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Evaluation of long-term (10^4-10^5 yr) surficial processes using in situ produced cosmogenic nuclides.

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In situ-produced cosmogenic nuclides result from nuclear reactions between cosmic-rays derived particles and the elements constituting the Earth's surface material. Cosmogenic ^{10}Be ($T^1/_2$=1.5 Ma) and ^{26}Al ($T^1/_2$=0.73 Ma) produced within the quartz mineral fraction of surficial rocks may be used to quantitatively study soils emplacement and development. Depth distributions of in situ-produced ^{10}Be and ^{26}Al along quartz veins and soil profiles permit: 1/ to clarify mechanisms involved in soil formation and landform evolutions, 2/ to quantify burial or denudation rates. Lateral variations of the in situ-produced ^{10}Be concentration provide qualitative basis for distinguishing allochthonous from autochthonous materials, and, in the later case, allow estimating lateral displacement rates. Furthermore, since in many cases they represent the average concentration-weighted for area and denudation rate of the various erosional environments present, the in situ-produced ^{10}Be concentrations accumulated in river-borne quartz can be used for estimating of long-term denudation rates on scales of drainage basins. Comparison of classical drainage–basin mass balance estimates of denudation reflecting modern denudation rates with denudation rates determined on geologically significant time scales using in situ-produced ^{10}Be provides an efficient quantitative approach for determination of the extent of erosion induced by human activity.