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A-type granite belts of two chemical subgroups in central eastern China: Indication of ridge subduction

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ABSTRACT

Early Cretaceous A-type granites in the Lower Yangtze River belt, central eastern China, with both A_1 and A_2 chemical subgroups, formed at 125 ± 2 Ma, after a Cretaceous ridge subduction. Remarkably, A_1 and A_2 group granites are distributed in three zones, roughly parallel to each other and to a slightly older adakite belt. In general, A_1 granites form in intraplate settings, whereas A_2 granites near paleo-convergent margins. The alternate distribution of these two subgroup A-type granites is compatible with a proposed Cretaceous ridge subduction in the region. The subduction of a dry and hot spreading ridge may have only released small amount of fluids, so that metasomatism on the overriding lithosphere was undetectable, correspondingly resulted in A_1 granites later on. In contrast, wetter and colder oceanic crust away from the spreading ridge was responsible for mantle metasomatism and consequently the formation of A_2 granites. Further away from the ridge, the subduction angle was much steeper, and dehydration of the slab had occurred earlier during the subduction, and thus dramatically reduced mantle metasomatism, corresponding to A_1 granites again. Both A_1 and A_2 granites formed within a short period of time due to slab window/rollback, after the ridge subduction. The distribution of the A_1 and A_2 granites together with the adakite belt may be taken as discrimination indice for ancient ridge subduction.

1. Introduction

The Lower Yangtze River (LYR) metallogenic belt, which extends from Wuhan in Hubei province in the west to Zhenjiang in Jiangsu province in the east, is an important metallogenic belt in eastern China (Chang et al., 1991; Deng et al., 2002; Pan and Dong, 1999; Xing, 1999; Zhai et al., 1992, 1996). Most of the deposits in the LYR belt formed in the Early Cretaceous (140 ± 5 Ma) (Mao et al., 2006; Sun et al., 2003; Yang et al., 2007), and are closely associated with adakites of the same ages (Liu et al., 2010a; Wang et al., 2004, 2006, 2007; Xu et al., 2002; Zhang et al., 2001). Much attention has been paid on the geological evolution of this region (Chen et al., 2001; Ling et al., 2009; Sun et al., 2007; Xing and Xu, 1995). In addition to the adakite, there are a large number of the Early Cretaceous A-type granites along both banks of the LYR (Li et al., 2011; Wong et al., 2009; Xing and Xu, 1994; Zhang et al., 1988). The age distribution and formation mechanism of these A-type granites are important for understanding the geological evolution of the LYR belt.

The genesis of A-type granites in the LYR belt remains controversial. A-type granite is anhydrous, alkalic and anorogenic, which generally indicates formation in an extensional environment (Bonin, 2007; Eby, 1990, 1992; Loiselle and Wones, 1979). The extensional environment in the Early Cretaceous along the LYR belt was proposed to be either back-arc/post-collision extension settings (Cao et al., 2008; Du et al., 2007), or intracontinental shearing associated with mantle upwelling (Fan et al., 2008). Alternatively, it has been attributed to slab roll-back of the subducting Pacific plate (Wong et al., 2009) or a slab window induced by a ridge subduction (Ling et al., 2009).

In this contribution, we present the geochemical compositions and zircon ages of Maotan, Huayuangong, Xiangshuijian, Banshiling A-type granites on the south bank of the LYR. These together with previously published results are important to better understand the genesis of A-type granites and to constrain the geological evolution of the LYR belt.

2. Geological background

The LYR belt is situated in the east part of the Yangtze block, central eastern China (Fig. 1). Late Mesozoic igneous rocks widely

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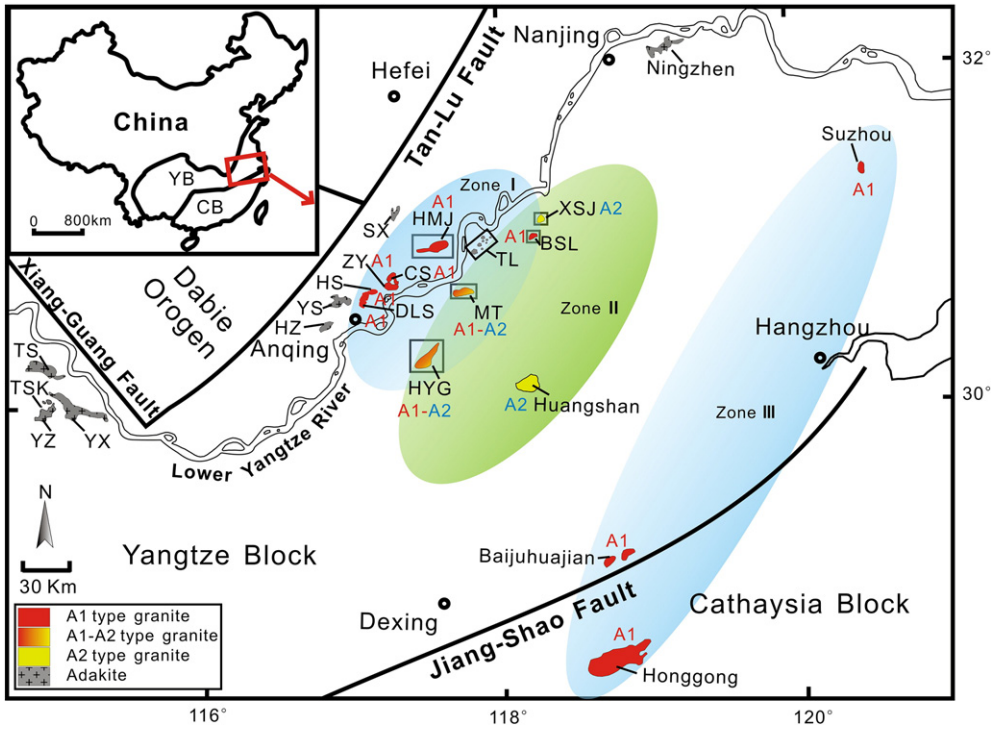

