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## Development of the Sumdo Suture in the Lhasa Block, Tibet, China

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### 1 Abstract

The Qinghai–Tibet plateau is a composite continental fragment formed by collision of multiple terranes and island arcs. The Lhasa terrane, which is located in the central part of the plateau, is bounded by the Yarlung–Zangbo suture to the south and Bangong–Nujiang suture to the north. An E–W–trending belt of (ultra)-high pressure eclogite was discovered in the Sumdo region of the Lhasa terrane. Careful field studies combined with petrological, geochemical and isotopic analyses show that the Sumdo eclogites mark a Carboniferous–Permian suture zone, at least 100 km long, containing ophiolite fragments, eclogites and Indosinian post–orogenic granitoids. This suture divides the Lhasa block into a northern and southern segment.

Sumdo eclogite occurs about 200 km east of Lhasa city, and extends over 100 km in an E–W direction. Sumdo eclogites were accompanied by garnet amphibolite and plagioclase amphibolite formed by retrograde metamorphism of the eclogites. The eclogites were derived from oceanic basalts. LA–ICPMS U–Pb dating of zircon from the Sumdo eclogites indicates a Permian metamorphic age (260–270 Ma) and a Carboniferous protolith age of  $303 \pm 4.8$  Ma.

The ophiolite fragments in the Sumdo suture zone are composed of the ultramafic rocks, MORB–type basalt, OIB–type basalt and island arc basaltic andesite, some of which are intruded by post–collisional granites. The ultramafic body, a typical tectonic block in the suture zone,

is completely serpentinized. Its geochemical features suggest that it is composed of harzburgite, typical of depleted mantle peridotite. The MORB and OIB–type basalts crop out in the Chasagang Formation, and the basaltic andesite crops out in the Leilongku Formation, both of which make up the Sumdo Group.

Zircons from the OIB–type basalt with typical magmatic characteristics yield an average U–Pb age of 306 (95%) Ma, suggesting formation in a Paleo–Tethyan basin in the Carboniferous. U–Pb dating of zircon from the basaltic andesites yielded a concordant age of  $265 \pm 3.1$  Ma, similar to the metamorphic age (266–270 Ma) of the eclogites, suggesting formation during subduction of the oceanic crust. Indosinian granodiorite with an age of  $194 \pm 4.3$  Ma crops out north of the Sumdo suture. These granodiorites are similar to the late Indochina granites in the Lhasa block, and most likely formed during continent–arc collision or during closure of the Paleo–Tethyan Ocean.

A four–stage model for the evolution of the Sumdo Paleo–Tethyan suture is proposed: 1) From the Ordovician to the Devonian Gondwanaland was part of an epicontinental sea; 2) In the Carboniferous, continental rifting produced a local basin, which then evolved into a Paleo–Tethyan ocean basin, dividing the Lhasa block into two segments; 3) From the Permian to the early Triassic, Paleo–Tethyan oceanic crust was subducted northward and; 4) In the middle Triassic and early Jurassic, the two fragments collided to form the modern Lhasa block.

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