

Editorial for Special Issue “Selected Papers from the 7th National Youth Geological Congress”

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This Special Issue compiles 25 selected papers from the 7th National Youth Geological Congress (Shenyang, China), offering a comprehensive synthesis of regional geology, ore genesis, and mineral exploration in China. Organized into four themes, the volume deciphers (1) Paleozoic–Mesozoic magmatic evolution and geodynamic regimes of the Eastern Central Asian Orogenic Belt and adjacent regions; (2) Precambrian crustal growth, mantle metasomatism, and metamorphic history of the North China and Yangtze Cratons; (3) hydrothermal fluid evolution, mineralization mechanisms, and deep-exploration advancements via geophysics and AI-driven geochemical mapping; and (4) sandstone-hosted uranium metallogeny, sedimentary architecture, and provenance tracing in major energy basins.

1. Tectonic–Magmatic Evolution and Metallogeny of the Central Asian Orogenic Belt and Adjacent Regions

Li et al. (Contribution 1) demonstrate that Early Jurassic arc magmatism in the northern Erguna Block was driven by high-angle southward subduction and rollback of the Mongol–Okhotsk Ocean, featuring extensive mantle metasomatism and lower-crustal melting.

Wu et al. (Contribution 2) identify Early Cretaceous highly fractionated I-type rhyolites in the northern Great Xing’an Range, attributing their origin to partial melting of basaltic lower crust within a post-orogenic extensional regime induced by Paleo-Pacific slab rollback.

Ma et al. (Contribution 3) delineate two Late Mesozoic volcanic episodes in the western central Great Xing’an Range, recording a tectonic transition from a continental arc to a post-collisional extensional setting tied to Paleo-Pacific subduction dynamics.

Zhang et al. (Contribution 4) constrain Early–Middle Permian I-type intrusions in the south-central Great Xing’an Range, providing evidence for continuous subduction of the Paleo-Asian Ocean beneath the Songliao–Xilinhot block.

Li et al. (Contribution 5) investigate Neoproterozoic bimodal intrusions in the northern Erguna Block, where A-type granites and gabbroic diorites record an intraplate extensional environment during the Rodinia supercontinent cycle.

Huang et al. (Contribution 6) date Late Permian volcanic–clastic sequences in the northern Songliao Basin, capturing the final subduction and closure stages of the Paleo-Asian Ocean under cold, dry paleoclimatic conditions.



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Shi et al. (Contribution 7) trace the Permian–Triassic magmatic evolution in northern Liaoning across four distinct tectonic stages, confirming that the Paleo-Asian Ocean closed prior to the Late Triassic.

Qian et al. (Contribution 8) report Late Jurassic–Early Cretaceous adakitic granites in the central Great Xing’an Range, generated by partial melting of thickened lower crust during the Mongol–Okhotsk tectonic transition.

Qian et al. (Contribution 9) employ Mg isotopes to show that Changbaishan tholeiitic basalts originated from carbonatized pyroxenite melting at 160–180 km depth, triggered by subducted Pacific slab–sediment interactions in the Mantle Transition Zone.

2. Precambrian Tectonic Evolution of the North China and Yangtze Cratons

Zhang et al. (Contribution 10) establish a sedimentary–metamorphic model for crystalline graphite in the Paleoproterozoic Huangtuyao Formation, North China Craton, constraining mudstone deposition to ~2102 Ma and peak metamorphism (445.9–534.0 °C) to ~1888 Ma during late Paleoproterozoic orogenesis.

Yang et al. (Contribution 11) analyze 2.52 Ga metabasalts and associated rocks in southern Liaoning, demonstrating that Neoproterozoic intra-oceanic subduction and back-arc closure led to terrane accretion along the margin of the Longgang Block at ~2.49 Ga.

Wang et al. (Contribution 12) use Fe–Si–O isotopes and trace elements from the Hugushan BIF in the central North China Craton to show that alternating banding resulted from hydrothermal fluids mixing with seawater under redox-stratified oceanic conditions.

