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Re-Discussion on the Metallogenic Age of the Hadamengou Gold Deposit in Inner Mongolia, China

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Abstract

The Hadamengou gold deposit is located in the western segment of the northern margin of the North China Craton (NCC). The mineralization age of the Hadamengou gold deposit is a matter of controversy. Based on the extensive collection the results of previous research, we infer that the Hadamengou gold deposit is exposed to prolonged geological evolution. It was formed as early as the Middle Hercynian orogen. The metallization mainly took place in the Early Indosinian epoch.

Keywords: Hadamengou, mineralization, Indosinian

1. Introduction

The Hadamengou gold deposit is situated approximately 20 km west of Baotou County, Inner Mongolia (Fig.1). It is hosted in a set of Pre-Cambrian high-grade metamorphic rocks. It is a super large gold deposit in Inner Mongolia, and one of the largest gold mines in China, with a reserve of about 100 tons of gold @ about 4.13g/t Au (Nie et al., 2002; 2004; Zhang, 2012).

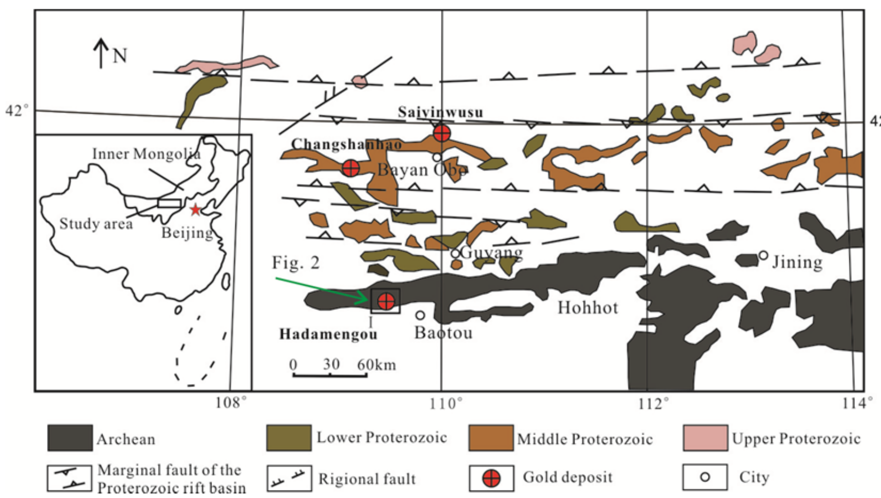

Figure 1. Simplified regional geologic map of the northern margin of the NCC showing the location of major Au deposits (modified after Xiao et al., 2000)

Although, various aspects of the Hadamengou deposit have been described in geological literature, the metallogenic age of the deposit remain controversial. Some scholars believed that the main mineralization is the Hercynian (Headquarters of Gold Exploration Branch of Chinese Armed Police Force, 1995; Meng et al., 2002; Hou et al., 2014; Zhang et al., 2016).Some workers suggested that the mineralization resulted from the Indosinian magmatic-hydrotherma (Chen and Liu, 1996; Nie et al., 2005; Xia, 2011). Furthermore, some scholars suggested that the gold mineralization occurred during the Middle-Late Yanshanian period (Miao et al., 2000; Ma et al., 2012). Much of the debate relates to the quality of previous data and the limited understanding of the ore genesis and tectonic setting of the deposit.

In this paper, based on the extensive collection the results of previous research, through the analysis of the regional tectonic background and metallogenic condition, we discussed the metallogenic age of the Hadamengou gold deposit to provided guidance for regional prospecting.

2. Deposit Geology

The Hadamengou mining area was subjected to intensive tectonic and magmatic activities (Fig.2). The Daqingshan-Wulashan piedmont fault is the most important faults in the mining area, and produces several secondary faults. The ore bearing faults controlling the gold veins are mainly east-west striking, with some north-east and north-west striking.

