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Do earthworms affect the fractionation of silicon in soil?

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It is known that earthworms can increase the content of water-extractable silicon (Si) in soil, thus contributing to the availability of Si for plants. However, effects of earthworms on other Si fractions in soil, such as adsorbed Si, Si bound to SOM, Si occluded in pedogenic oxides and amorphous silica have not yet been studied. Therefore, we investigated the effects of the endogeic earthworm Octolasion cyaneum Savigny on the fractionation of Si in soils and that of the epigeic earthworm Eisenia andrei Bouché on the solubility of Si-containing model substances. We quantified the amounts of Si before and after passage through the earthworm gut by using a sequential Si extraction procedure. The amounts of Si extracted from the earthworms' casts were generally larger than in the undigested samples. This increase was especially pronounced for Si bound to soil organic matter (up to 41%), and for Si in wheat straw (up to 71%) and quartz (up to 1730%). With the soils, the increase in extracted Si was pronounced for the more mobile fractions (Si bound to organic matter and occluded in pedogenic oxides) at the expense of the fraction of amorphous silica. The amounts of mobile and adsorbed Si (plant-available Si) in soil tended to decrease after the passage through the earthworm gut, possibly by occlusion in aggregates formed in the gut. Our results indicate that both mechanical weathering of ingested Si-containing particles and microbial processes, promoting aggregate formation, SOM degradation and mineral solubility, contribute to the increased solubility of Si, which induced the redistribution of Si among fractions.