Liu et al. (Contribution 13) investigate the ~880 Ma Taoyuan syenogranite in the Micangshan Massif, Yangtze Block, linking its depleted-mantle I-type signature to subduction-driven metasomatism during Rodinia assembly.

Zhang et al. (Contribution 14) date Middle Jurassic (~170 Ma) mafic–ultramafic cumulates in northern Liaoning, attributing their metasomatized mantle source to back-arc extension and lithospheric thinning induced by Paleo-Pacific subduction.

3. Ore Genesis, Mineralization Mechanisms, and Deep Exploration Technologies

Xie et al. (Contribution 15) combine multi-system isotopes (S–Pb–He–Ar–H–O) and fluid inclusions from the Chaijiagou Mo deposit, North China Craton, demonstrating that fluid boiling and fluid–rock interaction drove Mo–Cu precipitation, whereas magmatic–meteoric fluid mixing triggered subsequent Pb–Zn mineralization.

Ding et al. (Contribution 16) investigate invisible gold hosted in arsenopyrite (Au⁺) and pyrite (Au⁰) at the Sawayardun deposit, southwestern Tianshan, revealing that gold enrichment occurred via Sb-rich melt scavenging, dissolution–reprecipitation, and As-facilitated lattice incorporation in a reducing meso-epithermal system.

Xie et al. (Contribution 17) evaluate wolframite and sulfide trace elements alongside in situ S isotopes from the Sansheng deposit, Inner Mongolia, establishing that tungsten mineralization and late sulfide precipitation shared a magmatic–hydrothermal source linked to the highly fractionated Sansheng granite.

Song et al. (Contribution 18) present C–O–Hf isotopes and zircon U–Pb dating (~211 Ma) for the Qieliekeqi siderite deposit, West Kunlun, proposing a two-stage metallogenic model comprising Late Cambrian hydrothermal sedimentation followed by Late Triassic magmatic–hydrothermal overprinting.

Liang et al. (Contribution 19) integrate physical property data, gravity–magnetic surveys, and Wide Field Electromagnetic Method (WFEM) inversions in the Liaodong

region, revealing that deep boron iron mineralization extends beneath granite bodies, inside large folds, and along unconformity contacts.

Pei et al. (Contribution 20) develop a geology- and topography-constrained U-Net deep learning model for the Gouli area, Qinghai, upscaling stream sediment geochemical maps to 1:25,000 scale and successfully sharpening Ag, Cu, and Pb anomalies above known mineralized zones.

4. Sedimentary Basins, Provenance Analysis, and Sandstone-Hosted Uranium Metallogeny

Zhang et al. (Contribution 21) apply detrital zircon U–Pb dating and heavy mineral analysis to uranium-bearing sandstones of the Saihan Formation in the Erlian Basin, tracing primary detrital and uranium provenance to intermediate–acid granites of the Sonid Uplift.

Zhang et al. (Contribution 22) examine gas compositions and fault networks in the Ordos Basin, showing that methane-dominated gases from Triassic source rocks migrated along tectonic faults to act as the key reducing agent for uranium mineralization in eolian reservoirs.

Liu et al. (Contribution 23) analyze sand-dispersion architecture and trace elements in the Saihan Formation, Erlian Basin, establishing that braided channel facies, sand body thickness (40–80 m), and sand-to-mud ratios strictly control redox transition zones and uranium precipitation.

Nie et al. (Contribution 24) synthesize global organic matter (OM) functionality in sandstone-hosted uranium systems, establishing unified metallogenic models for humic-dominated, roll-front, and deep hydrocarbon seepage-related deposit types.

Deng et al. (Contribution 25) evaluate paleocurrents and geochemical signatures of the Upper Permian Longtan Formation in the Lower Yangtze region, linking sediment provenance to active continental margins and island arcs within the Jiangnan Orogen and Cathaysia Block.

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List of Contributions

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