



Interaction among biogenic, climate and tectonic processes influences tufa precipitation, Araripe Basin, Brazil

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Tufas are continental freshwater carbonates common in epi-karst zones. They are composed of micrite and microsparitic crystals of calcite with variable primary moldic and fenestral porosity and with the frequent presence of biogenic content. By definition, tufa petrogenesis depends on climate processes and usually has precipitation induced by biological activity. Our examples include two morphotypes resulting from weathering of limestone of the Crato Formation, Araripe Basin, NE Brazil, and precipitated along vugular fractures. To understand how the climate and the biological activity act on precipitation of these rocks, we integrate structural data, petrography, and $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values. Tufas are always associated with joints and faults in the northern boundary of the basin. The block where tufas occur has a dip angle between 5° and 30° , which differs from the regional average of 0° to 3° . The tufas fill vugular steep fractures with preferential planes oriented N50E and N30W and have a pipe-shaped growth pattern with top-down and center-out growth direction. The presence of organic filaments and mollusk shells are recurrent in all samples. Isotopic values measured on 32 samples indicate $\delta^{18}\text{O}$ VPDB between $-11,4\text{‰}$ and $-1,7\text{‰}$ and $\delta^{13}\text{C}$ VPDB between $-12,1\text{‰}$ and $-5,1\text{‰}$. The enrichment of ^{16}O reveals the composition of meteoric water, responsible by the limestone dissolution and tufa precipitation. Organic fractioning induced by photosynthesis of the C4 plants result in ^{12}C enrichment in the tufas. Macro and microscopic analysis revealed bryophyte filaments. Moreover, the porosity pattern strongly evidences the presence of these plants in tufa diagenesis. The close association of these rocks with the boundary faults suggests a relationship with climate denudation processes. The Araripe Basin is part of a set of continental rift basins in the Brazilian Northeast affected by uplifting. Thus, there are two stages recognized; the first one corresponds to the exhumation and reworking of the basement, probably in the early Cenozoic; and in the second stage a more intense weathering under semi-arid climate during Oligocene, or later.