

## Early aged ophiolites in the Qinghai-Tibet plateau and their tectonic implications

Xiao Xuchang\*, Wang Jun and Zhang Zhaochong

*Institute of Geology, Chinese Academy of Geological Sciences, Beijing, PO Box 100037, CHINA*

\* To whom correspondence should be addressed. E-mail: [xxchng@public.bta.net.cn](mailto:xxchng@public.bta.net.cn), [xxchng@geochina.cn](mailto:xxchng@geochina.cn)

The Precambrian ophiolites, the oldest ophiolites, have attracted the studies from many geologists in recent decades (Li et al. 1997, 2001; Scarrow et al. 2001, Colombo et al. 2001), because the Pre-Cambrian ophiolites are relevant to the evolution of plate tectonics in the early period of the earth. This paper reveals two definite Pre-Cambrian ophiolites, named "Aoyougou Ophiolite", in the northeast and "Kudi Ophiolite" in the northwest of the Qinghai-Tibet plateau; the former lies near the intersection of 39°5' North latitude and 98°15' East longitude, the latter lies at the intersection of 77°10' East longitude and 36°45' North latitude.

Assemblage, age and tectonic implications of the Aoyougou ophiolite  
The Aoyougou ophiolite occurred along the southern margin of northern Qilian orogen and is always associated with the late-early Proterozoic sediments containing stromatolites. It consists of serpentinite (mainly serpentized harzburgite), gabbro, diabase dikes, basaltic rocks associated of pillow lavas and red-banded siliceous rocks, and has been dismembered, formed thrust slab intercalated with the Proterozoic sediments, but in some places, it is noteworthy that the upper part of the ophiolite, the basalt with pillow structure was overlain by the Proterozoic limestone or dolomitic limestone containing the Stromatolites (Hian-hua Li et al. 1997), the *Colonnella* sp. and the *Kussiella* sp. (Li et al. 1997). The diabase dikes from the ophiolite were samples for the SHRIMP U-Pb zircon geochronology and give the ages of 1777±28Ma (Zhang et al. 2001). It is most probably the earliest ophiolite in China.

Samples from the Aoyougou ophiolite were analysed for major, trace and rare elements, showing that the SiO<sub>2</sub> contents of diabase and lavas range from 45.60% to 52.83% and TiO<sub>2</sub> from 1.42% to 3.22%, resembling to those of MORB and OIB. The diagrams of SiO<sub>2</sub> vs. Nb/Y and ΣFeO vs. ΣFeO/MgO indicate that all basaltic rocks belong to tholeiite series. Low MgO, Cr and Ni contents and Mg value of the basaltic rocks suggest that they might not be the primary magmas melted directly from mantle sources, but the evolved magmas after fractional crystallization of olivine, Cr-spinel in magma chamber. A tentative Zr/Y vs Zr diagram for basalts shows that the Aoyougou ophiolite might have formed in a small oceanic basin with slow spreading rate.

### Assemblage, age and tectonic implications of the Kudi ophiolite

The upper part of the ophiolite comprises a thick series of

basaltic rocks with pillow structure intercalated of thin bedded reddish siliceous rock, intruded by mafic dikes, which are well exposed along the road, the lower part mainly consists of the gabbro associated with gabbro-diorite and tonalite, the peridotite and dunite which occur at the top of the mountain.

There are much debate concerning the age of the Kudi-ophiolite in last few years in geological circle at home and abroad, so the highlight of this presentation is to report the reasonable isotopic age of 510±4 Ma (U-Pb ratio in zircon) for the gabbro-diorite, operated at the advanced and most powerful dating technique, the SHRIMP II (Beijing SHRIMP Center, Institute of Geology, CAGS). The Sm/Nd isochron age for the ultramafic rock is 651±53Ma (Ding et al. 1996).

The radiolaris from the siliceous rocks associated with the upper part of basaltic rocks are *Entactinia* sp and *Spumellaria* sp. ascribed to the Early Paleozoic (Zhou 1998).

On the basis of geochemical studies including major, trace and rare-earth elements data suggest oceanic basin (mainly the MORB) affinities for the major part of basaltic rocks.

Both the geochemical and geochronological data integrating with the geological setting suggest that the Kudi-ophiolite might have formed in an archipelago ocean which developed in the northwestern margin of the Tibet plateau during the Late-Proterozoic. It was not a vast ocean, the so-called Protero-Tethys, but a multi-island-ocean-basin which was subducted and closed probably during the early Paleozoic.

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