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Research Advances

New insights of the Cenozoic Rotational Deformation of Crustal Blocks on the Southeastern Margin of the Tibetan Plateau and its Tectonic Implications

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Objective

The lateral extrusion of crustal materials around the southeastern edge of the Tibetan Plateau since the Oligocene is believed to be one of the main inducements of ~1300 km latitudinal crustal convergence in the Tibetan Plateau, since the collision of India and Eurasia in the Paleogene. Two end-member models were used to describe the process of lateral extrusion of crustal material on the southeastern edge of the Tibetan Plateau. The "tectonic escape" model suggests the Indochina Block, Chuandian Fragment and Shan-Thai Block have experienced lateral extrusion along strike-slip fault systems, and the "crustal flow" model suggests that the upper crust has undergone southeastward escape in the form of ductile deformation, driven by viscous lower crustal flow channels. In addition, the GPS observations surrounding the Tibetan Plateau indicate that crustal materials currently experience clockwise rotation around the Eastern Himalaya syntaxis. This work conducted paleomagnetic studies in the Cretaceous and Paleogene red-beds along the southeastern margin of Tibetan Plateau, in order to reveal the kinematic characteristics of crustal blocks during the Cenozoic, and the relationships between the activity of strike-slip fault systems and the extrusion of crustal blocks.

Methods

Paleomagnetism is an effective method of revealing the kinematic characteristics of crustal blocks on a long-time scale. Furthermore, the anisotropy-based inclination shallowing test and elongation/inclination correction were used to test the inclination shallowing of red-beds, and improve the reliability of estimation of latitudinal displacement of crustal blocks. Several paleomagnetic sampling sections were arranged in the Cretaceous and Cenozoic sedimentary strata, in the Simao Terrane, Chuandian Fragment and Baoshan Terrane. Furthermore, previously published Cretaceous and Cenozoic paleomagnetic data of the southern edge of the Tibetan Plateau were also selected for comparison.

Results

The paleomagnetic studies show that the Simao Terrane as the northwestern part of the Indochina Block, the Baoshan Terrane as the northern part of the Shan-Thai Block, and the Chuandian Fragment have experienced very complex rotational deformation in the Cenozoic (Fig. 1). Since the early Miocene, the Shan-Thai and Indochina Blocks firstly experienced southeastward extrusion with ~20° clockwise rotation relative to the South China Block. Then, during the middle to late Miocene, the Shan-Thai Block further experienced ~15° clockwise rotation. The activity of strike-slip faults surrounding the Simao Terrane induced the internal different rotational deformation of the terrane. In the north side of the Red-River strike-slip fault system, the western and central parts of the Chuandian Fragment experienced ~20° integral clockwise rotation relative to the South China Block since the middle Miocene. However, the eastern part of the Chuandian Fragment experienced different rotational deformation since the Pliocene, because of the intense regional crustal deformation and activity on faults systems. The Yuanmou-Luezhijiang left lateral strike-slip fault formed the eastern boundary of the Chuandian Fragment prior to the Pliocene, and then it was substituted by the Xiaojiang left lateral strike-slip fault since the Pliocene, due to the eastward spreading of the clockwise rotational movement of the Chuandian Fragment. The paleomagnetic studies of the Baoshan Terrane indicate that the crustal material on the southeastern edge of Tibetan Plateau first underwent latitudinal crustal shortening in the Oligocene, and the

