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Geochronology and Tectonic Implications of Diabase Intruded Into Xiangshan Group in the Southeastern Alxa Block, NW China

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The southeastern Alxa Block (i.e., the Hexi Corridor) is a tectonic junction between the North China Block (NCB) to the east, the Alxa Block to the north, and the western Qinling–North Qilian Orogenic Belt to the southwest (Fig. 1). The southeastern Alxa Block had undergone complicated evolution since the Early Paleozoic, an extension event occurred in southeastern Alxa during the Early Paleozoic, a convergence in the Late Paleozoic, an extension in the Mesozoic, and an extrusion during the Cenozoic (Bian et al., 2001; Feng and He, 1995, 1996; Liu et al., 2005; Zhang et al., 2004). Different views on the tectonic settings focusing on different extension stages in the study region was proposed, such as a “Helan aulacogen” during the Paleozoic and a “collisional valley” in the Late Paleozoic (Feng and He, 1995, 1996; Lin et al., 1995; Tang and Guo, 1990; Tian and Zhang, 1997). However, current research shows that it may not be an intra–continental aulacogen in the study region during the Early Paleozoic (Zhang et al., 2004, 2012). A collisional valley may have resulted from the procession of the formation of the North Qilian Orogenic Belt during the Early Paleozoic (Feng and He, 1996; Lin et al., 1995; Tang and Guo, 1990; Tian and Zhang, 1997) and may also have been due to the collapse of the orogenic belt. However, no definitive evidence can support all of the above views. Fortunately, there are some diabase in central the Ningxia Hui Autonomous Region (Zhongning–Zhongwei region) of northwest China, with approximately 6 km^2 exposed, mainly crops out in Mopanjing, southern Mibo Shan. As all know, the diabase always occurred in an extensional environment and we can exploration the tectonic evolution under the geochronology and geochemistry of the diabase. Nevertheless, no exact isotopic ages of the diabase have been reported to date.

The diabase has intruded into the Early Paleozoic Xiangshan Group (BGMRNHAR, 1965, 2000). The wall rocks of the diabase are sandstones, limestone, and chert of the Langzuizi Formation. Lacking of the age of the diabase, many researchers believed that they are genetically related and may have been generated in the Early Paleozoic (BGMRNHAR, 1990a; Feng and He, 1995; Huo, 1993). Some studies have discussed the sedimentary environment of the Xiangshan Group combining the diabase. Some scholars have even argued that the Xiangshan Group and the diabase belong to a hypoplastic ophiolitic mélange (Deng et al., 2007; Xu et al., 2006a; Zhou, 1992).

In this paper, the zircon ages of the diabase were measured by SHRIMPII (sensitive high–resolution ion microprobe II) and LA–ICP–MS (laser ablation inductively coupled plasma mass spectrometry) methods in this study, and a weighted mean age of 277.2±2.8 Ma and 276.3±7.6 Ma were obtained, respectively (Figures 2 and 3). Combined with a weight age 266±37 Ma of diabase in the western Hexi corridor and basalt aged at 266±37 Ma, the diabase in the study region should be Early–Middle Permian. The samples 13NX57 and 13NX58 may belong to tholeiitic rocks and alkaline basaltic rocks for its major elements, with rare earth element (REE) and trace element characteristics. The diabase was a product of an intra–plate extension event, resulting in a high potassium content, and might been affected by the continental crust, resulting in a strong positive Pb anomaly. The data suggest that the study region was once in a back–arc extensional setting in the Early–Middle Permian caused by the northward subduction of the Yangtze Block beneath the North China Block (NCB). The emplacement of the Late Paleozoic diabase in the study region argues against the idea that the so–called “Helan aulacogen” did not develop during the Early Paleozoic. There may have been a back–arc extension environment in the study region during the Early–Middle Permian in the convergence between the NCB and the Yangtze Block.

