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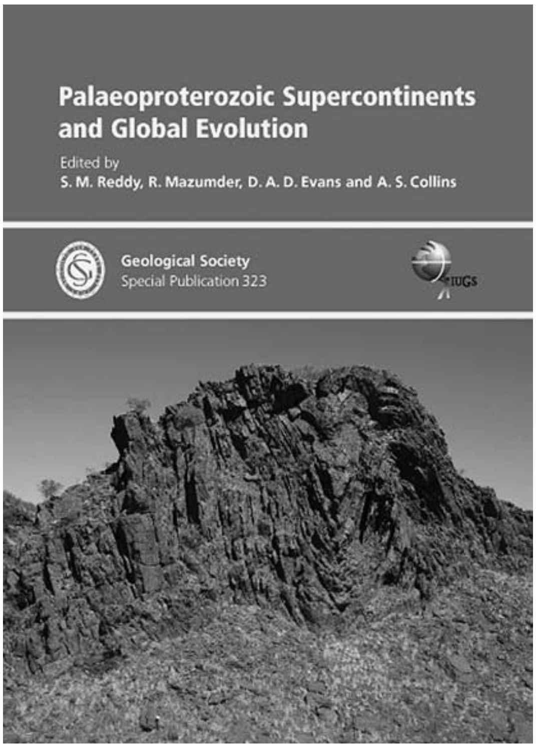


The Palaeoproterozoic rocks (2.5–1.6 Ga) nowadays form scattered segments, but their comparable tectonothermal history, isotope characteristics and palaeomagnetic signatures promoted the concept of the existence of a large supercontinent, Columbia, during the Palaeoproterozoic. The challenge of reconstructing this supercontinent and its original position has led to joint efforts among geoscientists from various disciplines and from several countries. The volume under review is a testimony to such an effort, comprising detailed analyses of new and already available data. The problems analysed are complex, so that it is not surprising that 15 out of the 16 contributions are co-authored, mostly (13 out of the 16) by researchers from at least two countries. As can be expected for such complex rocks, geochronology and isotope geochemistry play a large role. However, many contributions in this volume present detailed data on structural geology, palaeomagnetism and sedimentology.

The introductory chapter (Palaeoproterozoic supercontinents and global evolution: correlations from core to atmosphere) is very wide in scope and is aimed at a much larger readership than just Palaeoproterozoic experts. It provides a highly readable overview of Earth's evolution during the early Proterozoic, showing how it differs from the later Earth history; it has excellent tell-tale diagrams and tables.

The next chapter (The IGCP 509 database system: design and application of a tool to capture and illustrate litho- and chrono-stratigraphic information for Palaeoproterozoic tectonic domains, large igneous provinces and ore deposits; with examples from southern Africa) reports on the outcome of the efforts by at least 20 regional experts "to establish a database system to facilitate data capture, sharing and standardization and to provide standardized software for producing time-space correlation charts derived from information in the database. All information thus captured will remain available in a digital format for future researchers". This database and the retrieval system may well become a separate tool by itself, as indicated while analyzing data from different areas in southern Africa. Using box models and flow charts, this contribution explains how the database (which includes numerous complexly interrelated smaller databases) works.

The third chapter (The Columbia connection in North China) paints the picture of the supercontinent Columbia and its North China representative using a broad canvas of isotope, geochronological and metamorphic data. The analysis shows that the North China Craton has experienced a similar tectonothermal history as the Baltic shield and the Amazonian and Sao Francisco cratons, which all might have belonged to a single supercontinent during 1.8 to 1.7 Ga. These segments were experiencing extensional tectonics, while the coeval Laurentia and North Atlantic cratons were undergoing collision tectonics. Hence the North China Craton was separate from Laurentia and Greenland.

SHRIMP dates on metamorphic rocks are presented in the chapter 'The Precambrian Khondalite Belt in the Daqingshan area, North China Craton: evidence for multiple metamorphic events in the Palaeoproterozoic era'. This leads to a substantive revision of the Neoarchaen-Palaeoproterozoic stratigraphy. The Hf-zircon data suggest three phases of addition of juvenile material from the mantle but the largest contribution to this segment of Columbia came from recycling of Neoarchaean crustal material.

