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A POSSIBLE PLUME HEAD LOCATION OF THE PERMIAN LARGE IGNEOUS PROVINCE: CONSTRAINTS FROM MAFIC SILL PROVINCE AND DOMING STRUCTURE IN NW TARIM BLOCK

Wu H-X.[1, 2], Zhang F-Q.[1, 2], Dilek Y.[1,3], Li P.[1, 2], Chen X-X.[1, 2],
Lin X-B.[1, 2], Cheng X-G.[1, 2], Chen H-L.[1, 2]

[1] *School of Earth Sciences, Zhejiang University, Hangzhou 310027, China*
[2] *Structural Research Center of Oil & Gas Bearing Basin of Ministry of Education, Hangzhou 310027, China*
[3] *Department of Geology & Environmental Earth Science, Miami University, Oxford, OH 45056, USA*
Corresponding author: zhangfq78@zju.edu.cn

Keywords: *Tarim Large Igneous Province; earliest Permian; Mafic sill province; Doming structure; Mantle plume.*

One hypothesis suggested that the early Permian Tarim Large Igneous Province (TLIP) in Northwest China was attributed to a mantle plume. The observations that large volumes of flood basalts erupted in western half part of the Tarim block and several kimberlitic intrusions exposed in the Wajilitag area led many geologists to suggest that the plume head was probably near the NW Tarim block, while others suggested that its head was located in the northern margin. In addition, intense Mesozoic tectonism and Cenozoic overprint have significantly remolded much of the crust of the block edge.

In this work, we propose a possible plume head location of the Permian TLIP in Aksu-Wushi area, northwestern margin of the Tarim block. Extensive basic rocks over an equant area about 1800 km^2 are exposed around the Precambrian outcrops in this area. At least two layer-concordant diabase sills are redefined which used to be known as Ediacaran basaltic interlayers. Field observation shows that these layered diabase sills intruded in the lower Ediacaran reddish sandstones and mudstones. For example, the beds of Ediacaran strata are truncated by some sills locally. In addition, diabase is composed of its granular pyroxene and amphibole, and plagioclase microcrystals with automorphic lath clusters. It is a typical diabase structure in intrusive environment. The magmatic zircons separated from one of diabase sills obtained a concordia U-Pb mean age of 292±5 Ma. Our new age data shows that the diabase sills were emplaced in the earliest Permian epoch. We recommend these Permian widespread diabase sills in Ediacaran could regard as a mafic sill province as another subsurface part of TLIP. Besides, an oval doming structure also has been identified in the Aksu-Wushi area. The Aksu blue schist, as the oldest exposed basement of NW Tarim block was just in the doming center, and Cryogenian to Paleozoic sedimentary strata embraced the doming trap from inner to outside. Field mapping and seismic reflection profiles indicate that this doming structure was formed in the latest Carboniferous before the large volumes of mafic magma intrusion and eruption. We attribute this rapid and significant surface uplift, doming structure, subsequent mafic sill province emplacement and continental flood basalts eruptions during earliest Permian to the rising and giant melting above a plume head.

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A COMPARATIVE STUDY OF TWO LARGE IGNEOUS PROVINCES (SIBERIA, EMEI MOUNTAIN) IN RUSSIA AND CHINA

Yong P.

Tomsk State University, Geology and Geography Faculty, Tomsk

Keywords: *Large igntous provinces; Continental flood basalt; Mantle plume; Siberian large igneous province; Emei Mountain large igneous province.*

Introduction

A large igneous province (LIP) is an extremely large accumulation of igneous rocks, including intrusive (sills, dikes) and extrusive (lava flows, tephra deposits), arising when magma travels through the crust towards the surface. The formation of LIPs is variously attributed to mantle plumes or to processes associated with divergent plate tectonics(Bryan et al. 2008). Since the Late Permian, there have been four large igneous provinces on the Asian continent. Among them, Emei Mountain (~260 Ma) and Siberia (~250 Ma) large igneous provinces have the highest degree of research. This paper will summarize the main geological and rock geochemical characteristics of the two large igneous provinces, and highlight the activities of large igneous provinces and regional lithospheric uplifts, continental rift and stratification, bio-extinction events and large the linkages between scale mineralization events are assessed.

