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A negative carbon isotope excursion defines the boundary from Cambrian Series 2 to Cambrian Series 3 on the Yangtze Platform, South China

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ABSTRACT

A globally recorded negative carbon isotope excursion characterizes the transition from Cambrian Series 2 to Cambrian Series 3. This transition is also well exposed in sedimentary successions on the Yangtze Platform, and the Wuliu–Zengjiayan section, Guizhou Province, South China has been proposed as a potential Global Stratotype Section and Point (GSSP) for this boundary. Here, we report $\delta^{13}C_{carb}$ values for the Jianshan and the Wuliu–Zengjiayan sections. Both sections display a progressive decrease in $\delta^{13}C$ from values around +3‰ upwards in stratigraphy to a pronounced $\delta^{13}C$ minimum with values as low as −6.9‰ at the proposed boundary level, and a return to $\delta^{13}C$ values between 0 and +1‰ in the upper part of the sections. The $\delta^{13}C$ minimum is thought to be caused by a transgressive event, flooding the shelf area with ^{13}C depleted basinal anoxic bottom water. Our $\delta^{13}C$ data are in good agreement with carbon isotope profiles recorded elsewhere. These define the so called ROECE event (*Redlichiid–Oleneliid* Extinction Carbon Isotope Excursion, cf. Zhu et al., 2006, 2007) and may reflect the perturbation of the global carbon cycle during the Cambrian Series 2 to Cambrian Series 3 transition.

1. Introduction

Numerous studies across terminal Neoproterozoic and early Cambrian successions worldwide revealed the great chemostratigraphic potential of high-resolution carbon isotope records (e.g., Brasier et al., 1994; Kaufman and Knoll, 1995; Saltzman et al., 1998; Brasier and Sukhov, 1998; Montañez et al., 2000; Saltzman et al., 2000, 2004). Substantial changes in the carbon isotopic composition of carbonate rocks and organic matter appear to be associated with major faunal boundaries in the Phanerozoic (e.g., Holser and Magaritz, 1987; Magaritz, 1989; Zachos et al., 1989; Saltzman et al., 2000, 2004). The transition from Cambrian Series 2 to Cambrian Series 3 records a rise in global sea level, expressed in large scale transgressive events on the continental landmasses (e.g., Montañez et al., 2000; Hough et al., 2006). High-resolution $\delta^{13}C_{carb}$ records provide a chemostratigraphic framework for the boundary between Cambrian Series 2 and Cambrian Series 3 with previous studies published, e.g., by Donnelly et al. (1988), Brasier (1992), Brasier and Sukhov (1998), Montañez et al. (2000), Zhu et al. (2004), Guo et al. (2005), Wotte et al. (2007), Dilliard et al. (2007), and Shabanov et al. (2008).

A succession of carbonates and siliciclastic sediments across the Cambrian Series 2 to Cambrian Series 3 boundary at the Wuliu–Zengjiayan section, Balang village, Taijiang County, Guizhou Province, South China (Fig. 1) has been proposed as a potential Global Stratotype Section and Point (GSSP) for this boundary (Sundberg et al., 1999; Zhao et al., 2001a, b). Here, we report high-resolution carbonate carbon isotope data for two sections across this interval at Jianshan and Balang, Kaili area, Yangtze Platform, South China. The objective of this study was to investigate the link between $\delta^{13}C$ variations and geological and paleoenvironmental changes of global importance as well as to provide additional data for a global chemostratigraphic subdivision of the boundary from Cambrian Series 2 to Cambrian Series 3.

2. Paleogeographical evolution on the Yangtze Platform

The two sections studied here are located on the Yangtze Platform, South China. During Cambrian times, they were situated in a low latitude position (Fig. 2A). Sediments of the Kaili Formation were deposited in a shelf environment (Fig. 2B) presumably in a water depth between 90 and 300 m (Zhang et al., 1996). The transgressive event proposed for the boundary from Cambrian Series 2 to Cambrian Series 3 resulted in temporal changes in the depositional environment, with parts of the shelf being flooded with less oxygenated basinal bottom waters. This was accompanied by a change in the

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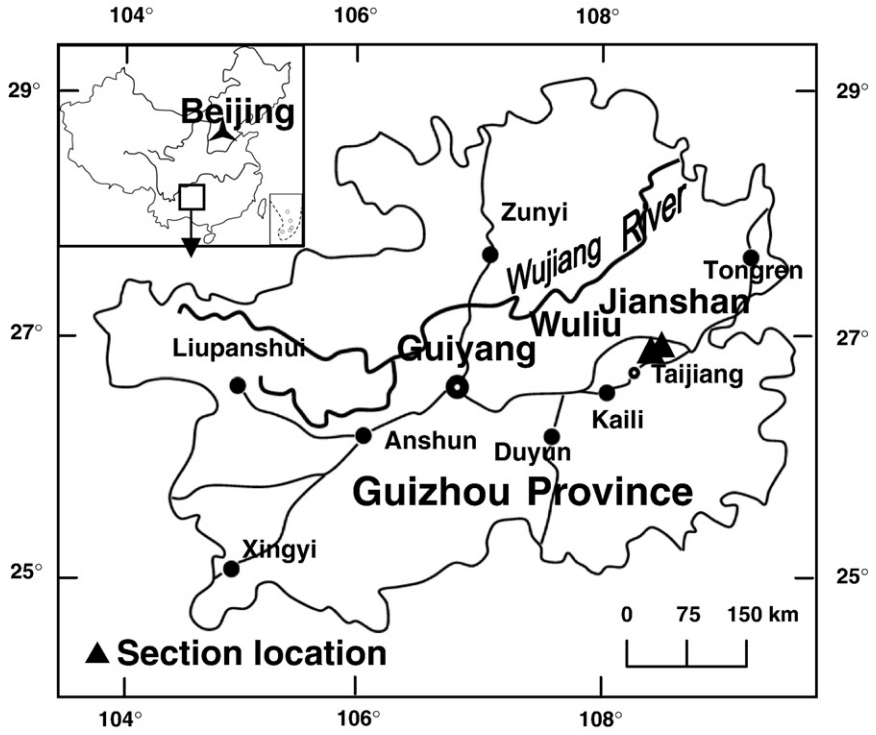

