



10Be inventories in Alpine soils and their potentiality for dating land surfaces

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To exploit natural archives and geomorphic objects it is necessary to date them first. Landscape evolution of Alpine areas is often strongly related to the activities of glaciers in the Pleistocene and Holocene. At sites where no organic matter for radiocarbon dating exists and where suitable boulders for surface exposure dating (using in situ produced cosmogenic nuclides) are absent, dating of soils could give information about the timing of landscape evolution. We explored the applicability of soil dating using the inventory of meteoric Be-10 in Alpine soils. For this purpose, a set of 6 soil profiles in the Swiss and Italian Alps was investigated. The surface at these sites had already been dated (using the radiocarbon technique or surface exposure dating using in situ produced Be-10). Consequently, a direct comparison of the ages of the soils using meteoric Be-10 and other dating techniques was made possible. The estimation of Be-10 deposition rates is subject to severe limitations and strongly influences the obtained results. We tested three scenarios using a) the meteoric Be-10 deposition rates as a function of the annual precipitation rate, b) a constant Be-10 input for the Central Alps and c) as b) but assuming a pre-exposure of the parent material. The obtained ages that are based on the Be-10 inventory in soils and on scenario a) for the Be-10 input agreed reasonably well with the expected age (obtained from surface exposure or radiocarbon dating). The ages obtained from soils using scenario b) produced mostly ages that were too old whereas the approach using scenario c) seemed to yield better results than scenario b). Erosion calculations can, in theory, be performed using the Be-10 inventory and Be-10 deposition rates. An erosion estimation was possible using scenario a) and c), but not using b). The estimated erosion rates are in a reasonable range. The dating of soils using Be-10 has several potential error sources. Analytical errors as well as errors from other parameters such as bulk soil density and soil skeleton content have to be taken into account. The error range was from 8 up to 21%. Furthermore, uncertainties in estimating Be-10 deposition rates substantially influence the calculated ages. Relative age estimates and, under optimal conditions, a numerical dating can be carried out. Age determination of Alpine soils using Be-10 gives another possibility to date surfaces when other methods fail or are not possible at all. It is, however, not straightforward, quite laborious and may consequently have some distinct limitations.