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GSA Annual Meeting in Phoenix, Arizona, USA - 2019

Paper No. 124-5

Presentation Time: 9:00 AM-6:30 PM

QUANTIFYING THE EFFECTS OF ORGANIC AGRICULTURE IN 26 CENTRAL CUBAN RIVERS USING SHORT-LIVED FALLOUT RADIONUCLIDES IN DETRITAL RIVER SEDIMENT

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Cuba has a long and varied history of land use, undergoing a nationwide agricultural transition in the 1990s from mechanized sugar monoculture to more sustainable agriculture using limited resources available after the fall of the Soviet Union. This step function transition in land use is an ideal natural experiment to understand the long term effects of organic agriculture on soil conservation.

We measured the activity of short-lived fallout radionuclides (⁷Be, ¹³⁷Cs, and ²¹⁰Pb_{ex}) in river sediment collected in August 2018 from 26 sites in central Cuba. Most of the 26 detrital sediment samples analyzed in two grain size fractions (n = 20/26 for <63 μm, n = 19/26 for 250-850 μm) have detectable activity of at least one isotope. 20 sites have detectable ²¹⁰Pb_{ex} and 21 have detectable ¹³⁷Cs, but only two sites have detectable ⁷Be, in coarse and/or fine grained fractions. This suggests that sediment is sourced from near the ground surface, but perhaps below the penetration depth of ⁷Be (5 cm). The absence of ¹³⁷Cs in 5 watersheds samples suggests that sites may have experienced deeper and/or more rapid erosion in the past. Four of these watersheds have detectable ²¹⁰Pb_{ex}, suggesting that erosion has slowed since the time of ¹³⁷Cs deposition. Overall our data suggest that erosion in this region is slow and shallow at the present time in many locations.

²¹⁰Pb_{ex} activity is directly correlated with elevation and agricultural land use and inversely correlated with basin slope but ¹³⁷Cs activity is not with any basin metrics. Agricultural land use and slope are significantly and inversely related, thus we cannot determine whether slope or land use is driving observed relationships. Watersheds with ²¹⁰Pb_{ex} but not ¹³⁷Cs in the coarse-grained fraction have higher elevations, higher slopes, and lower agricultural land use than samples with detectable ¹³⁷Cs. However, because agricultural land use is strongly associated with low elevations and slopes, it is hard to untangle relative importance of these terms. Fine-grained samples do not have significant differences between categories with different detectable isotopes. Overall our data suggest that land use change may have affected isotopic concentrations in detrital sediments but that we cannot conclusively distinguish between human and natural controls on erosion.

Session No. 124-Booth# 300

T15. Soil Forming Processes and Quaternary Landscape History (Posters)

Monday, 23 September 2019: 9:00 AM-6:30 PM

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