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Editorial

Editorial for the Special Issue "Mineralogy, Geochemistry and Geochronology of W-Sn Polymetallic Deposits"

Huan Li [1,*], Rongqing Zhang [2], Jiehua Yang [3] and Jingya Cao [4,5]

1 Key Laboratory of Metallogenic Prediction of Nonferrous Metals and Geological Environment Monitoring, Ministry of Education, School of Geosciences and Info-Physics, Central South University, Changsha 410083, China
2 State Key Laboratory for Mineral Deposits Research, School of Earth Sciences and Engineering, Nanjing University, Nanjing 210023, China
3 State Key Laboratory of Ore Deposit Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550081, China
4 Southern Marine Science and Engineering Guangdong Laboratory (Guangzhou), Guangzhou 511458, China
5 Department of Ocean Science, The Hong Kong University of Science & Technology, Kowloon, Hong Kong, China
* Correspondence: lihuan@csu.edu.cn

Tungsten and tin deposits provide numerous valuable and critical resources to the world, which has led to them attracting the increasing attention of economic geologists. This Special Issue focuses on recent advances in W-Sn polymetallic deposits, including topics such as geochemistry, geochronology, magma sources and the evolutionary processes of mineralization-related granites, in situ analysis of W- and Sn-bearing minerals, and fluid exsolution and mineral precipitation processes of typical W-Sn polymetallic deposits worldwide. A total of 15 papers from China, Russia, France, Japan, and Korea reporting on typical W-Sn polymetallic deposits are included in this Special Issue.

Of the papers included in this Special Issue, five of them report on the geochemical and geochronological features of W-Sn ore-related granitic rocks. The paper by Leng et al. [1] discusses the temporal, spatial, and genetic relationship between W polymetallic mineralization and the host granite. The authors measured the concentrations of ore-forming elements in different granites, aiming to reveal the metallogenic potential of the Indosinian Ziyunshan granite in Central Hunan in South China. Wang et al. [2] studied the trace elements and Hf isotopic compositions of zircons from quartz diorite at the Yangla W polymetallic deposit in Southwest China. They proposed that the Yangla granitoids were the products of large-scale silicic magmatic emplacement activities in the Triassic–early Jurassic and have good potential to host additional W polymetallic deposits. The paper by Luo et al. [3] reported the petrology, whole-rock geochemistry, zircon U-Pb chronology, and trace element geochemistry of granite bodies exposed in the Xianghualing ore field in South China. They emphasized the importance of the Cretaceous W-Sn metallogenic events in the Nanling Range. Tang et al. [4] examined whole-rock geochemistry, geochronology, and Sr–Nd–Hf isotopes to determine the genetic relationship between diverse ore-related granitoids and W metallogeny in the Tongshanling ore field in South China. Their results showed that the W-forming granite porphyry underwent well-recorded fractional crystallization and had a higher differentiation index and crystallization temperature. Seo et al. [5] studied fluid and melt inclusions occurring in unidirectional solidification textured quartz and quartz phenocrysts from the Upper Cretaceous Sannae–Eonyang granite, aiming to understand the magmatic–hydrothermal processes controlling W polymetallic mineralization in the granite. All five of the studies mentioned above have enhanced our understanding of the genesis of W-Sn mineralization related to granitic rocks.

The other ten contributions to this Special Issue mainly focus on W- and Sn-polymetallic ores by investigating the fluid source and evolutionary processes. Gao et al. [6] investigated

