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Evolution of lipid abundance and molecular composition during the podzolisation of laterites in the upper Amazon basin

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In the upper Amazon basin, the development of podzols at the expense of clay-depleted laterites is a natural process that leads to the remobilization of elements like Al, Fe and Si previously accumulated as a result of the ferrallitization process. Together with soil organic matter (SOM), they are redistributed within soil profiles or exported towards black rivers commonly draining podzolic areas.

Lipids generally accumulate in acidic environments and they could take part in the development of podzols due to their degrading action towards soil physico-chemical and biological properties. Furthermore, lipid evolution is affected by a wide range of factors such as pH, clay content, moisture, redox conditions, microbial activity, etc. They are thus useful biomarkers that provide information about the sources of SOM, microbial activity and pathways of degradation and/or stabilization of SOM.

The vertical and lateral evolution of free lipid content and molecular composition was investigated in key samples of a soil sequence representative for the transition between latosol and podzol in the Rio Negro basin, as well as in the overlying litter.

In this environment, lipids do not accumulate in the early stages of podzol development. Their abundance is especially low in horizons rich in organometallic com-

plexes, suggesting an immobilization through complexation. On the opposite, they accumulate in well-developed podzols, more than total SOM. Their stabilization is likely favoured by (i) acidity and waterlogging, (ii) a depletion of complexing elements like Al^{3+} and (iii) a decreased microbial activity, perhaps associated with the toxicity of lipids themselves towards microorganisms.

Lipid composition first reveals differences in microbial activity within the sequence. Both in surface horizons and poorly-developed podzols, it is high and leads to the release of numerous root-derived suberin monomers. Changes in relative abundances of microbial biomarkers also suggest an evolution in the structure and/or activity of microbial communities in surface horizons with increased podzol development. Then, similar distributions of various compound classes suggest the illuviation of colloidal SOM from surface to Bh horizons. At last, the occurrence of polyaromatic triterpenoids in deep horizons of the well-developed podzol provides evidence for the occurrence of anoxic conditions that certainly also contribute to the stabilization of phytotoxic lignin-derived aromatic compounds.

Taken together, these data show that free lipids do not seem to be involved in the initiation of podzol development, but that they may play a role in further enhancement of soil degradation.