Journal of Asian Earth Sciences 105 (2015) 320–337

Contents lists available at ScienceDirect

Journal of Asian Earth Sciences

journal homepage: www.elsevier.com/locate/jseaes

# Paleo-Tethyan evolution of Tibet as recorded in the East Cimmerides and West Cathaysides

Zhiqin Xu [a,b,*], Yildirim Dilek [a,c], Hui Cao [a], Jingsui Yang [a], Paul Robinson [d], Changqian Ma [e], Huaqi Li [a], Marc Jolivet [f], Françoise Roger [g], Xijie Chen [a]

[a] State Key Laboratory of Continental Tectonics and Dynamics, Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037, China
[b] State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210093, China
[c] Department of Geology & Environmental Earth Science, Miami University, Oxford, OH 45056, USA
[d] Department of Earth Sciences, Dalhousie University, Halifax, Nova Scotia B3H4J1, Canada
[e] China University of Geosciences, Wuhan 430074, China
[f] UMR 6118, CNRS, University Rennes 1, Campus de Beaulieu, 35042 RENNES Cédex, France
[g] Université Montpellier 2, Place Eugène Bataillon, 34095 Montpellier Cedex 05, France

ARTICLE INFO

*Article history:*
Received 29 May 2014
Received in revised form 21 January 2015
Accepted 23 January 2015
Available online 12 February 2015

*Keywords:*
Paleo-Tethyan Tibet
Orogenic collage
Cimmerides
Cathaysides
Paleo-Tethys
Ophiolites and suture zones
Décollement-type orogen

ABSTRACT

The Paleozoic-early Mesozoic geology of Tibet was controlled by the rift-drift, seafloor spreading and subduction zone tectonics of a Paleo-Tethyan realm, which evolved between the West Cathaysides (WC) and the East Cimmerides (EC). Different suture zones with ophiolites and ophiolitic mélanges, high-pressure metamorphic belts, magmatic arcs and accretionary prism complexes separating different terranes mark multiple subduction-accretion systems within this Paleo-Tethyan domain, reminiscent of the modern Western Pacific Ocean. Discrete basins separated by different continental blocks and magmatic arcs constituted a complex paleogeography of Paleo-Tethys, and these oceanic strands were closed as a result of subduction with different polarities during the late Paleozoic-Triassic. The Longmu Tso Shuanghu–Changning Menglian Suture zone (LS–CMS) in Tibet represents the main tectonic boundary between the WC and EC that developed in the Devonian. The East Kunlun-A'nyemaqen oceanic slab was subducted northward beneath the East Kunlun terrane in northern Tibet, whereas the Sumdo oceanic slab was subducted northward beneath the South Qiangtang-North Lhasa terrane in southern Tibet. The Longmu Tso Shuanghu–Changning Menglian and Jinshajiang–Ailaoshan–Song Ma ophiolites were developed and emplaced in subduction-accretion systems with opposite polarities (westward and eastward) beneath the North Qiangtang–Qamdo–Simao–Indochina terrane in central Tibet. The Jinshajiang–Ailaoshan–Song Ma oceanic slab was subducted westward beneath the North Qiangtang–Simao–Indochina terrane along the Jinshajiang and Ailaoshan–Song Ma trenches in a trench–ridge–trench triple junction plate configuration. The Emeishan mantle plume produced a large Permian basaltic terrane, developed on the western passive margin of the South China block. The final closure of the Paleo-Tethyan oceanic branches resulted in continental collisions and development of a vast Indosinian orogenic collage in the latest Triassic–Jurassic.

© 2015 Elsevier Ltd. All rights reserved.