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the He and Ar isotope compositions of fluid inclusions in pyrite and wolframite from the Xingluokeng ultra-large W polymetallic deposit. They evaluated the origin of ore-forming fluids and the contribution of the mantle to W-mineralization. The results showed that the ore-forming fluid of the deposit was not the product of the evolution of a pure crustal melt, but rather that an upwelling mantle played an important role in the formation of the deposits. Liang et al. [7] used LA-MC-ICP-MS U-Pb dating of cassiterite and C-O-S-Pb isotope analyses to investigate the mineralization age and source of the ore-forming minerals in the Bawang Sn polymetallic deposit. They concluded that the Bawang deposit is a hydrothermal vein-type deposit in the external contact zone of Late Cretaceous granite, and it is controlled by tectonic fractures formed by the interaction of magmatic–hydrothermal fluid and carbonate rocks. Yan et al. [8] integrated biotite Ar-Ar geochronology, fluid inclusion data from quartz, and C-H-O-S-Pb isotope geochemistry from the Juyuan W deposit. They proposed that the deposit was a quartz-vein type system related to the emplacement of granites which originated from a collision between the Tarim and Kazakhstan–Ili plates. Zhao et al. [9] highlighted the use of texture and geochemistry of scheelites in the W-mineralized Tongshankou skarn deposit. They proposed an REE substitution mechanism during the multistage W mineralization processes. Monnier et al. [10] dated monazite and rutile by using U-Pb isotopic systematics using LA-ICP-MS from hydrothermal W mineralization in the Echassières district of the French Massif Central. Their results provided evidence for multiple superimposed episodes of percolation of mineralizing fluids. Liu et al. [11] combined the statistical distributions of vein thickness with SEM–CL imaging of quartz to evaluate the mineralization potential at deeper levels in the Piaotang W-Sn deposit. They proposed that the vertical trend of vein thickness was altered by later hydrothermal events. Morishita and Nishio [12] used Li and O isotopes to study the Takatori W deposit (Japan). Their data indicate that granitic magma beneath the deposit played a crucial role in the deposit's formation. The paper by Damdinova and Damdinov [13] discusses the peculiarities of mineral composition and fluid inclusions of the Kholtoson W and Inkur W deposits from the Dzhida W-Mo ore field of Southwestern Transbaikalia, Russia. They proposed that hubnerite deposition from hydrothermal fluids was a result of decreasing temperature. As a part of their research, Wang et al. [14] carried out analyses of trace elements and rare-earth elements by using LA-ICP-MS on scheelite from the Yingzuihongshan W deposit, Western Inner Mongolia Autonomous Region, China. They concluded that the deposit is a quartz-vein-hosted tungsten type and is genetically associated with monzonitic granite. Liu et al. [15] applied cassiterite U-Pb dating and trace element analysis to the Dulong Sn polymetallic deposit in Yunnan Province, South China. The early stage of precipitation of cassiterite within the proximal skarn is mainly related to concealed granite (phase one and two Laojunshan granites) whereas the late stage of cassiterite is mainly associated with porphyritic granite.

We hope that this Special Issue will encourage new research on W-Sn deposits including unconventional stable isotopes (e.g., Sn and W isotopes) and U-Pb dating of low-U ore minerals such as scheelite and wolframite. We believe that further advances can be made through a machine learning approach to processing geochemical data in mineral exploration and ore genesis studies.