Fig. 1. Map showing the location of the Wuliu–Zengjiayan and Jianshan sections at Balang and Chuandong villages, Guizhou Province, South China.

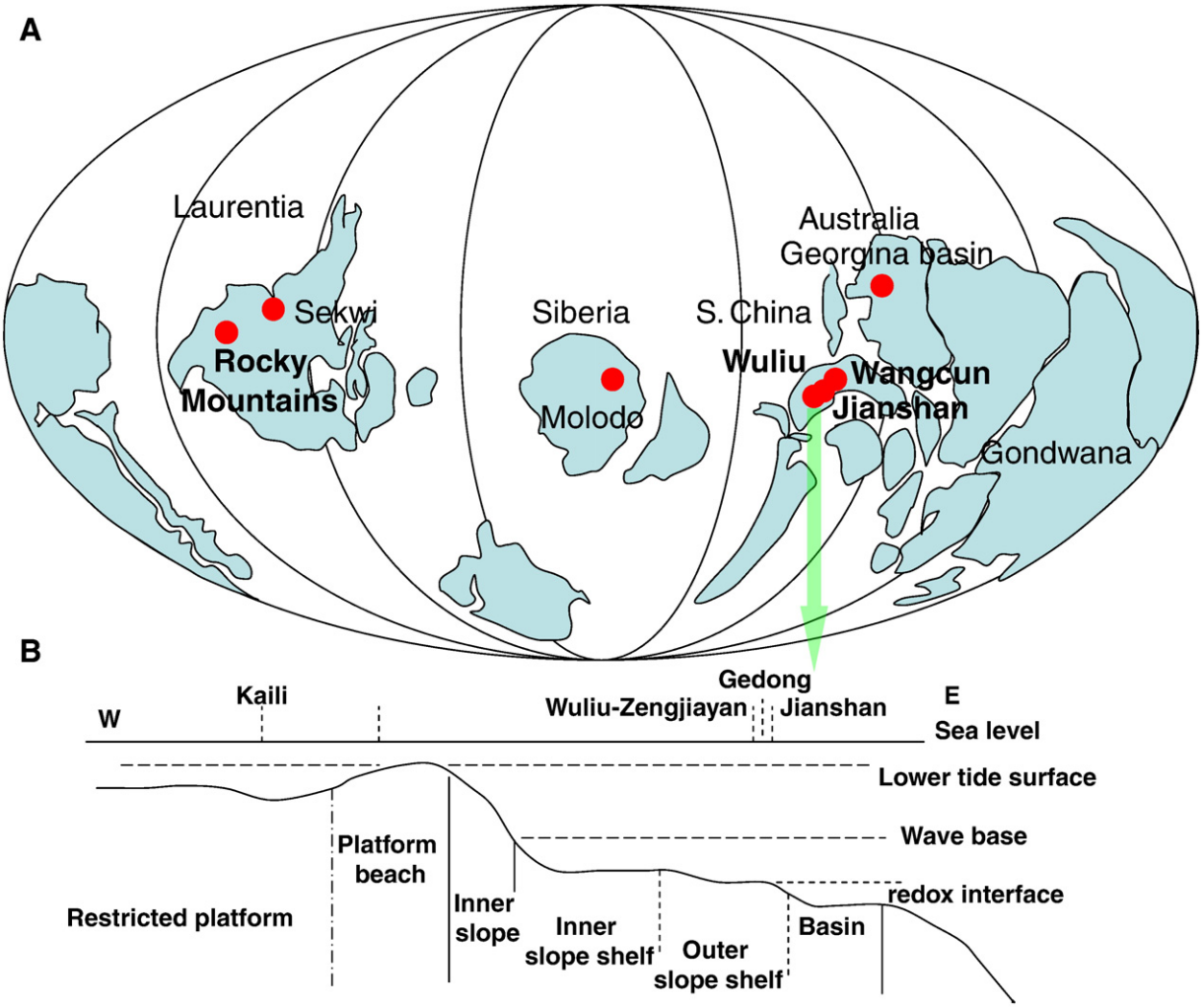

Fig. 2. Paleogeography of the studied successions: (A) Paleogeographic map for the Cambrian (after Scotese and McKerrow, 1990; Saltzman et al., 2000); (B) schematic view of the depositional environment at the studied sections (after Zhang et al., 1996).