

## Dynamics of soil carbonate growth in the tropical domain

Alexis Licht <sup>\*1,2</sup>, Julia Kelson <sup>3</sup>, Shelly Bergel <sup>2</sup>, Andrew Schauer <sup>2</sup>, Sierra V. Petersen <sup>3</sup>,  
Ashika Capirala <sup>2</sup>, Katharine Huntington <sup>2</sup>, Guillaume Dupont-Nivet <sup>4,5</sup>, Zaw Win <sup>6</sup>, and  
Day Wa Aung <sup>7</sup>

<sup>1</sup> Centre de Recherche et d'Enseignement de Géosciences de l'Environnement (CEREGE), CNRS : UMR7330, Aix-Marseille University, Aix-en-Provence, France

<sup>2</sup> Department of Earth and Space Sciences, University of Washington, Seattle WA USA

<sup>3</sup> Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, MI, USA

<sup>4</sup> Géosciences Rennes, CNRS : UMR6118, Université de Rennes 1, Rennes, France

<sup>5</sup> Institut für Geowissenschaften, Universität Potsdam, Potsdam, Germany

<sup>6</sup> Geology Department, Shwe Bo University, Sagaing Region, Myanmar

<sup>7</sup> Department of Geology, University of Yangon, Pyay Road, Yangon, Myanmar

Pedogenic carbonate is widespread at mid latitudes where combined warm and dry conditions favor soil carbonate growth in summer. The mechanisms and tempo of pedogenic carbonate formation are less certain in the tropics. There, longer periods of soil water saturation and higher soil respiration enhance calcite dissolution, particularly during summer. However, pedogenic carbonate growth during summer seasons remains the assumption of most studies using stable and clumped isotope proxies on paleosols.

To test this assumption, we investigated stable and clumped isotope values from Quaternary and Miocene pedogenic carbonates in the tropical monsoonal domain of Myanmar along an annual rainfall gradient. We show that carbonate growth in Myanmar occurs in the coldest months of the year due to sustained rainfall from mid spring to late fall. Carbonate growth timing locally varies from early winter to early spring; this trend is partly influenced by local rainfall amount, with growth at the wettest sites delayed to spring.

The winter bias in carbonate growth temperatures found in both Quaternary and Miocene Burmese soils, which is so far unique amongst pedogenic carbonates, constitutes a potential signature for past tropical monsoonal (warm summer-wet) climates in paleosols. We propose that high soil moisture year-round in the tropical domain makes carbonate growth more episodic than in temperate ecosystems and particularly sensitive to the seasonal distribution of rainfall. This sensitivity is facilitated by high winter temperatures that allow carbonate precipitation to occur outside of the warmest months of the year. This high seasonal sensitivity is expected to be more prominent in the geological record during times with higher temperatures and greater expansion of the tropical realm.

**Mots-Clés :** Pedogenic carbonate, monsoon, clumped isotopes, stable isotopes, paleosols, paleoclimate