Microbial, chemical and geotechnical characteristics of tropical heterogeneous soil

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Despite the presence of relevant biomass in the subsurface, soil microbiology has traditionally focused on superficial soils, where plant roots grow and microorganisms thrive, because of the importance of microbial processes in the maintenance of soil fertility and life on our planet. The vadose zone has been less studied and processes are still poorly understood, especially concerning tropical soils. Given the recent advances in environmental sciences, the relevance of interfaces between different areas of expertise must be evaluated. Also, some important phenomena of geotechnical engineering demands a better understanding of the role of biology and chemistry in soil properties and behaviour, and of the extension and usefulness of biological processes in geo-engineering. Subsurface soils present greater heterogeneity in the distribution of nutrients, carbon, water and oxygen, which leads to a greater variability in microbiota composition and activity. Besides, Brazilian residual soils present different characteristics from those from the Northern hemisphere, where most of the studies have been conducted to date; they frequently preserve the structure of the mother-rock and are very heterogeneous when not submitted to important weathering.

Environmental microbiota is the main regulator of soil processes, being responsible for the degradation and cycling of natural and anthropogenic compounds. Therefore, evaluating its metabolic state and composition allows assessing its biodegradation potential as well as monitoring biodegradation processes. However, environmental conditions, regulated by soil composition and structure, are determinant for these populations' distribution, composition and activity, hence the need to assess soil as a support for microbial growth and activities. Inter-disciplinary and multi-parametric studies analyse diverse parameters, providing different views for a better understanding of environmental processes.

This study has focuses a young residual soil from Rio de Janeiro, describing its main facies (one silty and one sandy) from a mineralogical, chemical and geotechnical point of view, relating these characteristics to those of the soil microbiota. Data show how microbial biomass and activity relate to carbon content, availability and use, as well as the relation between their distribution and soil characteristics. The sandy facies, despite a lower degrading activity, less carbon and water contents, supports a more efficient microbiota in carbon incorporation. In fact, soil carbon appears relatively more available than in the silty facies, and is allocated in more important amounts to the biomass. Those factors seem to be related to a better distribution of air, water and nutrients because of soil higher porosity due to its grain size distribution. Also, the sandy facies is a better drained soil where microbial activity is not disrupted by high rainfall, which seem to impact the microbiota in the silty facies because of higher water retention.

More powerful techniques will deepen this knowledge and different soils will be contemplated, seeking for comparative studies to validate this approach. The innovative integration of different areas contemplating environmental issues is thus highly emphasised by the pioneering combination of Geotechnical Engineering, Soil Microbiology, Geology, Chemistry and Agronomy.