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The effect of soil solution chemistry on the weathering rate of a Histic Andosol

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Histic Andosol in Western Iceland was studied using laboratory based repacked microcosms conjointly with sampling of field soil solution. The main primary phase of the 205 cm thick soil profile was basaltic glass, allophane content ranged from 2 to 22 w.t.% and the soil carbon content ranged from 11 to 42 w.t.%. Mean summer soil solution pH value ranged from 4 to 6 with the lowest value at 80 cm depth and highest pH from 150 to 205 cm. Dissolved silicon increased from 0.19 mM at 15 cm depth to 0.78 mM at 80 cm depth and did not change in deeper horizons. Aluminium was 6 μM at 15 –35 cm depths, increased up to 140 μM at 80 cm depth, decreased to 20 μM at 115 before dropping to 2 μM at 150 to 205 cm depth. Mean sulphate concentration ranged from 0.43 to 1.14 mM, fluoride concentrations from 2.5 to 8.4 μM, and mean DOC concentration of 0.28 mM did not change down the soil profile. At constant temperature, the dissolution rate of the basaltic glass, and probably allophane and imogolite, was dictated by the a^3_{H+}/a_{Al3+} activity ratio only, which in turn is governed by the pH, total dissolved Al and the anions capable of complexing Al^{3+}; SO_4^{2-}, $F^-$and organic anions (DOC). Dissolution rate was slowed down by up to 20% by decreasing undersaturation in the field. Dissolution rate of basaltic glass was stable after an initial flushing event at the beginning of microcosm experiments. Predicted dissolution rates increased up to a factor of 7 and 30 by speciating Al^{3+} with oxalate in field and microcosms respectively. Speciation with oxalate generally had more effect in shallow horizons than deep horizons.