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## Features and significance of the Yudai porphyry copper deposit in the Kalatag district, eastern Tianshan, NW China

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### 1 Introduction

The eastern Tianshan region covers around 60000 km<sup>2</sup> in area and is located in the eastern part of Xinjiang. The district contains various types mineral commodities including Cu, Ni, Au, Fe, Pb and Zn (Wang et al., 2006). The Dannanhu belt in eastern part of the area is interpreted as a volcanic arc and forms an important mineralized zone bordered by the Turpan-Hami Basin to the north and Kanggur back-arc basin to the south. Several porphyry deposits have been discovered in eastern Tianshan region, including Tuwu-Yandong, Linlong, Chihu, Yuhai and Sanchakou deposits (Wang and Zhang, 2016). Numerous studies have been completed on late Palaeozoic magmatic rocks in the district, but less attention has been paid to early Palaeozoic igneous rocks.

Several early Paleozoic Cu-polymetallic deposits have discovered in the Kalatag district of eastern Tianshan region within the last ten years, including the South Meiling VMS deposit, Hongshi hydrothermal vein deposit and Yudai porphyry Cu deposit (Deng et al., 2016a, b). Yudai was discovered in 2011, but the paragenesis of the deposit has been poorly understood due to the lack of detail studies. This paper is mainly describe the above issues.

### 2 Deposit Geology

The Yudai Cu deposit is situated in the western part of the Kalatag district, and is hosted by tuffaceous sandstone, bioclastic limestone, dacite, andesite and

volcanic breccia in the Lower Devonian Dananhu Formation. The area includes east-, northwest- and north-trending faults that control the location of volcanic eruptions, intrusive rocks, mineralization and alteration. Various magmatic intrusions are present in the western part of the Yudai area in the form of stocks and dykes covering approximately 5 km<sup>2</sup> in area. The intrusives include porphyritic diorite, porphyritic quartz diorite and gabbro hosted by the Dananhu Formation. The porphyritic quartz diorite is closely associated with mineralization, which yield SHRIMP zircon U-Pb age of 431.6Ma.

The mineralization of the Yudai area is lenticular, vein-type and disseminated in the porphyritic quartz diorite. It is around 1.5 km long, up to 400m wide, with dips 28° to 45° SW. The Cu grade range is up to 1.02%. The mineral association is pyrite-magnetite (-chalcopyrite-molybdenite), and the gangue minerals include chlorite, quartz and sericite with minor amounts of epidote and carbonate. The hydrothermal alteration is characterized by K-feldspar and biotite (potassic alteration), silica, chlorite, epidote, sericite and carbonate. The alteration is typically zoned with a centre containing K-feldspar, biotite, silica, and sericite succeeded by silica-sericite-pyrite to an outer zone characterized by chlorite-epidote-carbonate.

### 3 Significance

The porphyritic quartz diorite are calc-alkaline and low-tholeiite series with high Al<sub>2</sub>O<sub>3</sub> contents and Mg<sup>#</sup> values. They are characterized by a large ion lithophile element (LILE) enrichment in Ba, K, Sr and U, and a high field strength element (HFSE) depletion in Nb, Ta,

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Ti and Zr, positive Eu anomalies and high Sr/Y and La/Yb values, showing geochemical characteristics similar to adakites. The porphyritic quartz diorite have the characteristics with low initial  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios and relatively high  $\epsilon_{\text{Nd}}(t)$  values. These characteristics are indicative of an island arc setting.

The proposed Silurian island arc in the Kalatag district offers an opportunity to unravel the nature of magma formation and geodynamic evolution in eastern Tianshan region. However, the tectonic setting of Early Paleozoic magmatism is under debate with two contrasting interpretations: (1) based on study of the intrusions from the Yuhai and Sanchakou district, Wang and Zhang (2016) correlating it with the north-dipping Paleo-Tianshan ocean subduction beneath the Dananhu-Tousuquan arc; (2) Ma et al. (2015) arguing for a south-dipping Kelamaili ocean subduction beneath the Harlik-Dananhu arc. It is interesting to note that these two opposite views have been drawn out from similar geological, petrological and geochemical data.

Considering that the presence of the ~430 Ma South Meiling VMS deposit located in the southern part of the Kalatag district (Deng et al., 2016a), it is likely that the mineralization was deposited in response to the southward subduction of the Kelamaili Ocean beneath the Dananhu-Tousuquan arc during Late Ordovician to Early Silurian. In such a scenario, the Yudai adakitic magmas would be the result of the interaction between a subducted oceanic slab and mantle wedge peridotite.

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## References

- Deng, X.H., Wang, J.B., Pirajno, F., Wang, Y.W., Li, Y.C., Li, C., Zhou, L.M. and Chen, Y.J., 2016a. Re-Os dating of chalcopyrite from selected mineral deposits in the Kalatag district in the eastern Tianshan Orogen, China. *Ore Geology Reviews* 77: 72–81.
- Deng, X.H., Wang, J.B., Santosh, M., Li, Y.C., Wang, Y.W., Mao, Q.G., Long, L.L. and Chen, X., 2016b. New  $^{40}\text{Ar}/^{39}\text{Ar}$  ages from the Kalatag VMS deposits, eastern Tianshan, NW China: constraints on the timing of Cu mineralization and stratigraphy. *Ore Geology Reviews* 10.1016/j.oregeorev.2016.08.006.
- Ma Xinghua, Chen Bin, Wang Chao and Yan Xuelong, 2015. Early Paleozoic subduction of the Paleo-Asian Ocean: Zircon U-Pb geochronological, geochemical and Sr-Nd isotopic evidence from the Harlik pluton, Xinjiang. *Acta Petrol. Sin.* 31(1): 89-104 (in Chinese).
- Wang Jingbin, Wang Yuwang and He Zhijun, 2006. Ore deposits as a guide to the tectonic evolution in the East Tianshan Mountains, NW China. *Geol. China* 33(3): 461-469 (in Chinese).
- Wang, Y.H. and Zhang, F.F., 2016. Petrogenesis of early Silurian intrusions in the Sanchakou area of Eastern Tianshan, Northwest China, and tectonic implications: geochronological, geochemical, and Hf isotopic evidence. *International Geology Review* 58: 1294-1310.