

Special Issue on New Advances and Illustrations in Applied Geochemistry in China

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1. Introduction

The 9th national conference on applied geochemistry in China will be held in Chengdu, Sichuan province, in October 2023, hosted by the committee of applied geochemistry, the Chinese Society for Mineralogy, Petrology and Geochemistry (CSMPG). In order to facilitate the academic exchange on applied geochemistry, this Special Issue is intended for the presentation of new advances and case illustrations in the field of applied geochemistry.

This Special Issue gathers 14 scientific papers that capture various hot and challenging issues in applied geochemistry. These articles belong to three broad groups: (i) new advances and case illustrations in resource exploration; (ii) new advances and case illustrations in environment assessment; and (iii) new advances in the basic theory of geochemistry.

2. Resource Exploration

Geochemical exploration has played an important role in resource prospecting. This issue includes six papers on geochemical exploration. As discoveries of world-class mineral deposits continue to decline, shallow deposits are no longer enough to meet the daily needs of human beings, and exploration in covered areas has received increasing attention. The first paper, authored by J. Li, B. Zhang, Q. Gong, H. Liu, and N. Liu, presents the fine-grained soil-prospecting method in the Jiaojia gold deposit in Shandong province [1], where three lines of evidence on gold concentrations, microscopic morphology, and geochemical lithogenes were illustrated to explain the gold migration from ore to surface soils in a covered area. The second paper introduces the theory of the geoelectrochemical exploration method and presents three case studies on gold prospecting in covered areas [2], authored by M. Kang, H. Guo, W. Zhu, X. Luo, and J. Yang. Unlike the above two papers, the third paper, authored by B. Zhou, Z. Zhang, Z. Shi, H. Song, and L. Yu, focuses on the geochemistry and geochronology of a pluton in western Kunlun orogen [3], where the formation of the pluton and its mineralization potential on polymetallic deposits were illustrated. The paper by T. Dong, L. Kang, Y. Zhang, and Y. Gao presents prospecting on shale oil [4], where shales with higher TOC and lower pore fractal parameters in the Songliao basin, NE China, are favorable reservoirs.

The remaining two papers focus on determining geochemical anomalies in geochemical survey data. The first paper, authored by B. Zhao, D. Zhang, R. Zhang, Z. Li, P. Tang, and H. Wan, describes an advanced workflow of an object-based geochemical graph learning approach [5], where a case study on multiple mineral anomalies was illustrated in Southeastern Inner Mongolia, North China. The other paper illustrates a creative method to determine the tungsten composite anomalies using the geochemical gene technique [6], authored by J. Li, Q. Gong, B. Zhang, N. Liu, X. Wu, T. Yan, X. Li, and Y. Wu. The mineralization similarities of the geochemical metallogene can be viewed as useful integrated indices on geochemical tungsten exploration with the elimination of the lithological influence.



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3. Environment Assessment

The soil quality survey and environment assessment are enduring topics in applied geochemistry. This issue includes three papers that focus on the evaluation of soil nutrient status, pollution assessment of heavy metals, and geochemical survey of geoherbs, respectively.

The first paper, authored by J. Zhang, Y. Liu, S. Hong, M. Wen, C. Zheng, and P. Liu, presents the geochemical soil survey of heavy metals in a typical mining area [7], where single and integrated pollution indices were used to assess the environmental quality of soils, and the speciation of heavy metals were analyzed to discover their mobility. The second paper presents a LightGBM model to assess the soil nutrient status, authored by Z. Liang, T. Zou, J. Gong, M. Zhou, W. Shen, and J. Zhang [8], where the tobacco planting soil in Debao County, Guangxi province, was illustrated as an example. Finally, the quality of the top-geoherb in Chengde City, Hebei province, was geochemically surveyed in the paper authored by Z. Sun, W. Shen, W. Fang, H. Zhang, Z. Chen, L. Xiong, and T [9], where the geochemical signatures of trace elements (especially rare earth elements) and medicinal components of *Scutellaria baicalensis* were described.

4. Basic Theory

In this Special Issue, five papers focus on the basic theory of geochemistry, such as the elemental abundance, the equation of state of multicomponent fluids, geochemical indices and mechanism, and a new geochemical concept.

The successful return of Chang'E-5 (CE5) samples implores the study of the Moon in geochemistry. The paper authored by Z. Hou, Q. Gong, N. Liu, B. Jiang, J. Li, Y. Wu, and J. Huang compiled the reported geochemical data on Moon samples and derived the elemental abundance of Moon samples [10], where the statistical distributions of normal, log-normal, and additive log-ratio transformation methods were used to derive the elemental abundance of major components, trace elements, and rare earth elements, respectively. Furthermore, Moon samples were classified into two types, low-Ca and high-Ca samples.

An equation of state (EOS) of $\text{CH}_4\text{-N}_2$ fluid mixtures in terms of Helmholtz free energy is presented in the paper authored by J. Zhang, S. Mao, and Z. Shi [11], which can reproduce the pressure–volume–temperature–composition (PVTx) and vapor–liquid equilibrium (VLE) properties of $\text{CH}_4\text{-N}_2$ fluid mixtures. Dendrite is a typical self-similar morphology. The paper authored by N. Liu, Y. He, S. Xu, L. Xiong, Y. Wei, J. Li, P. Li, and Q. Gong presents a dendrite developed along the bedding plane in limestone and dolomite strata in Zhoukoudian, Beijing city [12], where the formation's dynamic mechanism was simulated on the diffusion-limited aggregation method on a model of fractal growth.

Sediment provenance is a main topic in research on soils, sediments, and sedimentary rocks. The paper authored by Z. Dong, L. Zhang, and B. Jin illustrates a case study on sediment provenance along the Subei coast to the Yangtze estuary [13], where the detrital mica composition was used as an efficient approach in sediment provenance analysis and transport tracing. With respect to the provenance and tracing of geological materials, a promising concept, the geochemical gene, has been presented recently [14], which can be used not only to classify geological materials [1,15] but also to determine geochemical anomalies [6]. The last paper, authored by Y. An, X. Yin, Q. Gong, X. Li, and N. Liu, presents an excellent illustration of the classification and provenance of geological materials [16], where the rock–soil–sediment system in the Wangquan area of Zhangjiakou, North China, was investigated and traced on geochemical lithogenes.

Although this Special Issue has been closed, more in-depth research into new advances and illustrations in applied geochemistry are expected to be presented at the national conference on applied geochemistry.

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