Zircon from kimberlites of the Nyurbinskaya pipe as indicator of kimberlite emplacement and lithosphere evolution

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About 300 zircon grains have been recovered from the kimberlite concentrate of the Nyurbinskaya pipe with the aim of finding mantle zircons that would allow estimation of the age of kimberlite emplacement. We evaluated the kimberlitic or crustal origin of individual zircon grains using a two-step approach. The first step included the preparation of mounts, collecting cathodoluminescense images of the zircons, electron microprobe analysis of major elements and LAM-ICPMS analysis of trace elements. These data identified zircons with low content of U (<50ppm) and Y (1-150ppm) and low Nb/Ta (<3) ratio of probable mantle (kimberlitic) origin and zircons of crustal origin with increased Y and U content.

The second step involved U-Pb dating and Hf-isotope analysis. The largest population, consisting of crustally-derived zircons, defines a U-Pb age peak at ca 2700 Ma, probably representing the Archean age of the lower crust below the Nakynsky kimberlite. This main population shows a range of εHf (t) values of 3.2 to -14.6 and T_{DM} crustal model ages between 3.6 and 2.7 Ga, and suggests that at least 70% of the deep crust was formed from 3.2-2.8 Ga ago. The minor age population represented by the kimberlite zircons of the Nurbinskaya pipe gave a weighted mean $^{206}Pb/^{238}U$ age of 381±7 Ma, which is considered as the best estimate for the kimberlite emplacement. The zircons of this younger age population have a narrow range of εHf(t) values of -33.5 to -34.5 and T_{DM} crustal model age of 3.2 Ga.

Are aliphatic monomers of grasses and herbs useful biomarkers for vegetation shifts?

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Each plant species has a unique aliphatic composition. The aliphatic monomer composition of differrent grasses and herbs was analyzed to investigate wheter the pattern can be traced back after decay and transformation into soil organic matter (SOM).

We analyzed the aliphatic monomer pattern (e.g. Alkanols, Alkanoic acids, Alkanes) of dominant grasses and herbs as well as of soil samples derived from four different regions where recently vegetation shifts took place or are assumed to have taken place (Bayerischer Wald and Limestone Alps, Germany; Bagé, Brazil; Qinghai, Tibet). Our aim was to develop a robust classification model for SOM source and vegetation history using these biomarkers. The data on the composition of the aliphatic monomers of the grasses and herbs were analyzed with three different classification models (linear, non-linear and binary), to find the best model to classify the different plant species. Based on the discriminant equations obtained, soil samples were classified and the performances of the three classification models were compared.

We yielded a series of monomers corresponding to previously reported hydrolysates [1, 2, 3], that discriminated significantly among the different grass and herb species. Hence, all tested classification models discriminated sufficently among the grass and herb species. Between 56% and 85% of the cases were classified correctly, depending on the respecitve site, the training set and the used model. However, the aliphatic pattern in soils is subjected to changes during decomposition of the plant material and the different biomarker monomers exhibited different turnover rates. Thus, only a multivariate binary classification model that did not rely on quantitative properties and compound ratios was sufficient to classify in average 67% of the soil samples correctly, depending on their decomposition status.

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