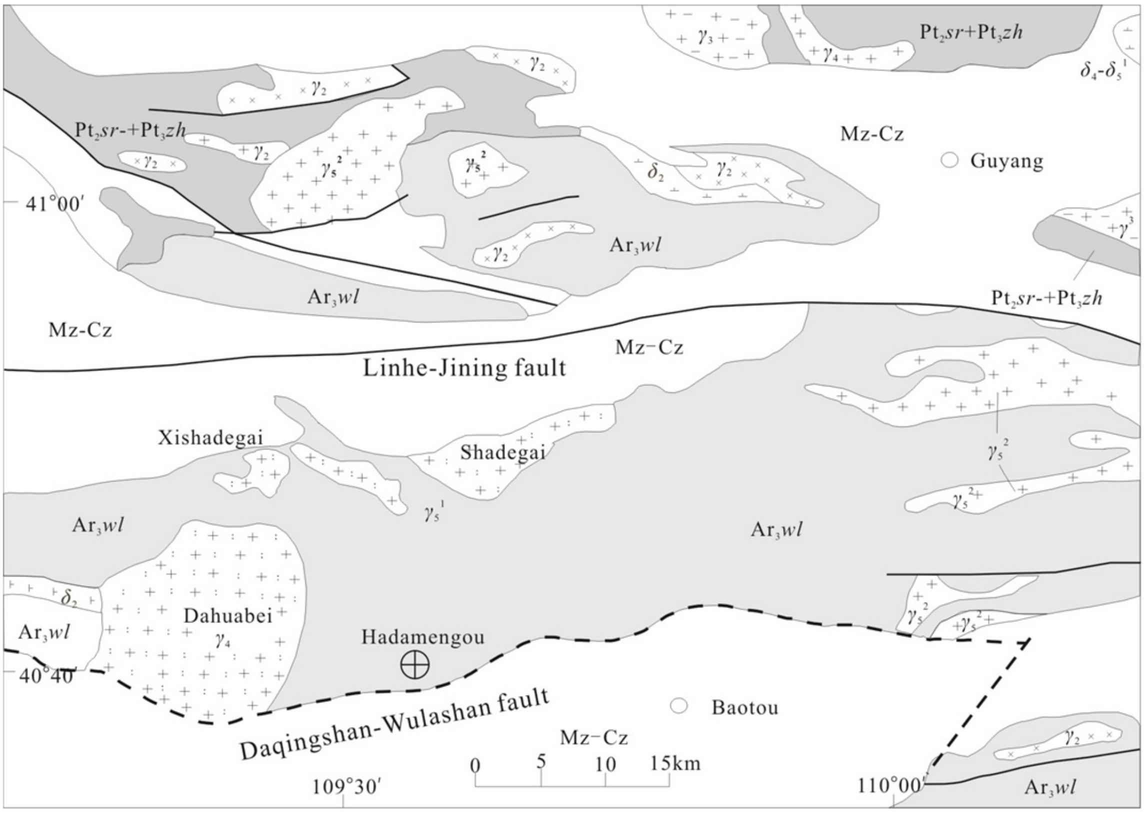

Figure 2. Simplified geological map of the Hadamengou regional Inner Mongolia (modified after Hou et al., 2014)

1—fault and speculated; 2—gold deposit; 3—city; 4—Cenozoic continental sedimentary rocks;
5—mesoproterozoic Sertengshan Group and Neoproterozoic Zhartaishan Group metamorphic rocks;
6—Neoarchean Wulashan Group metamorphic rocks; 7—Yanshanian granitoids; 8 —Hercynian—Indosinian granitoids; 9 —Caledonian granitoids; 10—Proterozoic granitoids; 11—Hercynian—Indosinian diorites;
12—Proterozoic diorites

Hydrothermal alterations are well developed in the Hadamenggou gold deposit. Wall-rock alterations are mainly potash feldspathization, silicification, pyritization, carbonation, epidotization, chloritization, sericitization. Among all these alterations, K-feldspathization is associated very closely with gold mineralization.

The gold mineralization of the Hadamengou gold deposit occurs in high-grade metamorphic strata in Archean Wulashan Group. Ore bodies occur as nearly EW-trending vein (Fig.3). The distribution of the orebodies is strictly controlled by fracture zones.

According to the nature of the host rocks, the primary ores can be classified into three types, gold-bearing quartz-potassic feldspar vein type, gold-bearing quartz vein type, and gold-bearing altered rock type.

The metallic minerals of the ore in the Hadamengou deposit are predominantly pyrite, magnetite and hematite, as well as minor chalcopyrite, galena, molybdenite. The gangue minerals in the ore consist mainly of quartz, feldspar, and calcite, and subordinately of chlorite, epidote, sericite, barite, and biotite.

3. Methods

A comprehensive literature search was conducted using “Hadamenggou”, “Inner Mongolia” and “gold deposit” as search algorithms in Web of Science, Google scholar and CNKI of electronic databases. In combination with regional tectonic background and metallogenic condition. This study discussed the metallogenic age of the Hadamengou gold deposit.

4. Results and Discussion

The Mineralization age of the Hadamengou gold deposit is a matter of controversy (Zhang et al., 1999; Miao et al., 1999; Hart et al., 2002; Meng et al., 2002; Nie et al., 2005; Hou et al., 2011).