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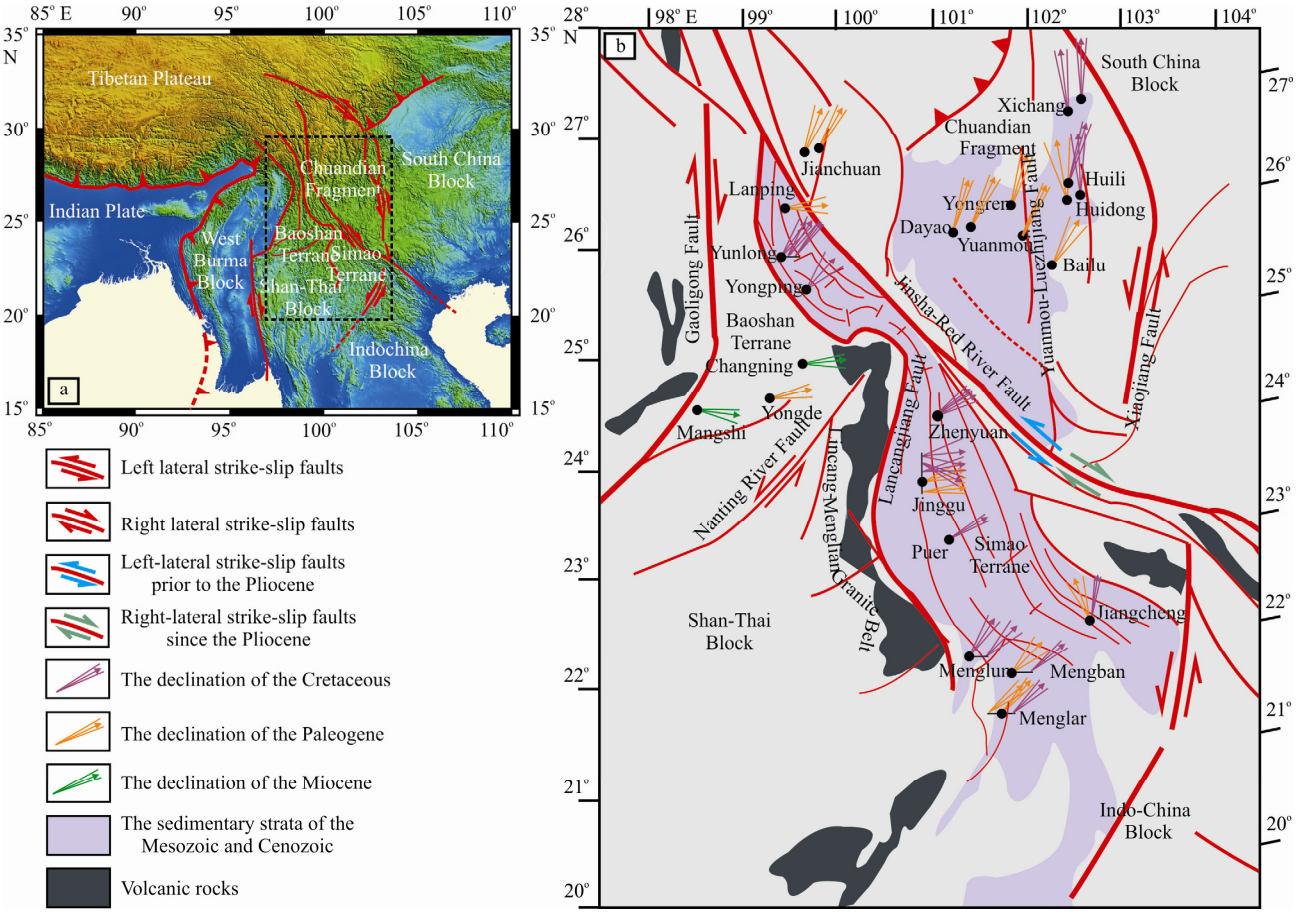

Fig. 1. (a), Schematic tectonic-geographical map of Southeast Asia; (b), Paleomagnetic declination characteristic of paleomagneitc study area in the southeastern edge of Tibetan Plateau. Arrow is the paleomagnetic declination. Straight lines on both sides of arrow are the uncertainties of paleomagnetic declination.

eastward extension was the main form of motion of the crustal material on the southern edge of Tibetan Plateau. Since the Miocene, the main form of crustal motion of Baoshan Terrane and Simao Terrane was gradually transformed into clockwise rotation, which possibly indicates that the fold and thrusting fault system induced crustal shortening and thickening in the southeastern edge of the Tibetan Plateau have reached extremity, and the southeastern part of the Tibetan Plateau has already been uplifted to the similar elevation with today's in the Miocene.

Conclusions

(1)The crustal material on the southern edge of Tibetan Plateau has experienced complex rotational escaping movement since the Miocene.

(2)The evolutionary of the block boundary strike-slip faults was controlled by the difference of clockwise rotational extrusion velocities between crustal Blocks.

(3)The southeastern part of the Tibetan Plateau has already been uplifted to the similar elevation with today's, in the Miocene.

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