A detailed structural analysis follows in 'The Lu'liang Massif: a key area for the understanding of the Palaeoproterozoic Trans-North China Belt, North China Craton'. It documents the collisional orogeny during the final assembly of North China Craton. The asymmetry of folds and other vergence data are used to establish the polarity of subduction.

Nd-isotope data from southern Siberia suggest mixing of juvenile and older crusts, as shown in the chapter 'Palaeoproterozoic to Eoarchaean crustal growth in southern Siberia: a Nd-isotope synthesis'. The protracted development of the continent culminated in Late Palaeoproterozoic granite activity and supercontinent building at 1.9 Ga. Nd systematics in gneisses, granulites, metasediments, and mafic dykes is used to prove major-scale recycling of Archaean material as old as 3.9 Ga, including accretion of older crustal fragments. Nd data suggest significant heterogeneity in the protoliths from the Palaeoarchean crust.

Palaeomagnetic data from sandstones, conglomerates and volcano-sedimentary rocks, in combination with geochronology, from the Akitkan Group are dealt with in 'Palaeomagnetism and U-Pb dates of the Palaeoproterozoic Akitkan Group (South Siberia) and implications for pre-Neoproterozoic tectonics'. The data suggest a relative post-Palaeoproterozoic movement between Siberia and the Superior cratons.

U-Pb (TIMS) and Sm-Nd dates on Ni-, Cu-, Cr-, Ti- and PGE-bearing layered complexes in the Kola peninsula support a large, long-lived mantle diapir or a multiple mantle-plume as the source of one of the earliest intraplate LIP and associated metallogeny. This chapter (Timing and duration of Palaeoproterozoic events producing ore-bearing layered intrusions of the Baltic Shield: metallogenic, petrological and geodynamic implications) describes the field relations along with isotope data. Helium-isotope studies of Kola belt intrusions suggest upper mantle derivation of magmas and very low contamination by the crust. As opposed to the North China Craton and South Siberia, the juvenile crust is here the dominant contributor to Palaeoproterozoic continental growth.

A rigorous presentation of palaeomagnetic data from the 1.12 Ga Sally Diabase dyke (Finland) is presented in the chapter 'Palaeomagnetism of the Salla Diabase Dyke, northeastern Finland, and its implication for the Baltica-Laurentia entity during the Mesoproterozoic'. A long-lived Mesoproterozoic connection between the Baltic and Laurentia is proposed, but only one site out 13 sites yielded this result.

The importance of Nd-systematics for analysis of Precambrian crustal evolution becomes once more clear from the chapter 'Sm-Nd data for granitoids across the Namaqua sector of the Namaqua-Natal Province, South Africa'. This contribution highlights the complexity of crust-building processes during the Archaean, Palaeoproterozoic and Mesoproterozoic in various terranes. Some terrane boundaries are well identifiable by their isotope data, but others show no major change. Contrary to the older ideas, the Namaqua belt is dominated by juvenile crust of 1.4 to 1.0 Ga, suggesting strong crustal extraction from the mantle during the Mesoproterozoic. The evolution of continents to form Rodinia after disintegration of Columbia seems no less complex than the assembly and growth of Columbia.

A model for the development of the Man-Leo shield in western Africa, by synthesizing various major-element and REE data, is presented in the chapter 'Geodynamic evolution of the

2.25–2.0 Ga Palaeoproterozoic magmatic rocks in the Man-Leo Shield of the West African Craton. A model of subsidence of an oceanic plateau'. A three-stage evolution of the Palaeoproterozoic occurred, beginning with mantle-plume-related extension producing a tholeiitic greenstone belt, followed by compressional granitic activity and vertical tectonics.

The chapter 'U-Pb and Sm-Nd constraints on the nature of the Campinorte sequence and related Palaeoproterozoic juvenile orthogneisses, Tocantins Province, central Brazil' highlights the growth of the Palaeoproterozoic continent by accretion of magmatic arcs where the magmatic activity is dominated by juvenile magma. However, the neighbouring Sao Francisco craton is dominated by recycled crustal material of comparable age. Thus the Campinorte succession is allochthonous with a thrust boundary. The Campinorte lithostratigraphy is similar to that of the Birimian Belt greenstone, except for the absence of mafic and intermediate volcanism in the former.