The isotope geochemistry studies indicate that metallogenic materials mainly supplied by magma, and partly from Late Archaean metamorphic rocks of Wulashan Group (Zhang, 2012; Hou et al., 2014).

The magmatic rocks are well developed in the mining area. The most common intrusive rocks are Dahuabei, Shadegai and Xishadegai granitoid. (Miao, 2000; Luo et al., 2000; Nie et al., 2002; Yang et al., 2003). Zircon LA-ICP-MS dating for Dahuabei pluton yilde 353.3±7Ma (Miao et al., 20101). LA-ICP-MS U–Pb analysis on zircon from the Xishadegai pluton gave an age of 245±10Ma. (Zhang et al., 2011). A zircon U–Pb LA-ICP-MS age from the Shadegai pluton yielded a date of 231±3Ma (Zhang, 2012). The consistency of the above dating data indicates an accurate time limit for the formation of the Hadamengou gold deposit and its host granite.

Nie et al. (2005) reported the Ar-Ar isochron age of sericite from the Hadamengou gold deposit. Sericite separates from the gold-bearing K-altered rock have been dated by $^{40}Ar/^{39}Ar$ method at 322.58±3.24Ma. Furthermore, sericite separates from gold ores give an $^{40}Ar/^{39}Ar$ isochron age of 239.76±3.04Ma. Isotopic age indicate that the Hadamengou gold deposit formed as early as the Middle Hercynian orogen, but the metallization mainly took place in the Early Indosinian epoch(Nie et al., 2005).

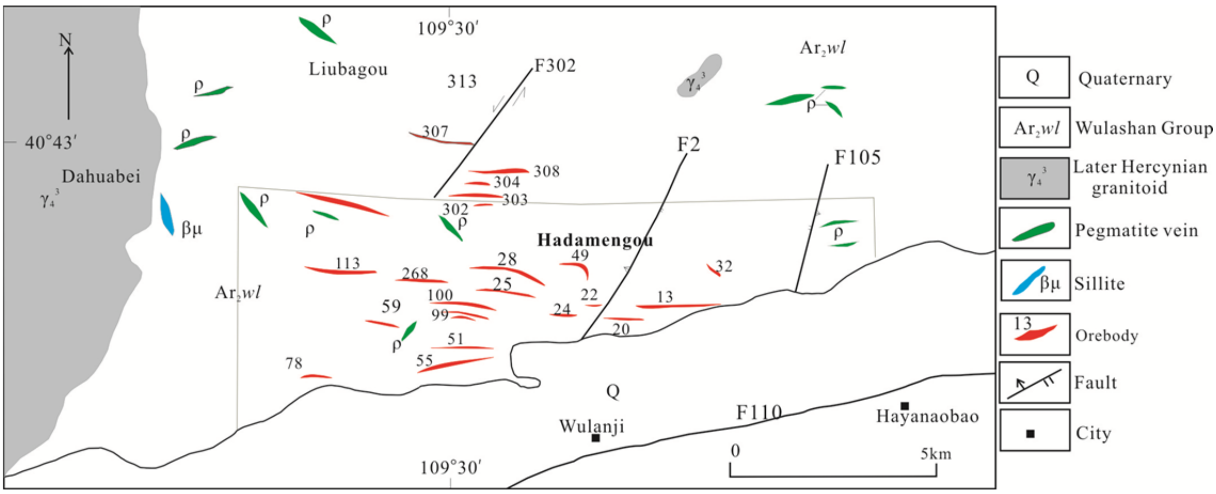

Figure.3 Geological map of Hadamengou gold orefield in Inner Mongolia (modified after Xin et al., 2013)

Combing with regional tectonic background, we infer that the Hadamengou gold deposit is exposed to prolonged geological evolution. Preliminary enrichment occurred during the period of the Middle Hercynian orogen and the large-scale mineralization formed during the Early Indosinian tectonic movement.

The Xishadegai Mo deposit is located on the North of the Hadamengou gold deposit. The Molybdenite Re-Os isotopic age of the Xishadegai Mo deposit suggested that molybdenum mineralization occurred during the Indosinian period (Hou et al., 2010; Zhang et al., 2011). Combing with the isotopic age data from the gold deposits in adjacent areas, we infer that a significant magmatism-mineralization event occurred during Indosinian period.

5. Conclusions

The Hadamengou gold deposit is exposed to prolonged geological evolution. It was formed as early as the Middle Hercynian orogen. The metallization mainly took place in the Early Indosinian epoch.

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