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Metallogeny Study of Molybdenum Deposits in Jiaodong Mesozoic Metallogenic Province, China

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Gold deposits are research focus in Jiaodong Mesozoic metallogenic province (Chen et al., 2005, Liu et al., 2010). Whereas the molybdenum polymetallic deposits in Jiaodong were rarely brought to the forefront, which have similar temporal and spatial orientation with gold deposits. Study on ore geology, chronology, ore genesis about these Mo deposits needs to be strengthened. Furthermore, the metallogeny relationship between the coexist Au and Mo deposit should be thoroughly probe into. The Qixia-Penglai-Fushan area, as an important secondary metallogenic area in Jiaodong, where develop numerous large-middle type Au deposits along with large-middle type Mo deposits, is the most ideally area to study the coexistence mechanism of Au and Mo deposits in Jiaodong area.

Based on the isotopic dating data, the mineralization of Mo in Jiaodong can be divided into two periods. The first period happened in the Early Yanshanian, the Xingjiashan skarn Mo-W deposit was typical. The second period was the Late Yanshanian, which coincided with "explosive" gold mineralize time, the typical Mo deposits included Shangjiazhuang (Chen, 2013; Li et al., 2013), Lengjia (Ding et al., 2013) and Nansu mineralization point (Liu et al., 2010). The two periods Mo metallogeny may be derived from different tectonic settings (Zhang et al., 2007).

Molybdenite Re-Os dating and LA-ICP-MS Zircon U-Pb dating shows that the timing of Mo mineralization in the Xingjiashan Mo-W large-type deposit was about 163 Ma, and the emplacement of Xingfushan pluton (ore-forming granite) was 166–167 Ma, respectively. Therefore, the Xingjiashan Mo deposit might be chronologically related to the emplacement of the Xingfushan intrusion, which indicated, the metallogenic time was the Early Yanshanian. This period, Middle-late Jurassic, was the peak time that the North China Craton developing orogenic belts, accompany with intensely magmatism, compression thickening and uplift of the lithosphere (Chen et al., 2005; Deng et al., 2007; Zhang et al., 2007). There are generally two views about the dynamics mechanism of compressional deformation in this period: (1) The collision of the North China Craton and the Yangtze Craton, which started from the Late Triassic (Chen et al., 2005); (2) The subduction effect of paleo-Pacific plate to the East Asian Plate(Maruyama et al., 1997; Wu et al., 2003; Zhang et al., 2007; Qiu et al., 2008). However, the two views both admitted the fact that the compression and thickening of the lithosphere included Jiaodong terrain in the Late Jurassic. In this period, the heat released from crustal thickening led to lower crustal remelting, which generated granitic magma in Jiaodong terrain (Best, 2003). Then the granitic magma, which carried metallogenic material, intruded into upper crust, supplied plenty of metallogenic material for Xinjiashan deposit. The characteristics of Re and REE in molybdenite also showed the lower crust origin.

Despite the magmatism was very intense in the Late Jurassic in Jiaodong, such as Linglong granite Complex batholith (Guan et al., 1998; Zhang et al., 2007) and Xingfushan granite, the total number of reported Mo and Au deposits were fewer. In addition, the mineralization pattern and deposits type related the two granites were totally different. Combining with the previous research results of the Linglong granite and gold deposits in Jiaodong region (Zhang et al., 2007; Qiu et al., 2008; Niu et al, 2011; Song et al., 2012; Lin et al., 2013), the Zircon from Guojialing granite in the Early Cretaceous captured zircon in Linglong granite (Guan et al., 1998), inferred that the Xingfushan granite possibly was a relatively secondary magma chamber near surface from Linglong granitic chamber or a deeper chamber. At the end of the

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magmatism, Mo and W could be existed as a gas phase with volatile accumulatively in the secondary chamber and hence the ore bearing potentiality was increased.

In the Early Cretaceous, the strongly mantle-derived magmatism happened with the lithosphere thinning in Jiaodong terrain (Zhu et al., 2012). The magma underplated in crust, which led to partial metling and mixing with the crust material or the Late Jurassic granite such as Linglong granite (160–150 Ma), formed the Early Cretaceous crust-mantle mixing granite (130–105 Ma). The magma mixing course may improve the initial abundance of ore-forming elements (Such as Mo and Cu) and sulfur content (Hattori,1993; Wang et al., 2012). The magmatism also can supply heat energy and volatilize for regional magma-thermal fluid metallogenic system. So the second Mo polymetallic mineralization period commonly developed in the late Yanshanian, such as Shangjiazhuang middle-type deposit.

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