

Organic carbon transport in small mountainous rivers on Dominica, Lesser Antilles

CLAIRE A. MONDRO*, STEVEN T. GOLDSMITH,
ANNETTE M. TRIERWEILER, BRENT M. JOHNSON,
SUSAN A. WELCH AND ANNE E. CAREY

The Ohio State University Byrd Polar Research Center and
School of Earth Sciences, 275 Mendenhall Laboratory,
125 South Oval Mall, Columbus, Ohio
U.S.A(mondro.1@osu.edu)

Small rivers on high-standing islands (HSIs) around the world provide a significant contribution to the total amount of carbon delivered to the global ocean. Because of high physical and chemical weathering rates caused by rapid uplift and extreme rainfall events, river systems in tropical areas generally also produce high carbon yields. Dominica is a volcanic island, with little organic carbon found in the bedrock, making it a highly suitable natural laboratory to investigate the delivery of organic carbon solely from soils. Besides uplift and erosion from heavy rainfall, weathering rates are affected by the topography of the watershed area and characteristics of the underlying bedrock. An investigation of the dissolved organic carbon (DOC) and particulate organic carbon (POC) yields from eleven rivers on Dominica compares the total carbon delivery from different regions of the island to determine a possible relationship between carbon transport and geographic and environmental characteristics of the rivers. Our results show some of the highest DOC yields reported to date, ranging $0.2\text{--}3.67\text{ t km}^{-2}\text{ yr}^{-1}$. These are among the few data available for tropical mountainous rivers worldwide found in watersheds of this small size ($1\text{--}70\text{ km}^2$). Phosphate measurements showed low to non-detectable concentrations, suggesting a phosphate-limited nutrient system affected by chemical weathering. A strong correlation with watershed area and silicate weathering rates is also observed. This linkage between DOC and silicate weathering yields sheds new light on the importance of volcanic active margin terrains in the annual global carbon cycle.

Pedogenic carbonate in the global carbon cycle: Active sink or long-term reservoir?

H.C. MONGER^{1*} AND D.R. COLE²

¹Plant & Environmental Sciences, New Mexico State
University, Las Cruces, NM 88003 USA

(*correspondence: cmonger@nmsu.edu)

²Chemical Sciences Division, Oak Ridge National Laboratory,
TN 37932 USA (coledr@ornl.gov)

Soil carbonate is the third largest C pool in the active global carbon cycle, containing at least 800×10^{15} grams of carbon, thus exceeding the amount in the atmosphere (ca. 750×10^{15} grams) or in land plants (ca. 560×10^{15} grams). Although carbonate dissolution-precipitation reactions have been understood for over a century, the role of soil carbonate in carbon sequestration, and in particular pedogenic carbonate, is deceptively complex because its formation involves interdependent linkages among climate, plants, microorganisms, silicate minerals, soil moisture depth and duration, pH, and Ca supply via rain, dust, or *in situ* weathering. An understanding of pedogenic carbonate in carbon sequestration also requires examination of the system at local to continental scales and at seasonal to millennial time scales (Fig. 1). In the Chihuahuan Desert of North America, $^{13}\text{C}/^{12}\text{C}$ ratios and radiocarbon dating were used in combination with electron microscopy of microbial formation of CaCO_3 and field measurements of CO_2 . These investigations reveal that pedogenic carbonate is both an active sink and a long-term reservoir [1, 2].

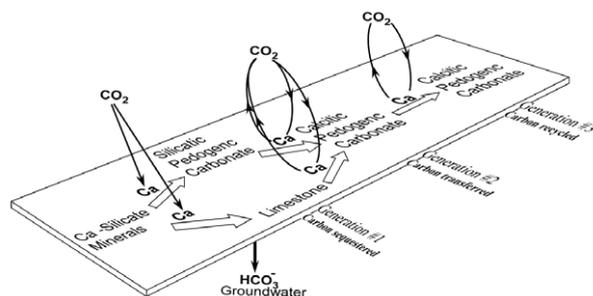


Figure 1: Illustration showing three generations in which carbon dioxide is sequestered, transferred, or recycled during formation of silicatic or calcitic pedogenic carbonate.

[1] Serna-Perez, *et al.* (2006) *Soil Sci. Soc. Am. J.* **70**, 795–805. [2] Monger *et al.* (2009) *Ecology* **90**, 1498–1511.