Fig. 1. Geological map of the Lower Yangtze River (LYR) belt. All the granites can be classified into three zones. DLS (Dalongshan), HS (Huashan), ZY (Zongyang), CS (Chengshan), HMJ (Huangmeijian) granites on the north bank of the LYR compiled from Fan et al. (2008) and Li et al. (2011) and BSL (Banshiling) on the south bank of the LYR are A_1-type granites near the Tan–Lu (Tancheng–Lujiang) fault forming zone I in the map; HYG (Huayuangong), MT (Maotan) granites on the south bank of the LYR have both A_1 and A_2 chemical group granites; Huangshan granite compiled from Xue et al. (2009) and Zhang et al. (2009) and XSJ (Xiangshuijian) granites are A_2 type granites in the zone II of the map; Suzhou, Baijuhuajian, and Honggong granites in zone III of the map are A_1-type granites near the Jiang-shao (Jiangshan-Shaoxing) fault (Wong et al., 2009). Adakites in the zone I contain TS (Tieshan), TSK (Tongshankou), YZ (Yinzu), and YX (Yangxin) compiled from Li et al. (2009) and Wang et al. (2004), YS (Yueshan) and HZ (Hongzhen) compiled from Wang et al. (2004), SX (Shaxi) (Yu et al., 2008), Ningzhen (Xu et al., 2002), and TL (Tongling) (Xie et al., 2009).

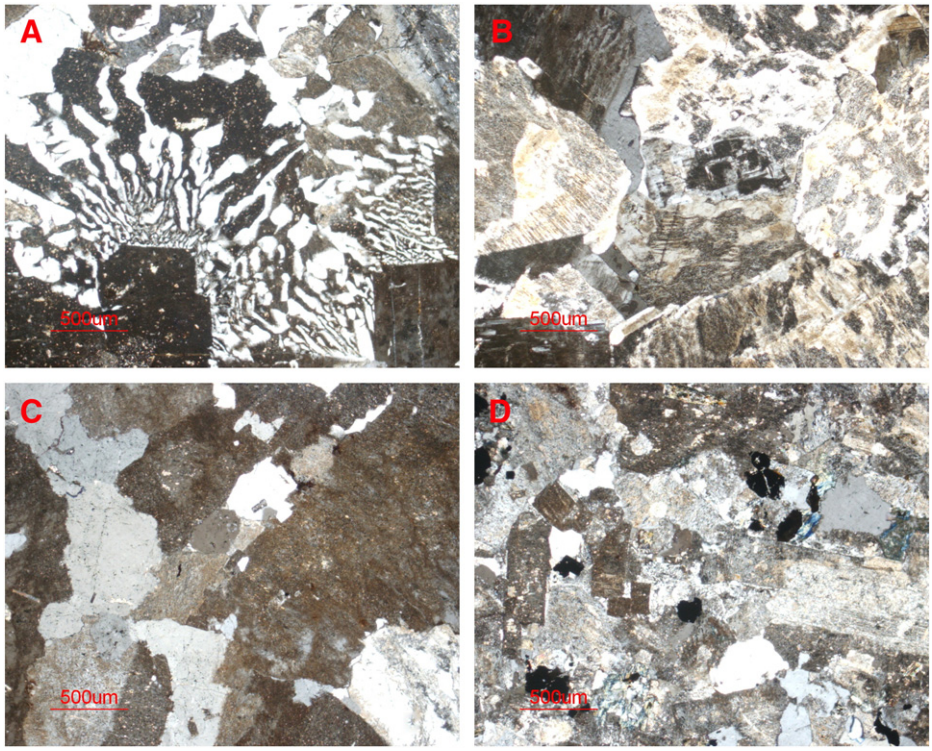

Fig. 2. A is a microscope photograph of the Maotan granite graphic texture (MT-9); B, C, and D are the individually microscope photographs of the Huayuangong granite (HYG-3), Xiangshuijian granite (XSJ-9) and Banshiling granite (BSL-9).