Sources of Qingchengzi Pb-Zn Orefield: Implications from Pb Isotope

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1 Introduction

Qingchengzi orefield, located in Liaoning province, is a large polymetallic orefield in Liaodong-Jinan metallogenic belt, NE China. This large orefield clustered several Pb-Zn, Ag, Au and Mo ore deposits with estimated reserves of 1.5Mt Pb and Zn metals, 1100t Ag and 200t Au metals. Previous studies have debates concerning sources and ore genesis of the coexisting polymetallic deposits. Controversial ore genesis models have been proposed: a magmatic hydrothermal origin (Xue et al., 2003; Yu et al., 2009), a metamorphic hydrothermal origin model (Zhang, 1984), a Proterozoic SEDEX origin (Wang et al., 1994) model and a reworking model with Proterozoic sedimentation modified by latter metamorphic and hydrothermal activities (Jiang and Wei, 1989; Li, 2005). We choose Pb isotope analysis to unlock the source of the ore-forming materials. Ore minerals and wall rocks were systematically collected for Pb isotope measurement. The ore minerals ( sphalerite, galena, pyrite, argentite, etc.) were subdivided into four groups corresponding to different mineralization types: 1 laminated Pb-Zn ore type, collected from conformable, stratiform ore bodies; 2 massive Pb-Zn ore type, collected from unconformable, vein and irregular orebodies; Type 1and2 belong to strata-hosted ores and 3 Pb-Zn ore occurred within intrusive bodies and 4the independent Ag ore type. Wall rocks in the orefield include igneous rocks (Triassic and Jurassic) and stratigraphic rocks (metamorphic rocks of Liaohe Group, e.g. marble and schist).

2 Results and Discussion

The Pb isotopic compositions of ore minerals (Fig.1) show strata hosted Pb-Zn ores, namely the laminated ores share similar Pb isotopes with \(^{206}\text{Pb}/^{204}\text{Pb} = 17.662-17.883;^{207}\text{Pb}/^{204}\text{Pb} = 15.558-15.608;^{208}\text{Pb}/^{204}\text{Pb} = 37.982-38.178\), suggesting they are derived from the same source. The intrusion-hosted Pb-Zn ores display small deviation from strata-hosted ores with relatively lower...
208Pb/204Pb ratios (Fig.1b). On the other hand, independent Ag ores present 206Pb/204Pb = 18.376-19.029; 207Pb/204Pb = 15.651-15.791; 208Pb/204Pb = 37.894-38.344. Distinctively enriched Pb isotopes of Ag ore suggest their source region is different from that of Pb-Zn ores.

The whole-rock Pb isotopes of Triassic granite and lamprophyre dykes show small variations: 206Pb/204Pb = 17.5574-17.865; 207Pb/204Pb = 15.452-15.509; 208Pb/204Pb = 37.597-38.344.
Pb analysis results show Pb-Zn ores and Ag ores originated from different sources. The strata-hosted ores, namely the laminated ores and massive Pb-Zn ores present similar Pb isotope compositions. By comparison, intrusion-hosted Pb-Zn ores present depleted Pb isotopes with lower 208Pb/204Pb ratios and the Ag ores display enriched Pb isotopes. Source of Ag ores is interpreted to be composed of more strata component, while the intrusion-hosted Pb-Zn ores are composed of more magmatic component, with the strata-hosted Pb-Zn ores in the middle. The lead mainly originated from orogen and upper crust, but Ag ores were featured with a higher proportion of upper crust material.

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References