## 1. Introduction

Reconstructions of Pangea and Tethys for the time interval of 295–200 Ma (Fig. 1; Dilek and Rowland, 1993; Dilek et al., 1999; Dilek and Robinson, 2003; Flower and Dilek, 2003; Scotese, 2004; Metcalfe, 2011, 2013) indicates that the Paleo-Tethyan and Neo-Tethyan oceanic realms developed in the wake of northward-drifting ribbon continents and continental masses that were rifted off from the northern edge of Gondwana (Fig. 1; Dilek and Rowland, 1993; Dilek et al., 1999; Dilek and Robinson, 2003; Scotese, 2004; Metcalfe, 2011, 2013). The Cimmerides represent one of these continental masses whose remnants are now found in Anatolia, Persia, Afghanistan and Tibet (Metcalfe, 1996a,b; Metcalfe, 1999; Fig. 1). The Cathaysides included mainly the South China, Indochina, Sibumasu and Qamdo continental blocks and were already part of the Paleo-Tethyan realm since the Sedonian (Wegener, 1912; Morel and Irving, 1981; Parrish, 1993; Collins et al., 2003). The evolution of Paleo-Tethys, as recorded in the geology of Tibet, was controlled to the largest extent by the

* Corresponding author. Tel.: +86 01068999663.
*E-mail address:* xuzhiqin@gmail.com (Z. Xu).

http://dx.doi.org/10.1016/j.jseaes.2015.01.021
1367-9120/© 2015 Elsevier Ltd. All rights reserved.

tectonic interactions between the Cathaysides and the Cimmerides during much of the late Paleozoic-early Mesozoic. The Gondwana-derived terranes that are currently separated by a series of suture zones in Tibet migrated across the Paleo-Tethyan Ocean and were accreted into Asian continental margins during the late Paleozoic and Mesozoic. The final closure of the Paleo-Tethyan Ocean resulted in collision of the East Cimmerides and the West Cathaysides in Tibet, and led to the development of a vast orogenic belt (indosinian orogenic belt) in South Asia (Fromaget, 1927, 1929, 1934, 1952; Huang, 1945; Ren and Qu, 1966).

A new Permian paleogeographic reconstruction of northern Peri-Gondwana and Paleo-Tethys with a focus on Tibet (Fig. 2; Metcalfe, 2002) indicates that Permian marine strata occurred in an array of blocks containing diverse faunas of different biogeographical affinities. The North Qiangtang-Qamdo Block contains Permian marine faunas of typically Cathaysian character, whereas the Himalaya Tethys zone in southern Tibet is characterized primarily by cold-water faunas. The South Qiangtang and Lhasa blocks are characterized by mixed warm- and cold-water faunas supplemented with a strong endemic component (Zhang et al., 2013a,b).

In this paper, we present an overview of the tectonic evolution of Paleo-Tethys as recorded in the geological history of the East Cimmerides and West Cathaysides. We examine the structure and geochronology of different continental blocks, island arcs and magmatic arcs, accretionary prism complexes, ophiolites and suture zones that collectively represent the Paleozoic-early Mesozoic geology of the East Cimmerides and West Cathaysides, and the Paleo-Tethyan oceanic strands in between them. This overview and the tectonic model presented in the last part of the paper are based on the extant literature and our own work in Tibet and in the surrounding regions. As we review the existing and new data on the Paleo-Tethyan evolution of Tibet, we focus on the following fundamental questions related to its Paleo-Tethyan tectonics: (1) How does the geology of the East Cimmerides (EC) and West Cathaysides (WC) reflect the Paleo-Tethyan tectonics in Tibet? (2) What were the timings of the opening and the closure of different strands of the Paleo-Tethyan Ocean, and what were the subduction polarities within them as they closed? (3) How did the amalgamation of various continental blocks and arc terranes within the Paleo-Tethyan realm occur, leading to the final closure of Paleo-Tethys and to the development of the Indosinian orogenic collage?

## 2. Paleo-Tethyan tectonic framework in Tibet

The Paleo-Tethyan realm in Tibet can be subdivided, based on the occurrence of markedly distinct Permian and younger sedimentary sequences and faunal successions in them (Ueno et al., 2003; Zhang et al., 2013a,b), into two main domains: The East Cimmerides to the west and the West Cathaysides to the east (Metcalfe, 1999). The East Cimmerides includes the South Qiangtang/North Lhasa (SQT–NLS) – Baoshan (BS) – Sibumasu (SB) terranes to the north and the South Lhasa terrane to the south (Fig. 3). The West Cathaysides in Tibet includes the North Qiangtang–Qamdo–Simao–Indochina and Songpan–Ganze terranes (Fig. 3). The final collision between the East Cimmerides and West Cathaysides resulted in the build-up of a broad Paleo-Tethyan (or Indosinian) orogenic belt during the latest Triassic and Jurassic (Xu et al., 2013) that is characterized by multiple ribbon terranes, Paleozoic ophiolites, island arc complexes, high pressure metamorphic belts, and fossil accretionary prism complexes.

