

## Research Advances

## A New Chronological Report of the Hongshi Breccia-Host Gold Deposit in the Western Qinling Region, China

WANG Chenguang<sup>1</sup>, CAO Yi<sup>1,\*</sup>, SUN Tao<sup>2</sup>, LI Weigang<sup>3</sup> and ZENG Hao<sup>4</sup>

<sup>1</sup> School of Earth Science and Resources, China University of Geosciences, Beijing 100083, China

<sup>2</sup> Zhaojin Mining Industry Co.Ltd, Zhaoyuan 265400, Shandong, China

<sup>3</sup> The First Research Institute of Geological Prospecting, Gansu Geological Prospecting Bureau, Tianshui 741020, Gansu, China

<sup>4</sup> No. 6 Gold Geological Party of CAPF, Xining 810000, Qinghai, China

### Objective

The western Qinling belongs to the western part of the Qinling–Dabie–Sulu orogen between the North China Block and South China Block. Multiple orogenic events might be responsible for different types of gold mineralization, making the western Qinling gold region one of the most important gold metallogenic belts in China. This region has demonstrated a total gold resource of >500 t and more than ten gold deposits with gold resource of >20 t. Almost all gold deposits in the western Qinling gold region can be classified into two distinct genetic types as orogenic (such as the Shuangwang, Baguamiao, Liba, Maanqiao deposits), carlin-type and carlin-like gold deposits (represented by the Zhaishang, Manaoke, Jinlongshan, Pingding, Zaozigou, Dashui, Yangshan gold deposit). The Hongshi deposit is a newly discovered breccia-hosted gold deposit in the western Qinling, which is of particular interest due to its unique type of deposit characterized by brecciated orebodies and high-grade gold content (up to 262 g/t). However, the Hongshi gold deposit has not been given its due share of research attention, especially its mineralization age and relationship with the magmatic-metallogenic events in western Qinling. Recently, a few mineralized quartz monzonite breccias have been found in the Hongshi deposit, the forming time of the mineralized quartz monzonite breccias may provide us clues for the cryptoexplosion event and the mineralization age. This work briefly described the characteristics of the Hongshi breccias-hosted gold deposit and presented new data of zircon LA-ICP-MS U-Pb ages, which may contribute to a better understanding of the mineralization age and ore-forming mechanism of this deposit.

### Methods

Zircons from the quartz monzonitic granite samples were separated using conventional heavy liquid and magnetic techniques, handpicked under a binocular microscope, and mounted in epoxy resin. Then the internal structures of zircons were documented by cathodoluminescence (CL). U-Pb Zircon geochronological analysis was completed in the Continental Tectonics and Dynamics Laboratory of Institute of Geology, Chinese Academy of Geological Sciences. U-Pb abundance data were measured by the latest Neptune Plus multiple collector ICP-MS (MC-ICP-MS) of Thermo Fisher Co. Ltd. The laser-ablation system used in the measurement is developed by the GeoLasPro 193 nm invented by the U.S. Coherent Co. Ltd. The MC-ICP-MS operating conditions were optimized with the measurements of reference zircon 91500. The accuracy of the data is verified by using GJ-1 as auxiliary standard. The MC-ICP-MS measurement was carried out using time resolved analysis operated in fast peak-hopping and DUAL detector mode using a short integration time. The data were calculated by the ICPMS Data Cal program (Liu et al., 2009) and the Isoplot program (Ludwig, 2003).

### Results

The Hongshi gold deposit characterized by high grade (up to 262 g/t, the average grade of 12 samples we tested is 42.68 g/t) has a total of approximately tens of gold (past production + reserves), and has obvious characteristics of breccia-type gold deposits. The main orebody is controlled by northeast and northwest trending faults. The breccias contain clasts of Sinian to Ordovician Muqitan green schist (Fig. 1a), chlorite schist, chlorite-sericite schist and minor quartz monzonite. The clasts range in size from 2–3 cm to 1.2 m and have angular shapes with jigsaw-fit type

