements on the soil of the mineral surfaces show that in all cases, apatite stimulates the microbial activity the most, followed by biotite and last oligoclase. Comparing the soil horizons, effects on total microbial activity are the highest in the E horizon, but when looking at total fungal activity the biggest changes are found in O and B horizon indicating that bacterial and fungal activities are affected differently by mineral amendment. Using ANOVA followed by pair wise comparisons according to Tukey, significant differences were found in microbial activity between the soil horizons and also between most of the different minerals, compared with the bulk soil.

Looking at the SEM images taken before and after weathering, minerals placed in the O and E horizon are clearly the most affected, and the magnitude of weathering between the different minerals corresponds to the microbial activity found.