Major fault systems separating these various tectonic entities in Tibet developed during their juxtaposition as the Paleo-Tethyan oceanic realm diminished. The Longmu Tso Shuanghu–Changning Menglian suture zone, which separates the East Cimmerides from the West Cathaysides (Fig. 3), represents the most important suture zone within the Paleo-Tethyan system in Tibet. The E–W trending Kunlun-A'nyemaqen suture zone in the West Cathaysides lies between the Songpan Ganze terrane to south and the Kunlun terrane to north, and the Jinshajiang–Ailaoshan–Song Ma suture zone separates the North Qiantang–Qamdo–Simao–Indochina terrane from the South China Block and the Songpan Ganze terrane (Fig. 3). The newly discovered Paleo-Tethyan Sumdo suture zone occurs between the South Qiangtang–North Lhasa and South Lhasa terranes of southern Tibet (Fig. 3; Yang et al., 2006; Chen et al., 2009). Numerous ophiolites and ophiolitic mélanges, high-pressure metamorphic units,

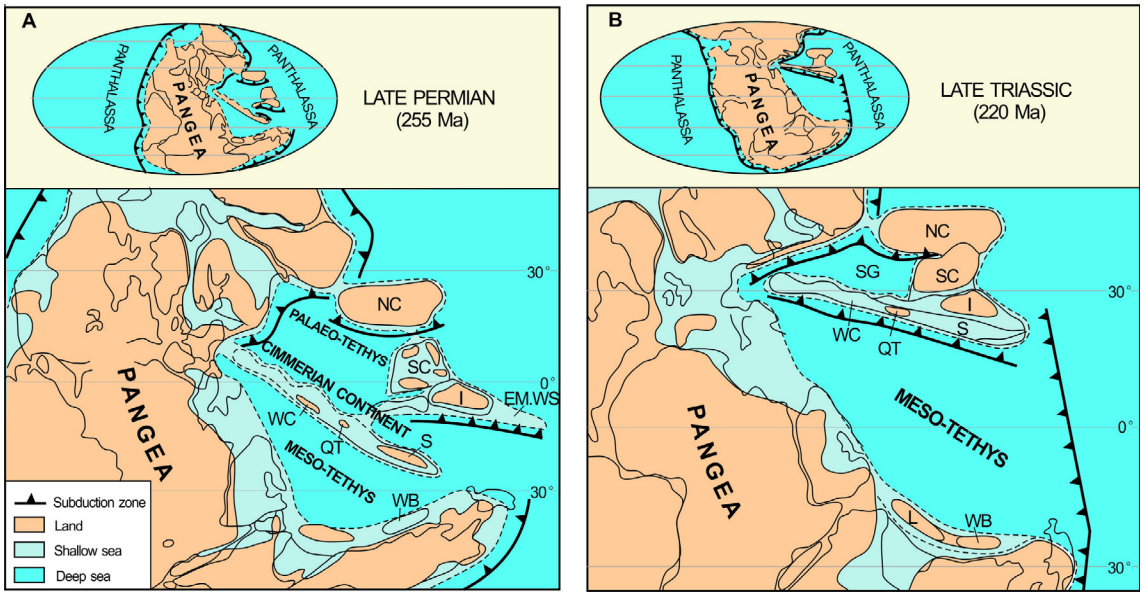


**Fig. 1.** Paleogeographic reconstructions of the Tethyan region for late Permian (A) and late Triassic (B), showing relative positions of the west and southeast Asian terranes and distribution of the landmasses and sea during these time periods (after Scotese, 2004). Key to lettering: SC – South China; I – Indochina; NC – North China; SB – Sibumasu; WB – West Burma; QT – Qiangtang; L – Lhasa; WC – Western Cimmerian Continent, SG – Songpan Ganze.

Download English Version:

https://daneshyari.com/en/article/4730501

Download Persian Version:

https://daneshyari.com/article/4730501

Daneshyari.com