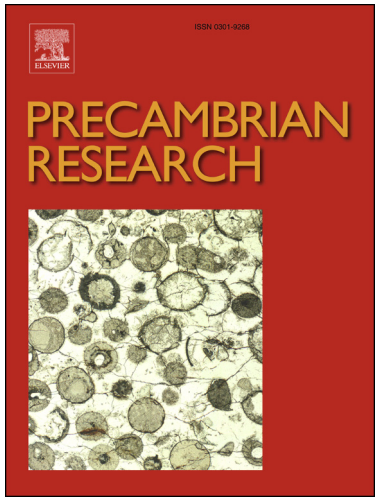

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Bivin G. George, Jyotiranjan S. Ray, Anil D. Shukla, Anirban Chatterjee, Neeraj Awasthi, Amzad H. Laskar

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Stratigraphy and geochemistry of the Balwan Limestone, Vindhyan Supergroup, India: Evidence for the Bitter Springs $\delta^{13}C$ anomaly

Bivin G. George[1,*], Jyotiranjan S. Ray[1,*], Anil D. Shukla[1], Anirban Chatterjee[1], Neeraj Awasthi[1], and Amzad H. Laskar[1]

1) Physical Research Laboratory, Navrangpura, Ahmedabad 380009, India

*Corresponding Authors: bivin@prl.res.in; jsray@prl.res.in

Abstract

The Vindhyan Supergroup of India, deposited in an intracratonic basin, is one of the important Proterozoic marine successions of the world that contains some of the most controversial Precambrian fossil discoveries. Despite their importance, the chronology of the host strata and global correlation of the events that occurred within the basin remain equivocal. Here, we present results of a detailed geological, geochemical and isotopic (Sr-C-O) study of the Balwan Limestone, the youngest carbonate formation of the supergroup, exposed only in the western sector of the basin. Our results suggest that the Vindhyan Basin had become a structurally controlled marginal sea towards the end of its existence and that the limestone was deposited in a subtidal environment that had strong depositional currents. We find evidence for a strong storm event or a tsunami during its deposition. Near primary $^{87}Sr/^{86}Sr$ of 0.70676 at the top and ^{207}Pb-^{206}Pb age of 866±90 Ma (Gopalan et al., 2013) of this ~120 m thick formation suggest its deposition during Late Tonian. $\delta^{13}C$ stratigraphy reveals the presence of the globally synchronous Bitter Springs anomaly (~12‰ shift) in the formation, the first such report from India.

Keywords: Vindhyan Supergroup, Rajasthan, Balwan Limestone, Carbon isotope stratigraphy, Bitter Springs Anomaly

1. Introduction

The Vindhyan Supergroup of central and western India, popularly known as the Vindhyans, is one of the largest and thickest sedimentary sequences, and probably one of the longest-lasting Proterozoic successions in the world. Deposited in an intracratonic basin with an exposed area in excess of 160,000 km^2 (Fig. 1), the supergroup spans in age from ~1.75 Ga to ~0.8 Ga covering almost a billion year of the earth's history (Gopalan et al., 2013; Ray, 2006). Considering its vastness in time and space in the Proterozoic Eon, it is natural to expect that the rocks of this supergroup may hold clues to the evolution of the crust, climate and life on our planet. This has led a large number of researchers to explore the easily accessible rocks of the Vindhyans which resulted in many significant paleontological discoveries such as the trace fossils of the earliest forms of multi-cellular life (Seilacher et al., 1998), small shelly fossils (Azmi, 1998; Bengtson et al., 2009, 2017), and advanced acritarchs and microfossils (Kumar and Pandey, 2008a; Prasad et al., 2005; Prasad and Asher, 2016; Xiao et al., 2016). Interestingly, most of these fossils, generally found in the Neoproterozoic or Cambrian rocks, have been reported from the Paleoproterozoic strata of the Vindhyans (Fig. 2), making them extraordinary. If deemed genuine, these have the potential to change our very understanding of the timing of emergence and evolution of