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Breakup of the Rodinia Supercontinent: Perspective from the Mineral Deposit

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The mechanism driving the breakup of the Rodinia supercontinent remains debated, with competing bottom-up (mantle plume–driven) and top-down (subduction- or slab rollback–controlled) models (Zou et al., 2021). These scenarios predict differences in mantle thermal structure, magma flux, and source characteristics (Zou et al., 2024), influencing mafic magmatism and related mineral systems. Magmatic Ni–Cu sulfide deposits, highly sensitive to high-flux mantle-derived magmatism, record mantle source properties, sulfur sources, and sulfide immiscibility through their major and trace element compositions, platinum-group element (PGE) systematics, Ni/Cu ratios, and sulfur isotopic signatures. They thus provide an independent, ore-deposit–based framework for constraining geodynamic processes during early supercontinent breakup.

The Yangtze Block, a key component of Rodinia, hosts several Neoproterozoic Ni–Cu sulfide deposits associated with rifting along its margins. We investigate the Wangjiangshan deposit using petrography, geochronology, and multi-isotopic and trace-element geochemistry to constrain magma sources, magmatic evolution, and sulfide segregation, and compare these results with coeval deposits across the Yangtze margins.

Results indicate that: (1) Wangjiangshan formed during early Rodinia rifting from high-Mg mantle-derived mafic magmas sourced from lithospheric mantle previously metasomatized by subduction-related fluids. Partial melting was likely triggered by a deep-seated mantle thermal anomaly during extension, and ore formation was controlled by sulfide immiscibility with predominantly mantle-derived sulfur. (2) Coeval deposits along the Yangtze margins share consistent parental magma characteristics and PGE systematics, distinct from arc-related magmatic sulfide systems. (3) Integrated evidence supports a two-stage evolution involving subduction-modified lithospheric mantle followed by plume-related thermal triggering and rift-related magmatism, highlighting deep mantle thermal input as a primary driver of early rift-related Ni–Cu sulfide mineralization during Rodinia breakup.

References:

1 Zou, H., Li, Q.L., Bagas, L., Wang, X.C., Chen, A.Q., Li, X.H., 2021. A Neoproterozoic low-$\delta^{18}O$ magmatic ring around South China: Implications for configuration and breakup of Rodinia supercontinent. *Earth Planet. Sci. Lett.* 575, 117196.

2 Zou, H., Li, H.K., Li, Z.Q., Wang, D.L., Safonova, I., Cao, H.W., Jin, X., Chen, H.F., Huang, C.C., 2024. Integrated detrital rutile and detrital zircon ages: A new perspective on the tectonic evolution of South China. *Natl. Sci. Rev.* 11(12).