

available at www.sciencedirect.com China University of Geosciences (Beijing)

## **GEOSCIENCE FRONTIERS**

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



### **RESEARCH PAPER**

# Extensional tectonics and sedimentary response of the Early-Middle Cambrian passive continental margin, Tarim Basin, Northwest China

# Zhiqian Gao\*, Tailiang Fan

Key Laboratory for Marine Reservoir Evolution and Hydrocarbon Accumulation Mechanism, Ministry of Education of China, China University of Geosciences, Beijing 100083, China

Received 5 July 2010; accepted 12 January 2012 Available online 25 February 2012

#### **KEYWORDS**

Passive continental margin; Extensional tectonics; Half-grabens; Normal faulting; Tarim Basin; Northwest China **Abstract** The fact that several half-grabens and normal faults developed in the Lower-Middle Cambrian of Tazhong (central Tarim Basin) and Bachu areas in Tarim Basin, northwest China, indicates that Tarim Basin was under extensional tectonic setting at this time. The half-grabens occur within a linear zone and the normal faults are arranged in en echelon patterns with gradually increasing displacement eastward. Extensional tectonics resulted in the formation of a passive continental margin in the southwest and a cratonic margin depression in the east, and most importantly, influenced the development of a three-pronged rift in the northeast margin of the Tarim Basin. The fault system controlled the development of platform - slope - bathyal facies sedimentation of mainly limestone-dolomite-gypsum rock-saline rock-red beds in the half-grabens. The NW-SE trending half-grabens reflect the distribution of buried basement faults.

© 2012, China University of Geosciences (Beijing) and Peking University. Production and hosting by Elsevier B.V. All rights reserved.

\* Corresponding author.

E-mail address: gzq@cugb.edu.cn (Z. Gao).

1674-9871 0 2012, China University of Geosciences (Beijing) and Peking University. Production and hosting by Elsevier B.V. All rights reserved.

Peer-review under responsibility of China University of Geosciences (Beijing). doi:10.1016/j.gsf.2012.01.007



Production and hosting by Elsevier

### 1. Introduction

Passive continental margins are formed when continental crust undergoes extensional rifting and are characterized by long-term stable oceanic basins at the outer edge of the continent. As an intermediate process between continental rifting and oceanic spreading, the extension phase contains important information (Cao and Zhou, 2003; Stern, 2007). Studies of the tectonic characteristics of passive continental margins are of great significance in understanding the distribution of stress during the extensional process, analysis of eustatic change, identification of paleoocean and paleoclimate features, reconstruction of the evolutional history of basins, as well as establishment of a sedimentary model. In addition, passive continental margin sediments contain abundant hydrated petroleum and natural gas resources (Barr, 1992; Yang et al., 2000; Zabanbarc and Zhu, 2000).

#### 2. Geological setting

Located in Xinjiang Uyghur Autonomous Region in China's far west and bounded by the Tianshan Mountains in the north and the Kunlun Mountains in the south, the Tarim Basin covers an area of  $56 \times 10^4$  km<sup>2</sup> (Fig. 1) and has abundant oil/gas resources. The basin is the largest petroliferous superimposed structure in China and has experienced multiple stages of formation and reworking. The basin is characterized by an exceptional volume of sediments, prolific source rocks and provides evidence of diverse tectonic events. It is considered to have a high hydrocarbon potential area with possible reserves.

The Paleo-Tarim plate, including the paleo-continental basement formed in the Archean and Proterozoic, and was consolidated during the Neoproterozoic. The pre-Sinian crystalline basement was covered by Paleozoic marine deposits, Mesozoic and Cenozoic terrestrial deposits. During the Early–Middle Cambrian, dolomite and gypsum deposits were dominant in the west, while to the east mudstone was deposited. The maximum thickness of the Early Cambrian dolomites is 200 m, and those of the Middle Cambrian are up to 400 m.

# **3.** Extensional tectonic features during the Early–Middle Cambrian

#### 3.1. New structural interpretation: extensional structures

Seismic data interpretation result indicates that the Tazhong (central part of Tarim Basin) and Bachu areas (Fig. 1) were under an extensional tectonic setting during the Early–Middle

Cambrian, when wedge-shaped formations were formed in halfgrabens (Fig. 2a). Stratal thickness therefore changes dramatically, and the variation shown by internal seismic reflection indicates changes in lithology and facies. With a subsequent change to a compressive environment, the Tarim Basin underwent tectonic reversion on existing extensional faults and formed additional faults which dip in the opposite direction to the listric faults of the extension phase. The current tectonic framework of the Tarim Basin was formed by these two tectonic regimes (Fig. 2b).

Most half-grabens were developed successively during the Early and Middle Cambrian and contain similar sediment thicknesses. However, the shape of the Middle Cambrian grabens is more distinct than those of the Early Cambrian, implying more intense tectonic activity during that period. Small-scale halfgrabens generally are long, narrow features, and when connected form a large half-graben structure, consisting of highland, slope and deep sags (Fig. 3). These large half-grabens largely controlled regional sedimentary geomorphology while smaller component half-grabens controlled the development of local strata and the distribution of sedimentary facies. Generally, seismic reflection within the half-grabens has low amplitude and strong discontinuity, indicating uniform sediments and no component variation. However, the slope and highland areas are characterized by strong amplitude and good continuity indicating a different lithological sequence with frequent change of depositional environment.

In addition to these half-grabens, there are also some normal faults in the Bachu and Tazhong areas which, in combination with the half-graben structures, suggest that the pattern of deposition was developed during the Early—Middle Cambrian (Fig. 4). The basin also experienced differential tilting during lateral extensional. Tilting was minor in the western part of the Bachu Uplift, steepest in the west part of the Hetian River and moderate in the southern part of the Tazhong Uplift.



Figure 1 Location of the Tarim Basin, China.

Download English Version:

https://daneshyari.com/en/article/4681837

Download Persian Version:

https://daneshyari.com/article/4681837

Daneshyari.com