Subarea characteristics of earthquake types in Yunnan*

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Abstract

Studies on the earthquake sequences and the source mechanisms of the strong earthquakes show that Yunnan has more obvious subarea characteristics of earthquake type. Strike-slip seismic fault and mainshock-aftershock earthquake sequences are dominant in whole Yunnan area. Considering the ratio of non strike-slip faults and non mainshock-aftershock, Yunnan area can be divided into four subareas with different characteristics, which are strike-slip mainshock-aftershock in central Yunnan (A1), incline-slip swarm in northwestern Yunnan (A2), strike-slip double shocks in western Yunnan (B1) and quasi-strike-slip mainshock-aftershock in southwestern Yunnan (B2), respectively.

Key words: activity of strong earthquake; earthquake type; subarea characteristics; Yunnan area

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Introduction

Seismicity in Yunnan area (21°N~29°N, 97°E~106°E) is frequent. During the 20th century, there were 333 earthquakes with $M \geq 5$ in Yunnan, among which $M 7$ earthquake is 10 groups, 13, and earthquake with $M 6.0$-6.9 is 69.

The strong earthquake activity in Yunnan area is closely related to the special geological location. On the one hand the west Yunnan is neighboring to lateral subducted zone of the India Plate toward the Chinese mainland of Eurasia Plate, which can be taken as the part of the Eurasia Seismic Zone. On the other hand the east Yunnan, within the interior of the continent, is located in the south segment of the North-South Seismic Zone of China. Study on the active blocks of Chinese mainland (ZHANG et al, 2002) suggested that Jinshajiang-Honghe fault belt can be taken as the boundary in Yunnan area, the east and west parts belong to Qinghai-Xizang (Tibetan) Plateau and Yunnan-Myanmar active block, respectively, which is identical to the east-west zoning of Yunnan’s seismicity (HUANGFU et al, 2000; HUANGFU and QIN, 2006). Therefore the earthquake activity in Yunnan has both intraplate and interplate characteristics, and the seismic types are more abundant. With gradually deep studies on the earthquake, differences among the seismic types in Yunnan area are gradually noticed by people (HUANGFU, 1997; QIN et al, 2005).

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Through comparison between mechanical property of statutory of strong earthquake and seismicity parameters, the paper studied the distribution characteristics of the seismic types and zoning of the seismic types, which would be helpful to the earthquake studies in Yunnan.

1 Modern fault pattern in Yunnan and nearby areas

Yunnan is located on the east side of Chinese mainland collision belt between the Indian and Eurasian plates, where the crustal movement is acute, the seismicity level is higher and closely related to the active blocks. The modern fault pattern in Yunnan is determined by the Himalayas movement. The Himalayas movement originates from the collision between the India Plate and the Eurasia Plate. About 45 Ma ago the continent-continent collision between the India subcontinent and the Eurasia continent along the Brahmaputra upheaved Qinghai-Xizang Plateau (MA et al., 1998). During this period the structural processes with deep influence on the Yunnan area come from the two aspects of the same source.

1) The strong extrusion from the west to the east in the Myanmar arc zone closing to Yunnan is the near ENE-component function of the NE India Plate movement on south area of the Himalayas east structural knot, i.e., Assamese arc. It can be seen that the action process was earlier than right collision of Indian Plate toward Chinese mainland in Eurasia Plate by analyzing the track of India Plate movement toward north in geological era. The lateral extrusion from the modern India Plate perhaps formed a nearly NNW fault without obvious surface trackway, but with good linear distribution of strong earthquakes (GUO et al., 1999).

Figure 1 Sketch map of the modern fault pattern in Yunnan area

I. Yunnan-Myanmar-Thailand block; II. Indochina block; III. Central Yunnan block; IV. East Yunnan block.
TC: Tengchong block; BA: Baoshan block; LS: Lanping-Sima behindarc basin; YI: Yanyuan-Lijiang continental margin sag; DZ: Central Yunnan sag; KD: Kangdian paleoupheaval; DD: East Yunnan block