



## Carbon isotope studies and lignin analysis of plants and soil organic matter detect vegetation changes in the southern Brazilian highlands

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The isotopic and biochemical composition of plants, organic surface layers and humic substances from 13 soils was characterized to discover the origin of the present mosaic of grassland ( $C_4$ ) and *Araucaria* forest ( $C_3$ ). The bulk soils were separated into light and heavy fractions by density fractionation.  $^{14}C$  dating and  $\delta^{13}C$  values reflect a chronosequence of *Araucaria* forest expansion on grassland which started after 1300 yr BP. The  $\delta^{13}C$  signature of lignin oxidation products (alkaline CuO oxidation, GC/C-IRMS) show that the differences between  $C_4$ - and  $C_3$ -derived phenols in the  $^{13}C/^{12}C$  isotopic signature are similar to those in bulk material. In addition, the isotopic signature of lignin derived phenols indicate that the  $^{13}C$  depletion with depth in old grassland soils results partly from the relative accumulation of  $^{13}C$ -depleted lignins. Forest expansion on grassland is clearly shown by  $^{13}C$  enrichment with depth and changes the composition of soil organic matter towards higher amounts of aliphatic compounds and lower aromatic C and O/N-alkyl C contents as detected by  $^{13}C$  NMR spectroscopy. Thus, current grasslands represent relics from periods with drier climate than today in the early and mid Holocene and are not the result of recent deforestation.