

# **Flat slab rollback as a trigger for large-scale skarn iron mineralization in the North China Craton**

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The North China Craton (NCC) is the major source of high-grade iron skarn deposits in China, with numerous mining clusters strategically located in both the eastern and western belts of its interior. These two belts of iron deposits were formed coevally at ca. 130 Ma. With the aim of elucidating the spatio-temporal distribution of these skarn iron deposits, we performed a comprehensive analysis of the petrological and geochemical characteristics of the dioritic intrusions intrinsically linked to these deposits. Our findings suggest that these intrusions were derived from a lithospheric mantle metasomatized by fluids released from subducting slabs, followed by crust-mantle interaction.

Chlorine (Cl) plays a pivotal role in the formation of skarn iron deposits, and its presence is primarily associated with the dehydration of serpentine within subducted slabs occurring at depths of less than 300 kilometres. Consequently, the formation of skarn iron ore is unrelated to the magmas emanating from the large mantle wedge situated beneath the 660-kilometer discontinuity, as observed through seismic tomographic images in East China. Based on the regional spatio-temporal distribution of magmatic rocks, we postulate that the large-scale skarn iron mineralization in the NCC may be intrinsically tied to the rollback of the subducted flat slab at ~137 Ma. This rollback created a triangular space between the leading edge of the flat slab and the overriding plate, leading to the upwelling of asthenospheric mantle, which triggered partial melting of the oxidized, Cl<sup>-</sup> and H<sub>2</sub>O-rich lithospheric mantle. This process gave rise to the primary basic magmas that generated the skarn iron deposits at ~130 Ma. Our model proposes the roll back of the initial flat slab subduction of the paleo Pacific plate as the geodynamic factor that triggered mantle magmatism and the formation of large-scale skarn iron mineralization in the NCC.