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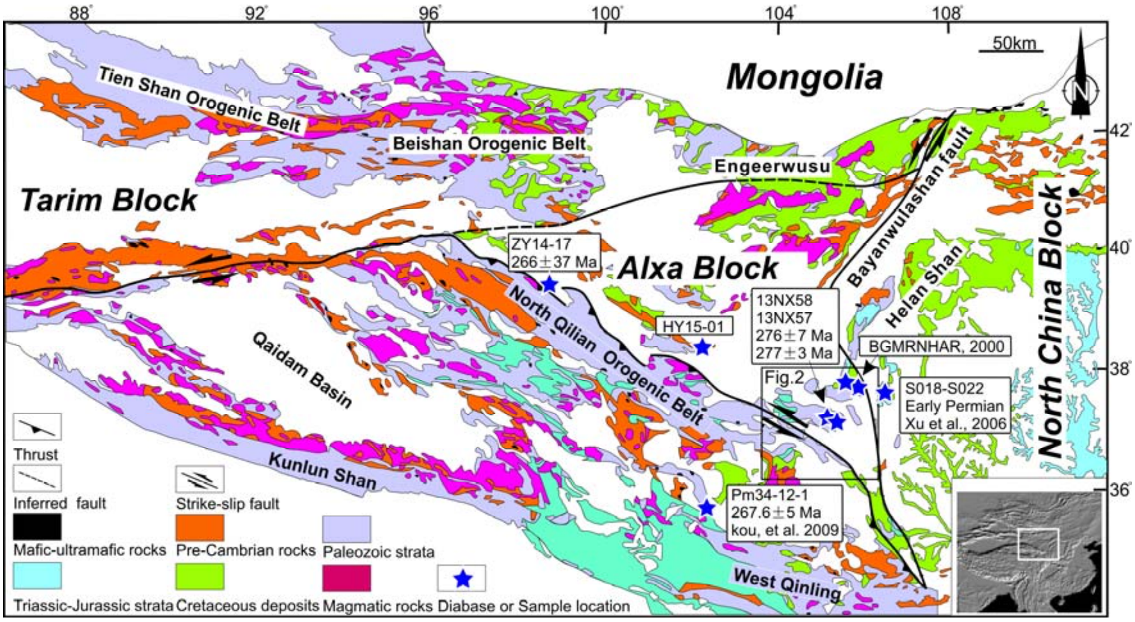

Fig. 1. Tectonic map of the study area and adjacent areas.

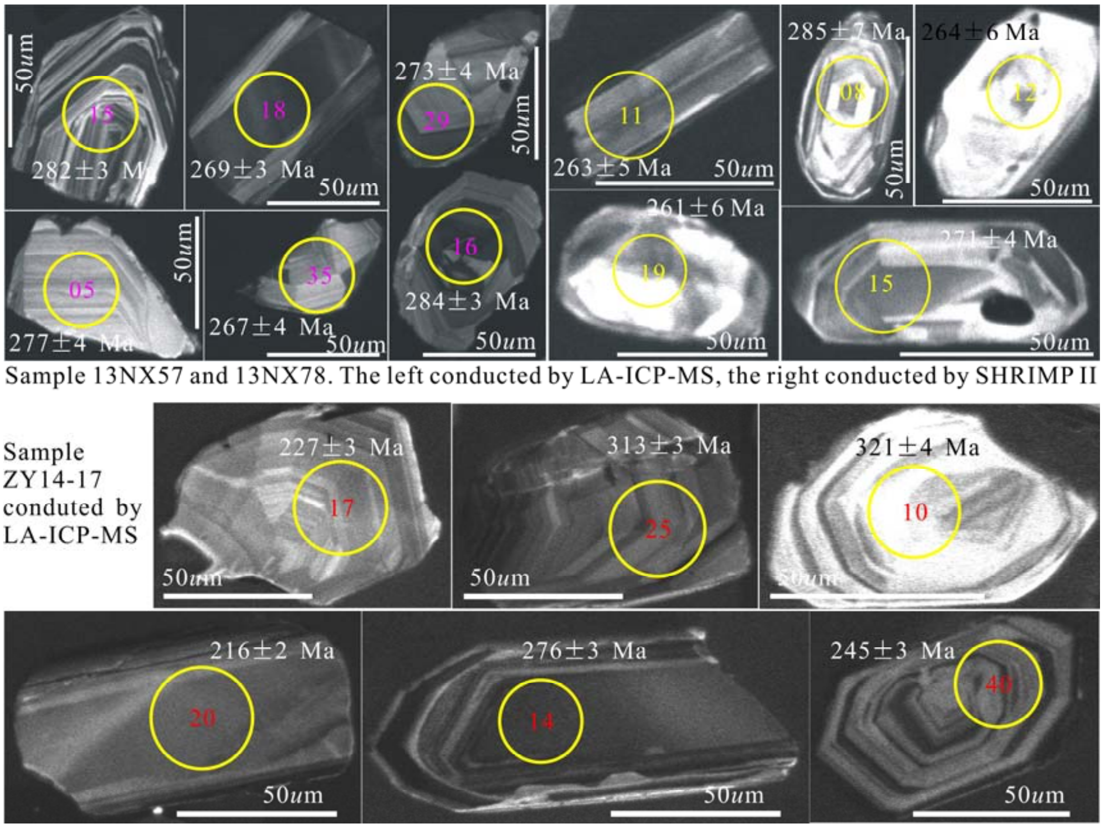

Fig. 2. CL images and ages of some zircons from diabase (Detialed information about the zircons can be found in above figure).

