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Editorial

# Introduction to the Special Issue "Role of Magmatic Activity in the Generation of Ore Deposits"

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This Special Issue presents eight original contributions concerning ore deposits in China, Russia, and Chile. The new chronologic, isotopic, major, and trace element and fluid inclusion data provide constraints on the tectonic environment of magma genesis and the relation of the ore deposits described to the emplacement of these magmas. Particularly noteworthy is the diversity of deposits addressed, including Cu–Mo porphyry, Mo, polymetallic, gold–bismuth, and Carlin-type gold deposits.

The two papers concerning the deposits in Russia provide valuable new information on deposits from mining districts for which few previous descriptions are available in the English literature. The paper by Damdinova et al. [1] discusses the composition of ore-forming solutions and the pressure and temperature (P-T) conditions of molybdenum mineralization in the Pervomaisky stockwork deposit, which is situated within the Dzhidinsky ore field (southwestern Transbaikalia, Russia). New geochronological data for zircons from granites, and muscovite and molybdenite from the ore zones, indicate the close association of granite formation and ore deposition processes, which occurred 119–128 million years ago. Their results demonstrate that the pH of the solutions is one of the key factors for ore deposition. The paper by Zaitsev et al. [2] describes features of the petrographic and chemical compositions, along with isotopic dating of the Ergelyakh and Sokh plutons, located within the Kular-Nera slate belt, Verkhoyansk-Kolyma folded region, northeast Russia. Intrusion of these two massifs took place approximately 145–150 million years ago. The ore potential of the granitoids of both massifs seems to be similar, but due to some differences in the redox conditions of their formation, it was realized only within the Ergelyakh massif with the generation of several minor intrusion-related gold–bismuth deposits.

The five papers concerning ore deposits in China address the genesis of a wide variety of deposits of different ages and in different mineralized belts. The paper by Jiang et al. [3] concerns a suite of mafic intrusions, composed of diabase and micro-gabbro outcrops in the Jingxi area of southern Youjiang Basin, SW China. Their study presents geochronological, geochemical, and Sr–Nd isotopic analyses of the mafic intrusions in Jingxi with the aim of determining their petrogenesis, tectonic setting, and metallogenic implications. Zircon U–Pb dating for the mafic intrusions yielded an age of 183 ± 3 Ma, which is coeval with the Carlin-like gold mineralization in the Youjiang Basin. Their new petrochemical data support a magmatism-related model for the Carlin-like gold mineralization in this basin. Ju et al. [4] investigate the tectonic setting and mineralization of three newly discovered large Mo ore deposits (Fu'anbu, Chang'anbu, and Jidetun) in the Shulan area in Jilin Province, which is a part of the Lesser Xing'an–Zhangguangcai Range polymetallic ore belt, an important Cu–Mo ore region of northeast China. They conclude that early Yanshanian (200–134 Ma) magmatism caused by the subduction of the Paleo-Pacific Plate was the main cause for the genesis of the Mo deposits in the Shulan area. The paper by Liang et al. [5] describes the Kengdenongshe Au–Ag–Pb–Zn polymetallic deposit, a newly discovered large-scale polymetallic deposit in the southeastern section of the East Kunlun Orogen, which contains an Au resource of 40 t, a Ag resource of 690 t, and a Pb–Zn resource of $10.5 \times 10^5$ t. Zircon U–Pb dating data show that these rhyolitic tuffs were emplaced at 243.3 ± 1.6 Ma. Their geochemical data indicate that the Kengdenongcuo rhyolitic tuffs, which host the deposit, originated along with contemporaneous syn-collision granitoids in the region due to arc-type magmatism as the Paleo-Tethys Ocean was closed. The contribution of Hu et al. [6] concerns biotite adamellites, with the formation age of 172–168 Ma, and garnet-bearing adamellites of 158–152 Ma, which occur in the Xingcheng area of western Liaoning. Geochronologic studies of the ore deposits in western Liaoning show that these Mesozoic metalliferous deposits formed in a compressive environment influenced by the subduction of the Paleo-Pacific plate. The ore deposits are similar to the magmatic events in ages, and magmatism provided both the thermal conditions and the source of the metallogenic hydrothermal fluid for mineralization. Finally, the paper by Qi et al. [7] describes the ore-related granodiorite pluton in the newly discovered Magushan Cu–Mo polymetallic deposit located in southeastern Anhui, eastern China. This is a middle-scale skarn-type polymetallic deposit with different ore types, including veinlets-disseminated skarn (the primary type), quartz veins, and porphyry. LA-ICP-MS zircon U–Pb analyses yielded a crystallization age of 135.7 ± 1.5 Ma for the granodiorite. They determine geochemical and isotopic features, which suggest that the Magushan granodiorites could be formed by metasomatized mantle-derived magmas, mixing with materials from the Neoproterozoic crust. This study concludes that the formation of the Magushan Cu–Mo polymetallic deposits may largely depend on an oxidizing environment and multi-sources of mixed mantle- and crust-derived materials.

Our own contribution, which concerns the well-known giant El Teniente Cu–Mo megabreccia deposit in central Chile [8], focuses on the debate concerning whether or not the formation of this and other giant Cu–Mo deposits depend on the genesis of a unique "fertile" magma or merely a very large amount of magma that otherwise, if emplaced in smaller volumes, might generate only smaller deposits or barren plutons. The new Hf isotopic data presented in the paper suggest the latter. The deposit formed above a large, long-lived, vertically zoned magma chamber that developed due to compressive deformation and persisted between ~7 to 4.6 Ma. Progressively more hydrous mantle-derived mafic magmas feed this chamber from below, providing heat, $H_2O$, S, and metals, but no unique "fertile" Cu-rich magma was involved in the formation of the deposit.

In summary, the eight papers focus on a number of different variables such as oxidation state, fluid composition, and magma volume that have played a role in generating ore deposits related to magmatic activity of different ages and tectonic settings.

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