\* Corresponding author. E-mail: caoyi@cugb.edu.cn

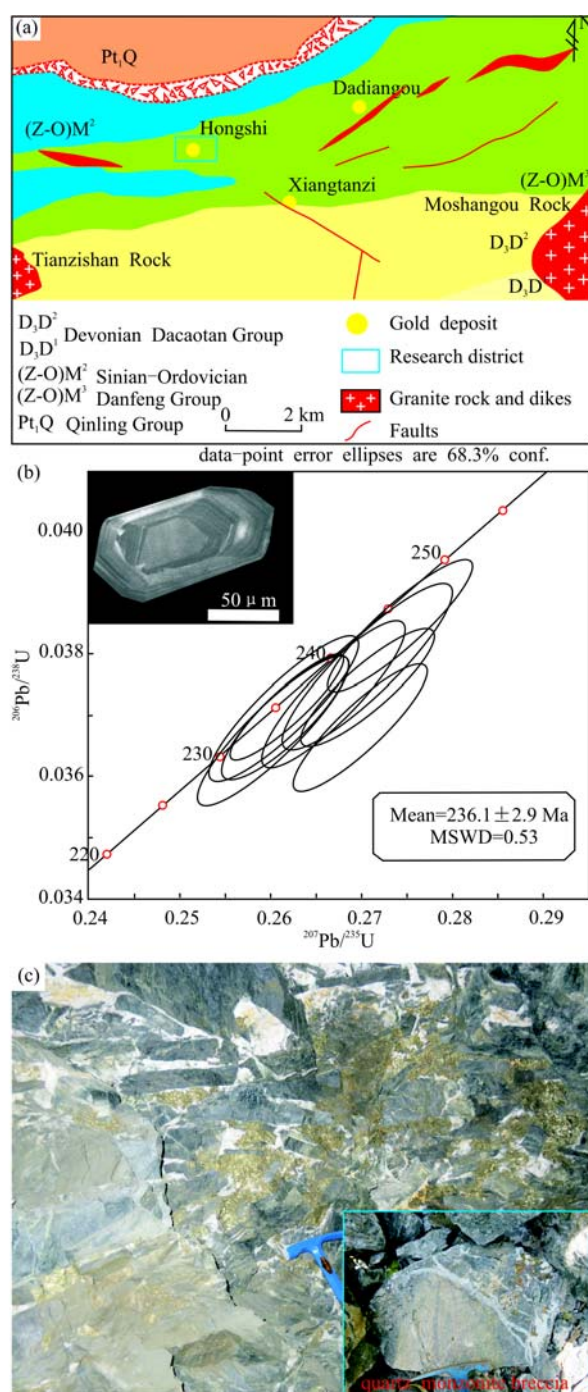


Fig. 1. (a), Simplified regional geological map of the Hongshi gold deposit; (b), Zircon U-Pb concordia plot for the quartz monzonite; (c), Breccia-hosted ores and quartz monzonite breccia; Abbreviations: Qtz, Quartz; Py, Pyrite.

breccias, suggesting that cryptoexplosion occurred only one time and the breccias were kept well in situ. The matrix of the breccias mainly comprises quartz, pyrite, and

a small amount of chalcopyrite and represents up to 50% of the breccias volume (Fig. 1c). The quartz monzonite breccias are medium- to fine-grained, locally porphyritic, and consist of plagioclase (25%–45%), alkali feldspar (35%–50%), quartz (5%–15%), and biotite (2%–3%), with minor accessory minerals such as zircon and apatite. Plagioclase occurs as euhedral to subhedral crystals and others minerals are anhedral.

The zircon grains from the quartz monzonite are colorless and euhedral. Their length varies from 40 to 100 μm, with length to width ratios of about 1.5:1. Most of these zircons show oscillatory zoning (Fig. 1b). Th contents show a range of 459.3–1516.9 ppm and U contents show a range of 802.4–2797.0 ppm. The Th/U ratios are in a large range of 0.45–0.67, and most are smaller than 0.58, indicative of a magmatic origin. They constituted a coherent group clustering tightly on or around concordia (Fig. 1b) and yielded a weighted mean <sup>206</sup>Pb/<sup>238</sup>U age of 236.1 ± 2.9 Ma, with MSWD = 0.53. Thus, the interpretation of the zircon LA-ICP-MS U-Pb isotopic results is simple and the obtained ages are interpreted as representing the crystallization timing of the zircons and the emplacement timing of the host rocks. According to previous research, this age is consistent with the Early Indosinian magmatic event (245–230 Ma) occurred in Western Qinling.

## Conclusions

The Hongshi gold deposit has a significant feature of breccia-hosted type gold deposit. Zircon LA-ICP-MS U-Pb dating for the quartz monzonite yielded a concordant weighted mean <sup>206</sup>Pb/<sup>238</sup>U age of 236.1 ± 2.9 Ma, which is consistent with the age data of the initial enrichment period (225–245 Ma) in the western Qinling metallogenic belt. It is indicated that the Au mineralization and related magmatic rocks in the Hongshi gold deposit were part of the Indosinian magmatic-metallogenic events in Western Qinling.

## Acknowledgements

This work was financially supported by the National Natural Science Foundation of China (grants No. 41573036 and 41030423) and the Xiangtanzi Gold Deposit Prospecting Program of the Zhaojin Mining Industry Company Limited (3-4-2016-061).