MODELAÇÃO DE SISTEMAS GEOLÓGICOS

Homenagem ao Professor Doutor Manuel Maria Godinho


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On Proterozoic ecosystems and the carbon isotopic composition of carbonates associated with Banded Iron Formations

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Abstract
A compilation of over 400 carbon isotope analyses of carbonates associated with Banded Iron Formations (BIF) reveals a strong major mode at $\delta^{13}C \sim -7\%$ (VPDB), a second major mode at $\delta^{13}C \sim -10\%$, and a minor mode at $\delta^{13}C \sim -1\%$. The minor mode is readily attributed to contemporaneous marine bicarbonate, perhaps slightly modified by mixing with carbon of lower $\delta^{13}C$ (i.e. < 0%). We compared the two major modes with literature examples of the structure of histograms of $\delta^{13}C$ of secondary carbonate cements from Phanerozoic sandstones which are hydrocarbon reservoirs. The processes and mechanisms responsible for the predominant modes in the sandstone cements $\delta^{13}C$ are thought to be reasonably well understood. Whereas the BIF-mode at $\delta^{13}C \sim -10\%$ corresponds to the most salient mode in the Jurassic cements (also $\delta^{13}C \sim -10\%$) and is accordingly ascribed to deep burial (thermal) remineralisation of organic matter, the BIF-mode at $\delta^{13}C \sim -7\%$ is not prominent in the sandstone cement compilations. We suggest it is attributable to a hydrothermal source. We conclude that the BIF-carbonate data can be explained without invoking a significant carbon source from biogenic processing of organic matter during shallow burial. We note that the absence of such microbial recycling of organic matter would preclude significant accumulation of biogenic CH4 in the sediments until a vibrant community of appropriate obligate anaerobes became established in the subsurface.

Introduction
Banded Iron Formations (BIF) are sedimentary rocks deposited mainly in the interval ~3.6 to ~2 billion years age (Trendall, 2002; Simonson, 2003;