

Cold and warm subduction and complex orogenic process of the Paleo-Tethyan suture zones in the southeastern Tibetan Plateau

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The formation and evolution of the Paleo-Tethyan tectonic regime have become the focus in the geoscience field. Previous studies focus on formation and evolution of one single subduction zone, whereas little attention was paid to the interaction of different subduction zones and its kinematic mechanism, which is significant for depicting deep cyclic processes of the Paleo-Tethyan tectonic regime. The Paleo-Tethyan subduction zones are mainly represented by the Changning-Menglian- Longmu Co-Shuang hu suture zone (CMLCS) and Song Ma-Ailaoshan-Jinshajiang suture zone (SAJ) in the northeastern and southeastern Plateau Tibetan. These suture zones are separated by the Lanping-Sima-Indochina Block, and are ideal for exploring the interaction of subduction zones and related kinematic mechanism.

Our study revealed that the CMLCS builds a nearly 2000 km oceanic cold-subduction high-pressure-ultrahigh pressure metamorphic belt. The continental crusts followed by the sinking of the Paleo-Tethys in the CMSZ also underwent steep and rapid cold subduction. The Song Ma eclogites are interpreted to be formed by Paleo-Tethyan warm subduction. From continental initial collision to mature collision stage, the breaking off of subducted oceanic slab results to asthenosphere upwelling, which would slow down subduction angle, warm subduction thermal structure and bring about granulite facies metamorphism in the medium-pressure facies field. In this regard, the SAJ documents transition of warm to hot subduction during oceanic subduction and continental collision.

The Song Ma eclogites are products of oceanic warm subduction at its final closure stage, which is different from the phenomenon as frequently expected. We interpreted this abnormal phenomenon as the products of interaction of the double-sided subducted slabs, the overlying continental block and the deep asthenosphere. The back arc basin that was derived from the eastward steep cold subduction of the Changning-Menglian Ocean would have promoted the overlying plate to be pushed onto the Song Ma-Ailaoshan-Jinshajiang Ocean. The tight coupling of upper and lower slabs is responsible for warm subduction in a low angle for the Song Ma-Ailaoshan-Jinshajiang Ocean.