

Comparison of different dating methods in a lake with annually laminated sediments

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The studies of natural historical archives such as lake sediments require reliable age-scale. In order to determine the age for sediments accumulated during last 100–150 years the ^{210}Pb method as well as the distribution of several artificial radionuclides (as ^{137}Cs , ^{241}Am etc.) have been used. But often due to diffusion processes these chemical elements can be mobile in sediments (Smith and Comans, 1996) and therefore the reliability of such datings decrease. Chemically stable markers such as spheroidal fly-ash particles which are emitted during the high-temperature combustion of fossil fuels have proven to be useful means for indirect dating of recent sediments (Renberg and Wik, 1984; Rose *et al.*, 1995). In this investigation laminated sediments of Lake Rõuge Tõugjärv (SE Estonia) were studied to establish high-resolution sediment chronology for palaeoenvironment reconstructions of the last centuries and to compare the accuracy of different dating methods.

Both CRS and CIC models were used to calculate ^{210}Pb dates. The ^{137}Cs and ^{241}Am

had subsurface peaks recording the 1986 Chernobyl accident and the weapons test fallout of 1963. Obtained dates were validated with independent age-scale of varve counting. Also the down-core distribution of fly-ash particle abundance was used and characteristic features in the particle concentration curve were dated according to the known fuel combustion history of the region.

Varve analysis, the results of radiometric dating and the distribution of fly-ash particles show chronologies, which are in good agreement. The marker horizons of vertical distribution of fly-ash particles can be accurately dated which allow further application of this method to determine the age of other sediment profiles. When studies of homogeneous lake sediments demonstrated younger ages by ^{210}Pb datings and were therefore corrected by ^{137}Cs and ^{241}Am age-scales, then in annually laminated sediments the chronologies obtained by ^{210}Pb method and by the distribution of artificial radionuclides coincide well. The latter confirms good preservation of paleoinformation in the sediments where bioturbation is missing.

References

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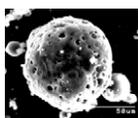


Figure 1: Spheroidal fly-ash particle, a tool for sediment

From high-Mg basalts to dacites: continued crystal fractionation in the Klyuchevskoy-Bezmianny magma plumbing system, Kamchatka

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A new representative data set for whole-rock major, trace, isotopic, and phenocryst compositions supports for the proposed genetic link between high-Mg to high-Al basalts of the Klyuchevskoy volcano and the andesite-dacite suite of the Bezmianny volcano. Considered collectively, these two sub-series form a typical calc-alkaline trend with a common inflection point and continuous variations for both compatible and incompatible trace elements (Fig. 1a). This is also confirmed by systematic changes in CPx phenocryst compositions (Fig. 1b), which display a strong correlation between $mg\#$ and trace element abundances determined by LA-ICPMS. These observations provide evidence that the volcanoes shared the same initial magma, which was derived from a common mantle source. We attribute these relations to prolonged ascent-driven decompression crystallisation of high-Mg water-unsaturated melts, followed by multiple eruption of HABs at Klyuchevskoy volcano, or by their continued crystallization in the magma chamber beneath Bezmianny volcano. The final stages of magma fractionation seem to have proceeded at essentially isobaric water-saturated conditions resulting in the observed andesites and dacites. The key details of this concept are supported by phase equilibria calculations using the COMAGMAT model.

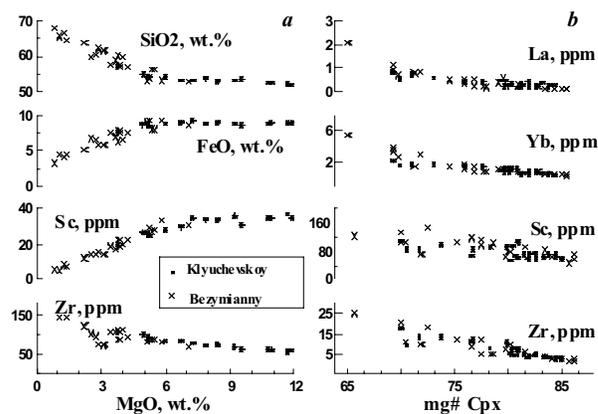


Fig. 1: Geochemistry of lavas (a) and phenocrysts (b).