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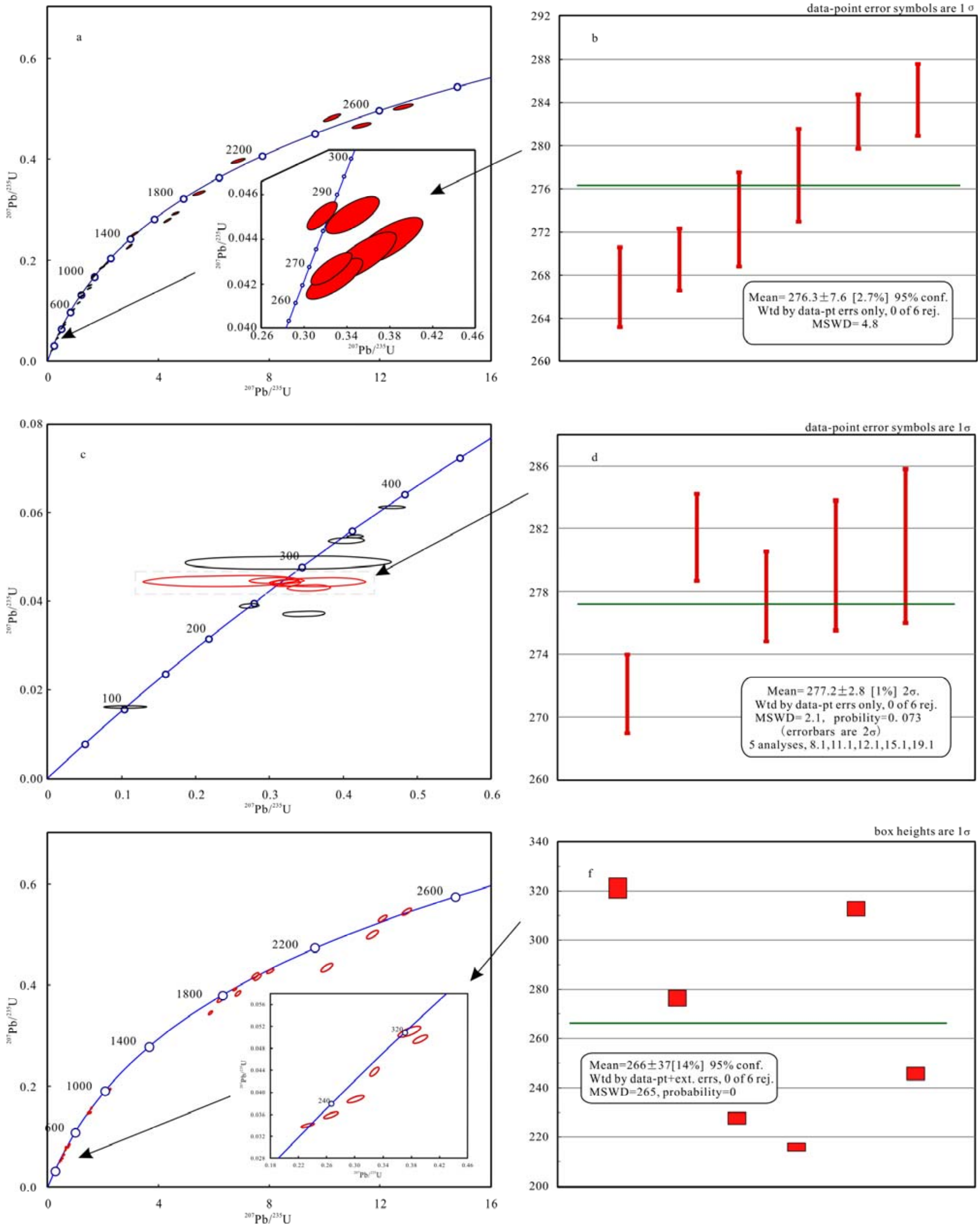

Fig. 3. Concordia diagrams of zircons age (Fig. 3a, 3c, 3e) and the weighted mean age (Fig.3b, 3d, 3f) diagrams (Fig. 3a, 3b, 3e and 3f show the results in the LA-ICPMS experiment, and Fig. 3c, 3d show the results in the SHRIMP II experiment).

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