Using U-Pb zircon and Sm-Nd whole-rock studies of tonalite-trondhjemite-granodiorite basement gneisses, evidence for 2.35 to 2.30 Ga juvenile crustal growth in the NW Borborema Province, NE Brazil suggests growth of continental crust in an island-arc setting during a period of general tectonic quiescence. This study reveals that not all tectonic lineaments are terrane boundaries, as quite a few such lineaments cut across terranes. The correlation is made with the western African successions, mentioning earlier rifting episodes separating them from their Brazilian counterparts.

Nine U-Pb SHRIMP dates, given in the chapter 'SHRIMP U-Pb c. 1860 Ma anorogenic magmatic signatures from the NW Himalaya: implications for Palaeoproterozoic assembly of the Columbia Supercontinent' form a significant contribution to Himalayan geology. This chapter devotes significant space to review the Himalayan geology and tectonism, much of which is Cenozoic in age. Palaeoproterozoic plume-related rifting and basic volcanism in that portion of Columbia are suggested for the area of the present-day Himalayas.

The chapter 'Palaeoproterozoic seismites (fine-grained facies of the Chaibasa Formation, east India) and their soft-sediment deformation structures' is the only contribution in this volume that is not based on geochronology and geochemistry, and as such has no bearing on the reconstruction of Columbia. It describes in vivid details the geometry of certain enigmatic sedimentary structures found in the generally low-grade metamorphosed, but locally intensely deformed, originally sedimentary, Chaibasa Formation. The sedimentary structures come from the fine-grained part of the formation free from outcrop-scale tectonic deformations, except for local penetrative foliation. The structures are described and analyzed in commendable details. Various structures are ascribed to earthquake-induced shocks, after evaluating the combination of features and an assortment of structures. Figure 16 puts the soft-sediment deformational story in a nutshell.

The chapter 'Correlations and reconstruction models for the 2500–1500 Ma evolution of the Mawson Continent' shows that the Gawler-Adélie Craton and the North Australian Craton formed a contiguous continental terrain all through the Palaeoproterozoic. The wealth of data, including geochronology, UHT metamorphism, palaeomagnetism and sedimentology from this badly exposed Neoarchean to Mesoproterozoic landmass are reviewed in-depth. The refinement of the palaeomagnetic data suggest that Australia and Laurentia may have been contiguous from approx. 1730–1595 Ma. The statement that "Due to the large degrees of freedom in reconstruction models for the Palaeoproterozoic, an exact geometry of the continental blocks is commonly not required and typically not possible" greatly reduces the uncertainty involving the fit of the continental blocks. The charts and tables correlating the events within the Mawson continent and Australia with the rest of the world will be very useful for students and researchers.

A quick survey of this volume brings out the following regarding the Palaeoproterozoic: (1) during the Palaeoproterozoic, the growth of continent involved both recycled older crust (North China Craton, South Siberia), and juvenile crust extracted from the mantle (Baltic, Brazil); Some areas like southern Africa have contributions from both; (2) distinct island-arc/volcanic-arc affinity is noticed for Brazil and southern Australia; (3) except for the western African Birimian Belt, and to some extent for its Brazilian counterpart, the general lack of greenstone belts from the Palaeoproterozoic may reflect a paucity in the development of such belts during this era; (4) plume-related magmatism is reported from only three areas: Kola peninsula in the Baltic, Birimian Belt in western Africa, and – with some uncertainty – northern India now within the Himalayas; (5) the complexity of extracting and interpreting palaeomagnetic data from Palaeoproterozoic: data from nearly unmetamorphosed dykes in Finland suffer from much uncertainty due to secular variation, whereas sediments from southern Siberia yield better constrained data on palaeopoles.

The graphics, except a few, are of excellent quality regarding both presentation and information. Authors and editors jointly created a work with good readability. The book is therefore valuable for all advanced undergraduate and graduate students of Precambrian geology, as well as for researchers of the Proterozoic. University and college libraries alike will find the volume useful to demonstrate the significance of integrated approaches from the various geoscience disciplines.

*Tapas Bhattacharyya*
*University of Calcutta, India*
*e-mail: tapasfs@gmail.com*