

Metallogenic Mechanism of the Jianshan Fluorite Deposit, Henan Province, China

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Abstract

The Jianshan Fluorite Deposit is one of the representative large fluorite deposits within the southern Henan fluorite metallogenic belt, where favorable metallogenic conditions have resulted in the development of numerous medium- to large-sized fluorite deposits. This study focuses on the Jianshan deposit and is based on detailed field investigations integrated with whole-rock and single-mineral trace element geochemistry, fluid inclusion analyses, H–O isotopes, and zircon U–Pb geochronology. Particular attention is given to the geological characteristics, ore-controlling factors, metallogenic age, ore genesis, and exploration indicators of the deposit. Zircon U–Pb dating of the K-feldspar granite from the Tianmushan–Laozhaishan intrusive complex yields a concordia age of 120 ± 0.82 Ma, corresponding to the Aptian stage of the Early Cretaceous. The fluorite orebodies are mainly hosted within the Tianmushan–Laozhaishan pluton and along fault zones in the surrounding strata, occurring predominantly as veins and lenticular bodies. Major ore textures and structures include massive, brecciated, and banded structures, as well as anhedral granular, euhedral–subhedral, and zoned textures. Fluorite is the dominant ore mineral, whereas quartz and calcite constitute the principal gangue minerals. Hydrothermal alteration is well developed and mainly includes silicification, sericitization, chloritization, and kaolinization. Fluid inclusions in fluorite are dominated by aqueous inclusions with minor H₂S-bearing gas phases, indicating a NaCl–H₂O hydrothermal system. Homogenization temperatures range from 130°C to 170°C, with salinities of 1–5 wt.% NaCl equivalent. In general, homogenization temperatures of fluorite with the same color increase with depth, whereas purple fluorite exhibits higher homogenization temperatures than green fluorite at the same depth. In contrast, fluid densities of fluorite with similar coloration decrease with increasing depth. Hydrogen and oxygen isotope compositions indicate that the ore-forming fluids were derived from a mixture of magmatic water and meteoric water. Integrated evidence suggests that fluorine was mainly sourced from Early Cretaceous Epoch magmatic-hydrothermal fluids, whereas calcium was primarily derived from Ca-rich strata. The Jianshan deposit is therefore interpreted as a post-magmatic medium–low temperature hydrothermal vein-type fluorite deposit.

Keywords

Metallogenic Mechanism, Hydrothermal Fluorite, Jianshan Fluorite Deposit