2010 GSA Denver Annual Meeting (31 October –3 November 2010)

Paper No. 146-3

Presentation Time: 2:20 PM-2:35 PM

STONE TO SOIL: ELEMENTAL FLUX RATES DURING PEDOGENESIS ON THE SOUTH CAROLINA PIEDMONT

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Opportunities to investigate pedogenic processes in undisturbed soil-bedrock profiles on the southern Piedmont are rare. Historic agriculture was widespread, physically and chemically altering most southern Piedmont soils. We sampled the granitic gneiss parent material and the overlying 6m soil profile from a historically uncultivated, stable, Ultisol located on the Calhoun Experimental Forest in Union County, SC. Our objectives were 3-fold: (1) to quantify flux rates of 8 elements (Si, Al, Fe, Mg, Ca, Na, K, and Mn) during in-situ soil formation on the southern Piedmont using chemical mass balance equations that reference soil horizons to parent material and meteoric 10Be soil residence times, (2) to characterize the distribution of meteoric 10Be in a highly-weathered Ultisol profile through measurement of other soil properties (including pH, %C, exchangeable cations, KCl acidity, texture, and effective CEC and base saturation) and multivariate analysis, and (3) to estimate Be mobility in soil during granitic gneiss weathering in the southern Piedmont using the mass balance approach described above.

Meteoric 10Be concentrations ranged from $2.12 \cdot 10^{8}$ to $7.01 \cdot 10^{8}$ atoms g^{-1} in the surficial 6m Ultisol profile with a maximum in the soil's upper B horizon, about 0.32-0.60m. Assuming a delivery rate of $1.3 \cdot 10^{6}$ atoms cm^{-2} yr^{-1}, the total meteoric 10Be inventory of $2.58 \cdot 10^{11}$ atoms cm^{-2} indicates a minimum residence time of 2.09×10^{5} years for the soil profile. Soil pH (measured in 0.01M CaCl2) ranged from 3.88 to 4.13 and was positively correlated to meteoric 10Be concentration ($r=0.62$, $p=0.0252$). Percent clay ($r=0.90$, $p<0.0001$) and percent sand ($r=-0.73$, $p=0.0071$) were also significantly correlated to meteoric 10Be concentration in the Ultisol profile.

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General Information for this Meeting

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Colorado Convention Center: Room 709/711
1:30 PM-5:30 PM, Monday, 1 November 2010

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