Indosinian epoch collsional orogenic belt in the Lhasa terrane, Tibet: geochronology, distribution and evolution

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The Lhasa terrane, a huge Tectonic-magmatic belt (2500km long and 150-300km wide), locates between the Yarlung-Tsangpo and Bangong-Nujiang suture zones. The continental crust basement and Paleozoic cover of the Lhasa terrane, together with the Himalaya terrane, is generally considered as the northern margin of Gondwanaland (Yin, A. and Harrison, T. M., 2000; Xu et al., 2006). The Lhasa terrane was finally separated from the Gondwana land with the formation of Yarlung Tsangpo Neo-Tethyan ocean.

However, the discovery of eclogite belt northeast of Lhasa city shed new light in contrast to the above-mentioned general understanding of the Lhasa terrane. The petrography, chronology and geochemistry studies indicate that the protolith of the eclogites might be from the Paleo-Tethyan oceanic crust during Carboniferous-Permian periods. The metamorphic age of eclogite facies is 262±5 Ma, which indicates the existence of a new Paleo-Tethyan suture zone in the Lhasa terrane (Yang et al., 2009).

Regional structure analysis and muscovite 40Ar-39Ar dating of muscovite-quartz schist, eclogite and retrograde eclogite indicates that the closure of the Paleo-Tethyan ocean basin and the following collision of northern and southern parts of the Lhasa terrane occurred at 220-240 Ma. It was an Indosinian epoch collsional orogenesis. This Indosinian orogenesis is further confirmed by the regional sedimentary characteristics, magmatic activity and ophiolite mélange. These evidences suggest that the Indosinian orogenic belt in the Lhasa terrane is widely distributed from the Coqen county in the west, and then extends eastward through the Nanmulin county, Ningzhong and Sumdo area, finally turns around the eastern Himalayan syntaxis into the Bomi region(Figure1).

Based on the evolutionary process, the geological development of the Lhasa terrane from early Palaeozoic to early Mesozoic can be divided into seven stages: ①During Ordovician-Devonian (O-D), the Lhasa terrane should be as a part of northern margin of Gondwana land with stable carbonate platform sediments②During Early - Middle carboniferous (C1-C2), the northern Lhasa terrane should have been departed from Gondwana.An initial ocean basin was formed.③During Middle-Late carboniferous(C2-C3), the initial ocean basin might develop into a mature ocean basin. ④During Late Carboniferous-Early Permian(C3-P1), the Paleo-Tethyan ocean basin should start the subduction process. eclogite oldest single zircon age (293±13Ma) confirms this inference(Yang et al., 2009). ⑤During Late Permian -Early Triassic(P3-T1), most of oceanic crust might be subducted and a remnant ocean basin was left, with large scale eclogites formed then. ⑥During Middle-Late Triassic(T2-T3), the Paleo-Tethyan ocean basin disappeared and an Indosinian collisional orogenesis occurred at 220 -240Ma, with the eclogite exhumation at the same time. ⑦During Late Triassic -Early Jurassic(T3-J1), the Indosinian orogenesis might go to the end and then late-orogenic granitic magmatic activities occurred, forming a large scale Indosinian epoch granite belt in the Lhasa terrane, with accurate zircon ages of 217-190 Ma.

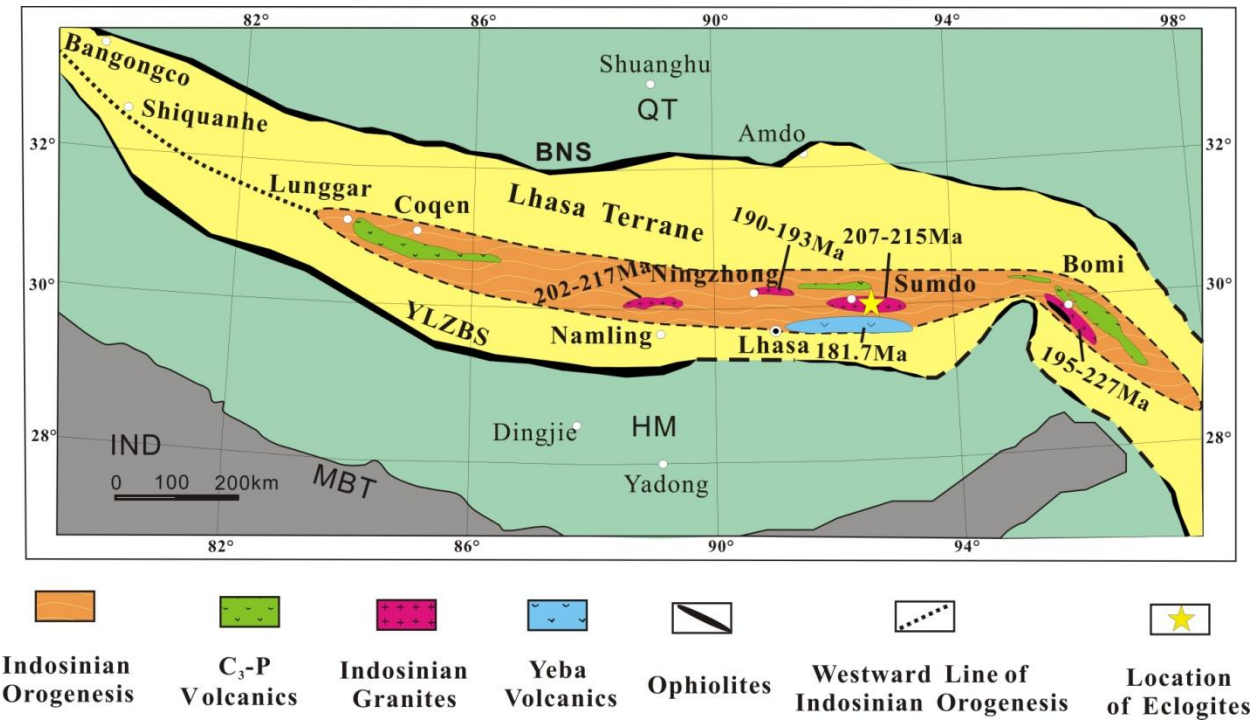

Figure1. The spatial distribution of Indosinian orogenic belt in the Lhasa terrane and the related igneous rocks of Neopaleozoic- early Mesozoic. QT- Qiangtang terrane; HM- Himalaya terrane; IND- India block; MBT- Main boundary fault; BNS- Bangong-Nujiang suture zone; YLZBS- Yarlung Tsangpo suture zone

All the above seven stages reveal a perfect evolutionary process of the Paleo- Tethys ocean between northern Lhasa terrane and southern Gondwana land. The Indosinian orogenisis is a significant event for the evolution of the Lhasa terrane as well as the Tibetan plateau.

References

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