Results

The Siberian flood basalts and the Emei Mountain flood basalts are composed of basalt and picrite. According to Ti/Y values, they can be classified into two types of magma, high Ti/Y (HT, Ti/Y>500) and low Ti/Y (LT, Ti/Y>500). According to the Nb/La value, HT and LT lavas can be further divided into HT1 (Nb/La<1), HT2 (Nb/La≥1) and LT1 (Nb/La<1), LT2 (Nb/La≥1) 4 lava subclasses.

It is clear from Figure 2 that all the LT2 basalts that are not contaminated by the earth's crust (or lithosphere) in the Emeishan and Siberian large igneous provinces all fall

within the mantle plume defined by DEP and PM above the ΔNb line. The composition points of most of the contaminated HT1 and LTI lavas fall within the area defined by the enrichment component (EN), which represents the mantle plume source basalt contaminated by the continental crust or (and) submarine lithosphere. This suggests that LT2 basalts that are not contaminated by the earth's crust (or lithosphere) may be derived from the front of the mantle plume, while HT2 basalts (including picrites) that are not contaminated by the crust (or lithosphere) may be derived from the end of mantle plume.

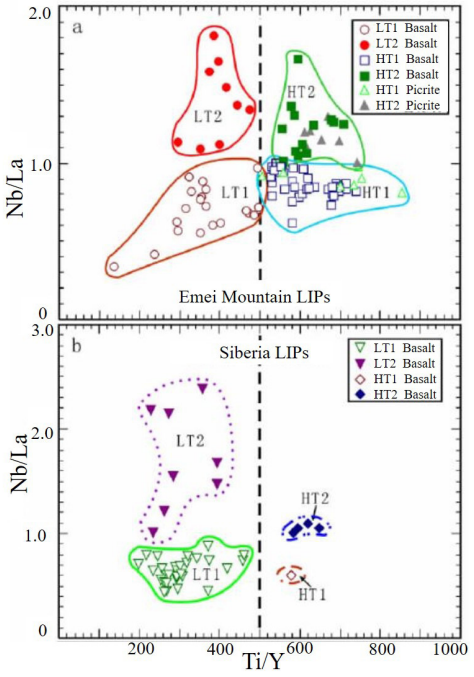

Fig 1. Classification of (a) the Emei Mountain basalts and (b) the Siberian basalts in terms of Ti/Y versus Nb/La. Data Sources: Emei Mountain: Chung and Jahn, 1995; Xu et al., 2001; Xiao et al., 2004; Wang et al., 2007; Zhang et al. 2008; Zhou et al. 2008. Siberian: Lightfoot et al., 1993; Wooden et al., 1993.

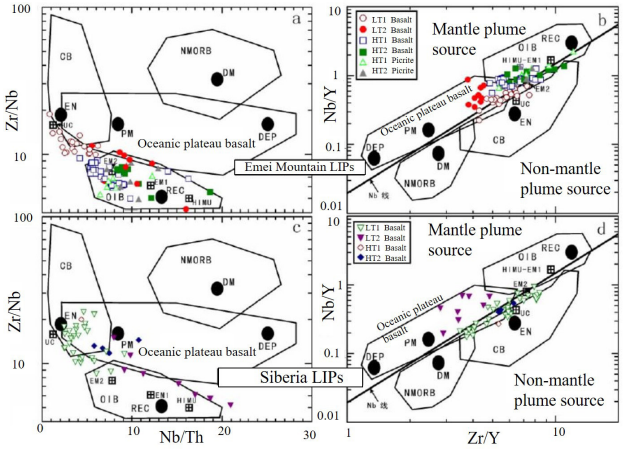

Fig 2. Distribution of (a,b) the Emei Mountain basalts and (c,d) the Siberian basalts on Nb/Th- Zr/Y , and Zr/Nb-Nb/Y disgrams (disgrams after Condie,2005). Abbreviations: UC-upper continental crust; CB-contaminated(by continental crust or/and subcontinental lithosphere) basalts; PM-primitive mantle; DM-shallow depleted mantle; HIMU-high-μ(U/Pb) source; EM1 and EM2-enriched mantle sources; OIB-oceanic island basalt; DEP-deep depleted mantle; EN-enriched component.

Conclusions

(1) These two large igneous provinces are composed of continental overflow basalts, dominated by basalt, followed by acidic rocks, and a small amount of picrite and picrite basalt, and symbiotic intrusion.

(2) Emei Mountain and Siberian Large Igneous Province contain world-class magma deposits. The existence of ore-bearing continental overflow basalts is a favorable condition for large-scale metallogenesis.

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