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Research Advances

Newly Discovered Ca. 163 Ma OIB-Type Diabase Dike from the Shiquanhe Ophiolites, Western Tibet

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Objective

The Shiquanhe ophiolite is an important tectonic belt in western Tibet. It has been debated whether the Shiquanhe ophiolite represents an allochthonous nappe derived from the Bangong-Nujiang suture zone to the north or the autochthonous remnants of a different oceanic crust (e.g., Wu Zhenhan et al., 2016). Geochemical and geochronological studies of ophiolitic components are critical to understand evolutionary history of the Shiquanhe ophiolite and to resolve the controversy. This paper reports, for the first time, the late Middle Jurassic oceanic island basalt-type (OIB-type) diabase dike in the Shiquanhe ophiolite. The diabase is an important supplement to the knowledge of the petrologic assemblage of the Shiquanhe ophiolite and provides constraints on its evolutionary history.

Methods

Detailed field investigation was carried out along a north-south profile through the Shiquanhe ophiolite. The diabase dike was found about 5 km to the north of the town of Shiquanhe (N32°34′42″, E80°03′42″). The samples were studied under a petrographic microscope. Major elements were analyzed by Rigaku RIX 2100 X-ray fluorescence spectrometers and trace elements were analyzed by ICP-MS (Agilent 7500a). Zircon U-Pb geochronology was performed by LA-ICP-MS at the Wuhan Sample Solution Analytical Technology Co. Ltd. (Wuhan, China).

Results

The diabase has intruded the peridotite of the Shiquanhe ophiolite, trending to the WNW at shallow dipping angle (Fig. 1a). It shows a typical diabasic texture in microscope (Fig. 1b). Zircon grains from the diabase are mostly colourless and transparent, idiomorphic to hypidiomorphic with sizes of 50-100μm. The Th/U ratios (0.48-0.71) indicate a magmatic origin. Zircon U-Pb gechronological analysis yields twelve concordant ages and a weighted mean age of 163.7±0.54 Ma (Appendix 1; Fig. 1c), indicating that the diabase was formed in the late Middle Jurassic time.

The diabase samples have SiO_2 of 40.93–49.88wt%, $Mg^{\#}$ of 46.32–60.42, high LREE content and high Zr/Y, TiO_2/Yb, Nb/Yb ratios, indicating an OIB-type mantle source (Fig. 1d). However, the samples are depleted in Nb and Ti and have Pb positive anomalies (Fig. 1d), suggesting they were contaminated due to subduction-related processes.

Notably, high magnesium andesite-type (HMA-type) diorites, with zircon U-Pb ages (160.8±2.3 Ma) similar to the OIB-type diabase, were previously reported from the Shiquanhe ophiolite (Liu et al., 2018). The synchronous HMA-type diorite and OIB-type diabase from the Shiquanhe ophiolite are similar to the rock assemblage in the Izu-Bonin-Mariana island arc (southwest Pacific) formed during the initial stage of oceanic subduction, suggesting the presence of an early stage oceanic subduction zone in the late Middle Jurassic time.

Conclusion

The diabase dike has a zircon U-Pb age of 163.7±0.54 Ma, suggesting that it was emplaced in late Middle Jurassic. Major and trace elemental characteristics indicate the diabase was derived from a OIB-type mantle source and contaminated by subduction-related processes. Together with synchronous HMA-type diorite reported from the literature, the OIB-type diabase indicates that the Shiquanhe oceanic crust experienced an early stage oceanic subduction in the late Middle Jurassic time. The timing of initial subduction associated with the Shiquanhe ophiolite is much later than that of the Bangong-Nujiang

