

Research paper

Advances in Cambrian stratigraphy and paleontology: Integrating correlation techniques, paleobiology, taphonomy and paleoenvironmental reconstruction

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Abstract

Papers resulting from the Fourth International Symposium on the Cambrian System, held in Nanjing, China, in 2005 cover three major aspects of geology and paleontology: (1) the developing global standard for Cambrian chronostratigraphy or regional correlation schemes; (2) regional lithostratigraphy, sedimentology and paleoenvironments; (3) organismal paleobiology, phylogenetic affinities and taphonomy.

A generalized curve of carbon isotopes ($\delta^{13}\text{C}$) through the Cambrian suggests a relationship between major biotic events, sea level history and the development of deposits of exceptional preservation (Lagerstätten). Recognition of this relationship increases the importance of the $\delta^{13}\text{C}$ profile as a tool for intercontinental and intracontinental correlation. Significant $\delta^{13}\text{C}$ excursions in the Cambrian are: BACE (negative excursion at the base of the Cambrian System); ZHUCE (positive excursion in the lower part of Stage 2); SHICE (negative excursion in the middle part of Stage 2); CARE (positive excursion near the base of Stage 3); MICE (positive excursion in the lower part of Stage 4); AECE (negative excursion in the middle part of Stage 4); ROECE (negative excursion near the base of Stage 5); DICE (negative excursion beginning near the base of the Drumian Stage); SPICE (positive excursion beginning at the base of the Paibian Stage); TOCE (negative excursion near the top of Stage 10). All acronyms other than SPICE are newly proposed. © 2006 Nanjing Institute of Geology and Palaeontology, CAS. Published by Elsevier Ltd. All rights reserved.

Keywords: Cambrian; Chronostratigraphy; GSSP; Chemostratigraphy; Paleobiology; Paleoenvironment

1. Introduction

Studies of Cambrian stratigraphy and paleontology are entering an exciting new phase. Important new developments in our understanding of Cambrian life forms and the physico-chemical changes that affected their

world unfold before us at a rapid rate. As we seek to fine-tune our information base, the need for a globally consistent chronostratigraphic framework becomes increasingly clear. This volume brings together a series of papers reflecting the state-of-the-art in diverse areas of Cambrian research. The papers, an outcome of the Fourth International Symposium on the Cambrian System held in Nanjing, China, in August, 2005, reflect not only what we now know, but also how we interpret the timing of Cambrian biotic events. The Global Standard Chronostratigraphic Scale has not yet been completed for the

