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Editorial

Special Issue on Critical Metal Occurrence, Enrichment, and Application

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1. Introduction

Critical metals are a new resource concept introduced in recent years, referring to a category of metal elements that have essential and irreplaceable uses for emerging industries such as new energy, new materials, information technology, and defense industries [1–3]. Critical metals, including rare metals (e.g., Li, Be, Rb, Cs, Nb, Ta, Zr, Hf, W, and Sn), rare earth elements (e.g., La, Ce, Pr, Nd, MS, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Sc, and Y), rare disperse elements (e.g., Ga, Ge, Se, Cd, In, Te, Re, and Tl), and other strategic metals (e.g., PEG, Cr, and Co) have been regarded as essential strategic resources for global high-technology applications. However, critical metals are categorized as rare, associated, and/or fine, and these critical metal characteristics constrain our understanding of their metallogenic mechanism and efficient utilization [4,5].

This Special Issue aims to gather papers on the occurrence of critical metals and enrichment and application research, concerning geological, geochemical, and isotopic methods. We intend to offer research paradigms for critical metals and provide a key basis to improve and perfect metallogenic theory, as well as improve our knowledge of critical metals.

2. Review of Special Issue Contents

A total of five papers in various fields of critical metal occurrence, enrichment, and application, concerning geological, geochemical, and isotopic methods, are presented in this Special Issue, especially in the key region of China [6,7]. One paper [8] reports the chronology, petrochemistry, and isotopic geochemistry of zircon and granite in the Xianghualing tin–polymetallic orefield. Two papers investigate the ore-forming fluids and stable isotope geochemistryof different deposits: a gold deposit developed in fine-grained granite [9] and the sediment-host Cu–Co–Pb–Zn [10]. One paper [11] applied zircon Hf-isotopic mapping to the metal exploration of the Sanjiang Tethyan Orogenic Belt. Another paper [12] conducts research on rutile, an important source of metals, hosted within the Baishugang–Wujianfang amphibolite-facies metamorphic rocks in the East Qinling Orogen.

Zhang et al. [8] report on the U–Pb age, Lu–Hf isotopes, and whole-rock major and trace elements of Laohuya granite. They concluded that the granite originated from the partial melting of a reworked ancient crust composed of TTGs and its sediments formed at 2.5 Ga.

Lv et al. [9] identify the ore-forming fluids and isotopic geochemistry of gold mineralization associated with fine-grained granite based on microthermometry and Raman spectroscopy, and it can be concluded that the Xiawolong gold deposit is of magmatic–hydrothermal origin.

Zhu et al. [10] investigate the behavior of Cu–Co and Pb–Zn separation mineralization at the Baiyangping deposit in the Lanping Basin. A detailed fluid-inclusion analysis and C–O–S isotopic study are reported, indicating fluid derived from the sedimentary

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basin. Mineralization is controlled by faults, thermochemical sulfate reduction, and the physicochemical conditions of the fluid.

Du et al. [11] use Kriging weighted interpolation in the Mapgis software system to contour Hf isotopes, revealing a relationship between the crustal structure and metallogenesis.

Wang et al. [12] report a rare example of rutile deposits hosted within the Baishugang–Wujianfang amphibolite-facies metamorphic rocks in the East Qinling Orogen. The enrichment of rutile is not only of great significance to the prograde metamorphic and metallogenic mechanism of rutile but also provides an important key concerning the regional prospects of mineral exploration.

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