

An early Ediacaran cap carbonate sequence in east central Brazil

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Introduction

The Sete Lagoas Formation is a 200 m thick carbonate unit sitting atop glacially-related diamictites (Jequitai Formation) at the São Francisco craton, east central Brazil. It is currently recognized as a typical Neoproterozoic cap carbonate, and most authors prefer a mid-Cryogenian (post-Sturtian) age for it, based mainly on Pb-Pb data. Recently, however, Ediacaran zircons have been recovered from the middle portion of the Sete Lagoas Formation, constraining the deposition of its upper half to be younger than 610 Ma [1]. These conflicting results underline the need for further research on the assignment of a relative age for the Sete Lagoas cap carbonate.

Materials and Methods

We present lithostratigraphic and C, O and Sr isotopic data from a 127-m section of the Sete Lagoas Formation near Correntina, Bahia. In addition, sixty-five carbonate clasts from four separate diamictite occurrences were sampled for C and O isotopic analysis.

Results and Conclusions

A 1.5 m thick layer of pink laminated dolomite marks the base of the Sete Lagoas Formation at Correntina ($\delta^{13}\text{C}$: -3.8 to -4.2‰; $\delta^{18}\text{O}$: -4.5 to -5.1‰). It is overlain by 55 meters of reddish laminated limestone with $\delta^{13}\text{C}$ values of about -5‰, jumping abruptly to around -0.5‰ at the middle of the section and remaining nearly constant upwards. The thin pink dolostone unit at the base of the section, preserving decreasing-upwards $\delta^{13}\text{C}$, is nearly identical to basal Ediacaran cap dolostones globally. The $^{87}\text{Sr}/^{86}\text{Sr}$ values obtained from high Sr carbonates (above 1000 ppm), around 0.7076, are also consistent with deposition during the early Ediacaran. The carbonate clasts display similar ranges of $\delta^{13}\text{C}$ (-6.7 to +2.6‰), except for the meter thick Carrancas Formation, which yielded pale dolostone clasts with $\delta^{13}\text{C}$ in a small range between -4.2 and -3.4‰, and $\delta^{18}\text{O}$ around -6.5‰. These could be derived from the cap dolostone unit itself, in which case the Carrancas Formation would represent resedimented basal Sete Lagoas Formation, implying that cap carbonate sections sitting atop it are incomplete. The base-truncated sections have confused previous attempts to assign a relative age for the Sete Lagoas cap carbonate. The combination of available lithostratigraphic, isotopic and geochronological data strongly supports the interpretation of an early Ediacaran age for the Sete Lagoas Formation. This new interpretation profoundly impacts the current views of Neoproterozoic history and sedimentation within the São Francisco craton.

[1] Rodrigues (2008) *Unpublished PhD Thesis, UnB, Brasília, Brazil*, 128 p.

An absorption method for porewater characterization in low permeability sedimentary rocks

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Determination of porewater geochemistry in low-permeability, low-porosity rocks is problematic given small fluid volumes and difficulty associated with extracting representative samples. Several techniques are available including crush and leach, vacuum distillation and forced advective displacement. However, these methods are not always successful and can be subject to error arising from the estimate of matrix porosities. The purpose of this study is to explore a new innovative method for characterization of representative pore fluids in clay rich rocks. The method involves the extraction of pore fluids using absorption into hydrophilic membranes. From preliminary experiments, scanning electron microscope (SEM) images and energy-dispersive x-ray spectroscopy (EDS) analyses confirm that the method successfully extracts porewater and associated solutes. Absorbed water was determined gravimetrically and the solute masses were quantified by x-ray fluorescence (XRF).

Interim experimental results have been compared with porewater compositions derived using the crush and leach technique. The gravimetric water-content analyses are subject to large errors, which carry through to porewater concentrations. However, when the extracted solute masses for major elements (Na, Mg, K, Ca, Br and Sr) are normalized to Cl mass, data from the absorption method display higher precision than data from the crush and leach technique. The Cl normalized elemental masses from the two extraction methods compare well for Sr and Ca, but K:Cl and Mg:Cl ratios obtained with the crush and leach method are higher than from the absorption method, while Br:Cl and Na:Cl ratios are lower.

Continuing research and development aims to refine the technique by investigating preferential ion sorption and reversibility of ion leaching, improving water-content measurements using near-infrared spectroscopy, and testing other analytical methods such as neutron activation analysis. With refinement of the water-content and solute analytical methods, the technique holds promise for characterizing porewater geochemistry occurring in low-permeability, low porosity rocks.