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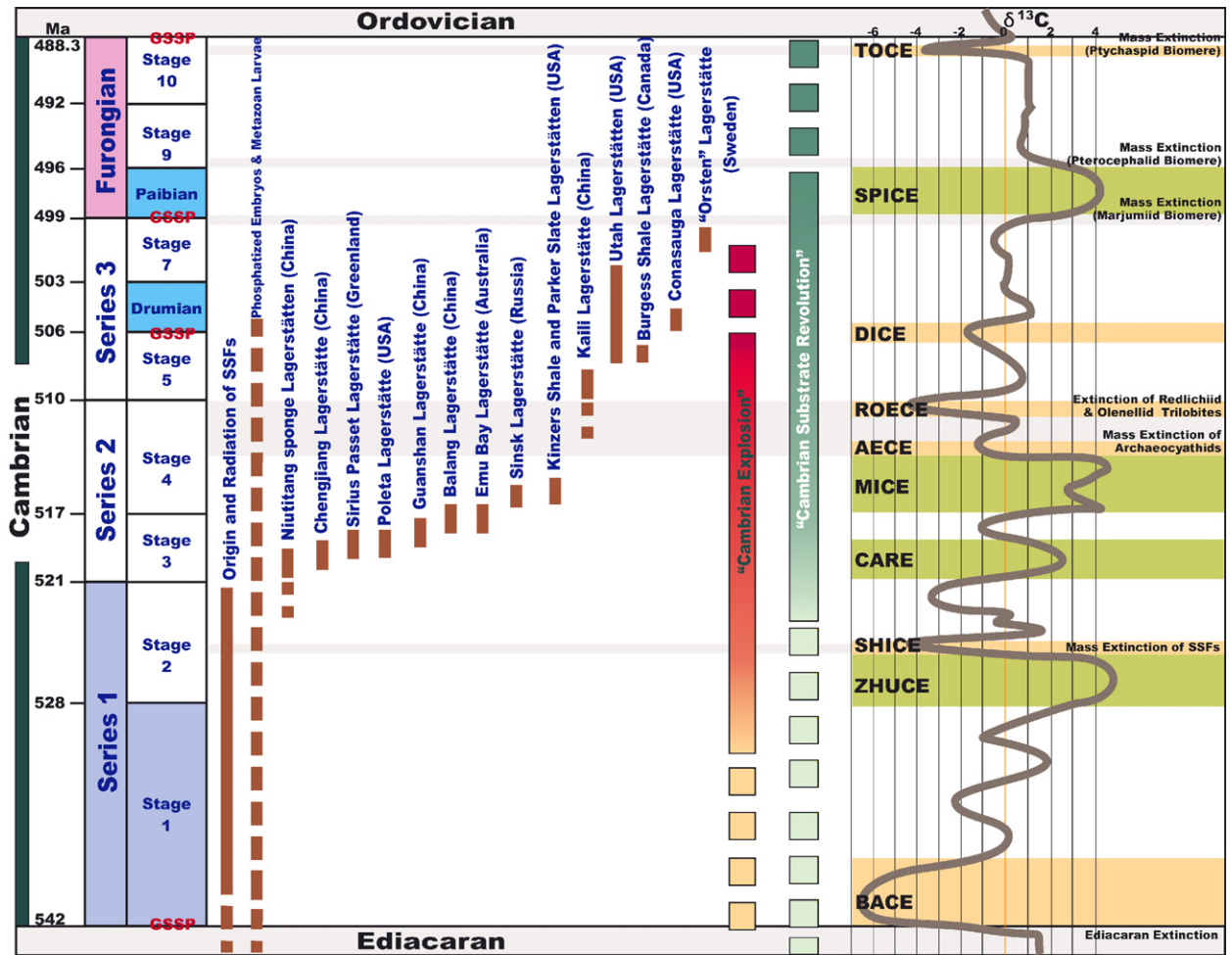


Fig. 1. Developing Global Standard Chronostratigraphic Scale for the Cambrian System (modified from Babcock et al., 2005) showing interpreted time equivalence of key biotas, bioevents and physico-chemical correlation signals. The curve of $\delta^{13}\text{C}$ is a composite based on various published (e.g., Derry et al., 1994; Zhang et al., 1997; Brasier and Sukhov, 1998; Saltzman et al., 1998; Montañez et al., 2000; Corsetti and Hagadorn, 2001; Buggisch et al., 2003; Peng et al., 2004; Zhu et al., 2004; Babcock et al., 2005; Guo et al., 2005; Maloof et al., 2005; Kouchinsky et al., 2005) and unpublished data sources.

Cambrian, and details of intercontinental correlation are still being actively investigated. Thus, the papers assembled in this volume contain stratigraphic information of mixed type: some usage is from traditional, regional correlation schemes and other usage derives from the Global Standard Chronostratigraphic Scale.

Fig. 1 summarizes some of the major evolutionary developments of the Cambrian. The figure should be useful for adjusting concepts and assumptions of the time relationships of bioevents based on historical, regional usage to the most recent model of Cambrian time (Peng et al., 2004, 2006; Babcock et al., 2005). It should be emphasized that the chronostratigraphic model is not yet complete. Only a few boundary stratotypes (marked by “GSSP”) have so far been ratified. Some papers in this volume address details of stratigraphic tie points.

Papers in this volume are arranged into three general categories: (1) discussions of either the developing global standard for chronostratigraphy or regional correlation schemes; (2) discussions of regional lithostratigraphy, sedimentology and paleoenvironments; (3) discussions of organismal paleobiology, phylogenetic affinities and taphonomy. Together, these contributions reflect an integrated approach to answering outstanding questions about Cambrian biotic and Earth history.

2. Cambrian Standard Chronostratigraphic Time Scale and regional correlation schemes

Development of an internationally applicable, standard chronostratigraphic scale for the Cambrian System

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