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References

1. Leng, J.; Lu, Y.; Li, X.; Zhao, X.; Liu, Y. Tungsten–Gold Metallogenetic Potential of the Ziyunshan Pluton in Central Hunan, South China: Insights from Element Geochemistry of Granites. *Minerals* **2023**, *13*, 144. [CrossRef]
2. Wang, X.; Li, B.; Tang, G.; Lei, Z.; Chang, H. Petrogenesis and Metallogenesis of Granitoids in the Yangla Cu-W Polymetallic Deposit, Southwest China: Evidence from Zircon Trace Elements and Hf Isotope. *Minerals* **2022**, *12*, 1427. [CrossRef]
3. Luo, Z.; Li, H.; Wu, J.; Sun, W.; Zhou, J.; Maulana, A. Geochronology and Geochemistry of the Xianghualing Granitic Rocks: Insights into Multi-Stage Sn-Polymetallic Mineralization in South China. *Minerals* **2022**, *12*, 1091. [CrossRef]
4. Tang, Y.; Kong, H.; Liu, B.; Zong, Q.; Wu, Q.; Jiang, H.; Tan, F. Geochronology, Whole-Rock Geochemistry, and Sr–Nd–Hf Isotopes of Granitoids in the Tongshanling Ore Field, South China: Insights into Cu and W Metallogenic Specificity. *Minerals* **2022**, *12*, 892. [CrossRef]
5. Seo, J.H.; Kim, Y.; Lee, T.; Guillong, M. Periodically Released Magmatic Fluids Create a Texture of Unidirectional Solidification (UST) in Ore-Forming Granite: A Fluid and Melt Inclusion Study of W-Mo Forming Sannae-Eonyang Granite, Korea. *Minerals* **2021**, *11*, 888. [CrossRef]
6. Gao, Y.; Chen, B.; Wu, L.; Gao, J.; Zeng, G.; Shen, J. Mantle-Derived Noble Gas Isotopes in the Ore-Forming Fluid of Xingluokeng W-Mo Deposit, Fujian Province. *Minerals* **2022**, *12*, 595. [CrossRef]
7. Liang, E.; Huang, D.; Zeng, G.; Liu, G.; Zou, G.; Luo, P.; Chen, D. Metallogenesis of the Bawang Sn-Zn Polymetallic Deposit, Wuxu Ore Field, Guangxi, South China: U-Pb Dating and C-O-S-Pb Isotopic Constraints. *Minerals* **2022**, *12*, 137. [CrossRef]
8. Yan, Q.; Chen, Z.; Zhou, Z.; Zhao, T.; Han, Q.; Li, J.; Liu, B.; Zhang, W. Fluid Evolution and Ore Genesis of the Juyuan Tungsten Deposit, Beishan, NW China. *Minerals* **2021**, *11*, 1309. [CrossRef]
9. Zhao, R.Z.; Wang, M.F.; Li, H.; Shang, X.Y.; Ullah, Z.; Wang, J.P. Texture and Geochemistry of Scheelites in the Tongshankou Deposit in Daye, Hubei, China: Implication for REE Substitution Mechanism and Multistage W Mineralization Processes. *Minerals* **2021**, *11*, 984. [CrossRef]
10. Monnier, L.; Melleton, J.; Vanderhaeghe, O.; Salvi, S.; Lach, P.; Bruguier, O.; Benmammar, A.; Bailly, L.; Béziat, D.; Gloaguen, E. Episodic Precipitation of Wolframite during An Orogen: The Echassières District, Variscan Belt of France. *Minerals* **2021**, *11*, 923. [CrossRef]
11. Liu, X.; Wang, W.; Zhang, D. The Mechanisms Forming the Five–Floor Zonation of Quartz Veins: A Case Study in the Piaotang Tungsten–Tin Deposit, Southern China. *Minerals* **2021**, *11*, 883. [CrossRef]
12. Morishita, Y.; Nishio, Y. Ore Genesis of the Takatori Tungsten–Quartz Vein Deposit, Japan: Chemical and Isotopic Evidence. *Minerals* **2021**, *11*, 765. [CrossRef]
13. Damdinova, L.B.; Damdinov, B.B. Tungsten Ores of the Dzhida W-Mo Ore Field (Southwestern Transbaikalia, Russia): Mineral Composition and Physical-Chemical Conditions of Formation. *Minerals* **2021**, *11*, 725. [CrossRef]
14. Wang, G.; Li, X.; Zhang, D.; Yu, J.; Liu, Y. Genesis of the Yingzuihongshan Tungsten Deposit, Western Inner Mongolia Autonomous Region, North China: Constraints from In Situ Trace Elements Analyses of Scheelite. *Minerals* **2021**, *11*, 510. [CrossRef]
15. Liu, S.; Liu, Y.; Ye, L.; Wei, C.; Cai, Y.; Chen, W. Genesis of Dulong Sn-Zn-In Polymetallic Deposit in Yunnan Province, South China: Insights from Cassiterite U-Pb Ages and Trace Element Compositions. *Minerals* **2021**, *11*, 199. [CrossRef]