The Bayan Har block is mainly bounded by the east Kunlun fault zone to the north, Garzê-Yushu-Xianshuie fault zone to the south and Longmenshan fault zone to the east (Fig. 1). In the past 20 years, large earthquakes have occurred frequently along this block's boundaries, which has received much attention from geoscientists. Whether large earthquakes will happen (and where) along this block's boundary faults in the future are two key problems that need to be addressed. This study calculates the accumulated tectonic stress and superposition of the Coulomb stress caused by fault slip of 16 large earthquakes since 1904, and evaluates the possible locations of future earthquakes that may occur around this block.

This work identified four main seismic gaps along the main fault zones of the Bayan Har block based on the distribution of large earthquakes since AD 1320. They are the EW-Datang-Xiugou, Maqin-Maqu, Qingchuan and Fenghuoshan seismic gaps (Fig. 1). The Tibetan plateau had been extruded northeastward by the Indian plate northward motion, with a velocity of 4 cm/yr since at least the Quaternary (Rowley, 1996; Copley et al., 2010). It therefore yields that the crustal deformation rate is essentially consistent with that of the Bayan Har block. The calculation assumes that the rate of the deep-crust brittle seismogenic layer corresponds to that of the earth's surface. Furthermore, paleoseismic data reveal that the

* Corresponding author. E-mail: zhouchunjing01@aliyun.com
earthquake recurrence interval in this study area is roughly 1000-4000 yrs since 24 ka. Based on the above conclusion and assumption, regarding the crust as a Maxwell viscoelastic body, we calculated an accumulated tectonic stress of 1000 yr and 4000 yr, respectively, and the tectonic stress variation accumulated at each seismic gap since the last large earthquake occurred, based on GPS velocity field data and with the finite element method. The result shows that the direction of the accumulated tectonic stress of the seismic gaps is roughly the same as the present regional tectonic stress. The calculated tectonic stress variation is up to a magnitude of 0.9-3.5 MPa, equivalent to a shear stress of 0.45-1.8 MPa at the fault slip direction, which is in the range of an average stress drop (0.1-20 MPa, Nur et al., 1974) of a large earthquake.

A semi-infinite viscoelastic crustal structure model and the viscoelastic stress/strain software (PSGRN/PSCMP) (Wang et al., 2006) were used to calculate the coulomb stress induced by 16 Ms≥7.0 earthquakes that occurred during 1904-2013, and to analyze its triggering action on the gaps. The result shows that the accumulated coulomb stress variation is positive in the EW-Datan-Xiougou seismic gap (positive value means triggering large earthquakes and negative value means delaying) with a maximum of 100 kPa, and it is still increasing at present. The coulomb stress variation at the western segment of the Maqin gap is positive with a maximum of 100 kPa, while that at the eastern segment is negative, but increases sharply and will reach a positive magnitude after 12 years. The coulomb stress variation at the eastern segment of the Maqin gap is positive, reaching up to 60 kPa, while that at the western segment is negative, increasing slowly and eventually reaching a positive magnitude after 420 years. The coulomb stress variation along most segments of the Qingchuan gap shows positive values with a maximum of 50 kPa. The whole Fenghuoshan seismic gap shows negative coulomb stress variation, ranging from -5.5 to -40 kPa, still with a dropping trend at present. Besides, we also calculated the accumulated coulomb stress variation before earthquake occurrence time of 10 large earthquakes since 1955 in the study area. The statistical result demonstrates that, during the past decades to hundreds of years ago, 90% of large earthquakes occurred around the Bayan Har block with positive coulomb stress, and accumulated coulomb stress of 70% earthquakes reached or exceeded the coulomb stress threshold (10 kPa, Stein et al., 1997).

It can be inferred from the tectonic stress in large seismic gaps along the main boundary fault zone and the accumulated coulomb stress variation caused by the 16 strong earthquakes that, there are four main seismic gaps along the fault zone of the Bayan Har block after the 2013 Lushan Ms 7.0 earthquake. Of these four seismic gaps, three segments, including the EW-Datan-Xiougou, Maqin-Maqiu and Qingchuan seismic gaps, have relatively greater seismic risk, while the Fenghuoshan seismic gap has relatively smaller seismic risk (Fig. 1). Considering there are densely populated areas in Sichuan and Shanxi provinces in the Qingchuan gap, prevention of large earthquake hazards along this segment is essential.

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