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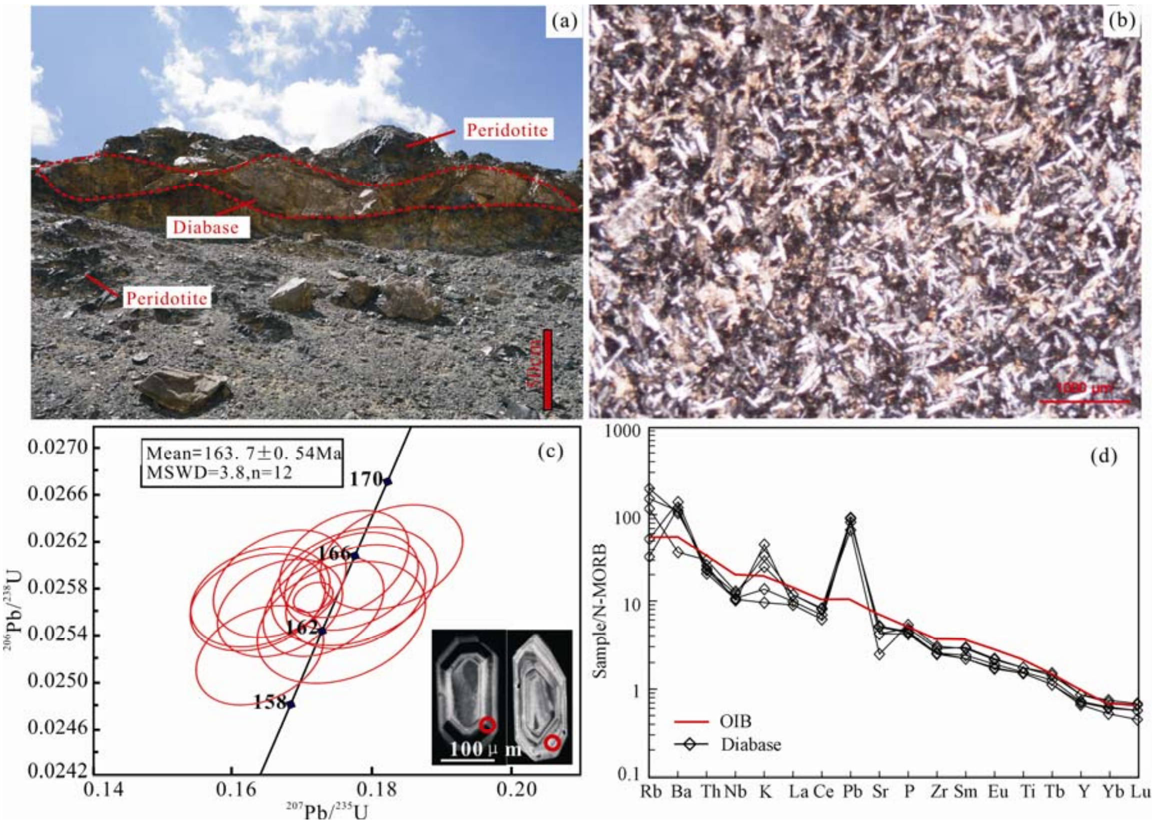

Fig. 1. (a), Filed photograph of the diabase dike intruding the Shiquanhe peridotite; (b), Photomicrograph of biabasic texture of the diabase; (c), Zircon U-Pb concordia diagram of the diabase; (d), N-MORB normalized trace-element spider diagram of the diabase in comparison to global average OIB.

suture zone (Zeng et al., 2016), suggesting that ophiolites from the two belts represent remnants of separate oceanic crusts.

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References

Liu, W., Huang, Q., Gu, M., Zhong, Y., Zhou, R., Gu, X., Zheng, H., Liu, J., Lu, X. and Xia, B., 2018. Origin and tectonic implications of the Shiquanhe high-Mg andesite, western Bangong suture, Tibet. *Gondwana Research*, 60: 1–14.

Wu Zhenhan, Zhao Zhen, Barosh, P., and Ye Peisheng, 2016. Early Cretaceous tectonics and evolution of the Tibetan Plateau. *Acta Geologica Sinica* (English Edition), 90(3): 847–857.

Zeng, M., Zhang, X., Cao, H., Ettensohn, F.R., Cheng, W., and Lang, X., 2016. Late Triassic initial subduction of the Bangong-Nujiang Ocean beneath Qiangtang revealed: stratigraphic and geochronological evidence from Gaize, Tibet. *Basin Research*, 28: 147–157.

Appendix 1 U-Th-Pb isotope composition of zircons from the Shiquanhe OIB-type diabase

Spot No.	Content (ppm)			Th/U	Isotope ratio				Age (Ma)				Concordance
	Pb	Th	U		$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	
SQH-03-01	175.266	1812.053	3780.955	0.479	0.167	0.006	0.026	0	156.585	5.464	164.527	1.924	95%
SQH-03-02	153.458	1610.157	3032.891	0.531	0.176	0.006	0.026	0	164.581	5.267	165.586	1.907	99%
SQH-03-04	172.871	1768.622	3671.583	0.482	0.167	0.006	0.026	0	156.601	5.161	163.214	1.738	95%
SQH-03-05	154.107	1610.69	3025.613	0.532	0.177	0.008	0.026	0	165.83	6.754	164.381	2.114	99%
SQH-03-06	154.548	1619.606	3031.031	0.534	0.176	0.008	0.026	0	164.235	6.865	162.445	2.172	98%
SQH-03-13	172.999	1775.902	3668.801	0.484	0.164	0.006	0.025	0	154.085	5.263	160.657	1.769	95%
SQH-03-08	165.31	1697.971	3065.759	0.554	0.183	0.007	0.026	0	170.416	5.784	165.961	1.879	97%
SQH-03-09	171.798	1731.06	3562.984	0.486	0.164	0.006	0.026	0	153.855	5.574	163.511	1.737	93%
SQH-03-10	158.319	1655.941	3025.132	0.547	0.177	0.006	0.026	0	165.452	5.455	164.662	1.754	99%
SQH-03-11	173.333	1752.06	3595.552	0.487	0.164	0.007	0.026	0	154.127	5.745	163.818	1.788	93%
SQH-03-12	156.279	1649.453	3035.609	0.543	0.178	0.007	0.026	0	166.001	5.695	163.824	1.855	98%
SQH-03-15	153.684	1614.767	3035.689	0.532	0.173	0.006	0.026	0	162.012	4.931	163.301	1.789	99%