U-series constraints for the rate of bedrock-saprolite transformation in the Rio Icacos watershed, Puerto Rico

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Transformation rate of cohesive bedrock into disaggregated saprolite is a key parameter in modelling the Earth's Surface evolution in response to external forcing (tectonics, climate, human activity). We propose to estimate such rates in the case of spheroidal weathering, a classical process, which often defines the transition of bedrock to saprolite in many rock types and many climatic settings. For this purpose, a series of rocks collected along two weathering profiles, developed on quartz diorite from the Rio Blanco stock in the Rio Icacos watershed (Puerto Rico), has been analysed for major and trace element concentrations as well as U-Th-Ra disequilibria, which is known to be useful to constrain weathering timescale [1].

Variations with depth of loss on ignition (LOI), major and trace element concentrations normalized to Al as well as variations with depth of $^{87}Sr/^{86}Sr$ isotope ratio confirm that the chemical weathering in this system mainly occurs at the rindlet/saprolite transition characterized by significant loss of Na, K, and Ca as well as Rb, Sr and Ba. Such a transition is marked by a preferential weathering of plagioclase and hornblende in respect to biotite [2]. The U-series nuclides variations along the profiles point out a dual process: a U and Ra leaching process, intense at the bedrock/saprolite transition and an input of U and Ra from the upper soil horizon linked to aeolian dust deposition and/or to U vegetation recycling. Using a simple U-Ra loss and gain model to interpret the U-Th-Ra disequilibria variations along the saprolite profiles allow us to constrain a very similar weathering rate of ~6m/100ka for both profiles. This result is consistent with the surface denudation rate of 6m/100ka based on studies of ^{10}Be concentrations in soil and sediments [3][4]. These data therefore suggest that the weathering and erosion processes in this watershed have reached a steady state.

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Spitzer Space Telescope observations of water and organics in the terrestrial planet-forming regions of circumstellar disks

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High dynamic range observations with the InfraRed Spectrometer (IRS) aboard the Spitzer Space Telescope have revealed widespread mid-infrared emission from water, the hydroxyl radical, and carbon dioxide along with simple organic species such as hydrogen cyanide and acetylene in the surface layers of the protoplanetary disks encircling pre-main sequence T Tauri stars [1–3]. Follow-up studies from ground-based facilities with high dispersion echelle instruments have confirmed the disk origin of the features seen with the IRS and constrained the emitting location to radii of at most few Astronomical Units (AU) [3, 4].

In the final year of its cryogenic operation, Spitzer has undertaken an extensive survey of the 10-35 μm molecular emission from protoplanetary disks (Spitzer PID#50641, John Carr, Principal Investigator). Together with archival results from the 'Cores to Disks' Legacy Science program [5] and Guaranteed Time Observations the new survey provides a suite of observations that span the known ranges of critical disk and stellar parameters such as dust settling, X-ray luminosity, age, and mass. Correlations of the molecular emission properties with these parameters are expected, and if confirmed could provide important constraints on the transport and fate of gas and dust in disks [6].

This talk will review the early findings from the new Spitzer data and ground-based follow-up spectroscopy. Key to this work are accurate models of the complex radiative transfer in the inner few AU of protoplanetary disks that have only recently become computationally feasible. In addition to an overview of the results from mid-infrared spectroscopy, the talk will also include a preview of new far-infrared through millimeter-wave capabilities that have the potential to trace the water and organic content of disks at larger radii and in regions closer to the disk mid-plane where planet(esimal) growth processes are most active.

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