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Improved alkaline extraction method for biogenic silica determination in soils

Harold Hughes, Barbara von der Lühe, and Daniela Sauer
Georg-August-Universität, Physical Geography Dpt., Göttingen, Germany

Here we present the first results of an innovative technique aiming at measuring the biogenic and amorphous silica content in soils developed on basaltic rocks. Biogenic silica (BSi) has become important to many research domains like soil sciences, biogeochemistry, aquatic sciences, palaeoecology, or agricultural science. In most soils, BSi is a small but highly reactive Si reservoir in comparison to lithogenic Si sources. This high reactivity makes it a key component of the soil-plant Si cycle. In the last decade, the continental cycle of Si has been increasingly studied, because of I) its interest as a nutrient for plants and diatoms (e.g., impact of land-use change, export through harvest, influence on crops resistance to stress conditions,. . .) and II) the major role of Si during chemical weathering. Constraining Si reservoirs in soil is, however, not easy due to the ubiquity of Si. Many methods have been developed to quantify BSi content in soils (mostly alkaline extraction techniques) and other pools of Si (e.g., mobile Si, adsorbed Si . . . with the sequential extraction of Si from soil material). Biogenic silica extraction methods that are based only on solubility are, however, difficult to apply for environments where large amount of lithogenic amorphous or poorly crystalline aluminosilicates are present, like e.g. in volcanic areas, as their solubility is close to that of BSi. In the last few years, methods quantifying BSi content based on both the dissolution kinetic and the chemistry of the dissolving phases have been developed and applied to various materials, including volcanic soils. These methods allow a more accurate control of the dissolving Si sources, but their use remains limited. The aim of our research is to develop a cost-effective variation of this method, with which leachate solution is sampled at a lower frequency, but can be analysed for other cations (in addition to Si and Al), allowing a better constrain on the dissolving phases. Soil samples can be analysed without pre- treatment. However, the method reaches its full potential when used after applying the first steps of a sequential Si extraction. The sequential extraction removes mobile Si, adsorbed Si, Si occluded in oxides and Si bound to organic material, leaving only BSi and minerals and thereby simplifying the interpretation of the results of the BSi analyses.