

Field Relationships and Geochemical Constraints on the Emplacement of the Jinchuan Intrusion and its Ni-Cu-PGE Sulfide Deposit, Gansu, China

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Abstract

Field mapping and petrological-geochemical investigation of the Jinchuan intrusion in north-central China clarifies how the intrusion was emplaced and provides a new model that explains how its large and rich Ni-Cu-platinoid deposits may have formed. The intrusion was emplaced into high-grade gneisses and marbles along a disconformity at the base of an overlying cover sequence, indicating that it was emplaced as a sill, not a near-vertical dike, as previously proposed. After emplacement the intrusion was rotated to its present orientation and deformed and metamorphosed under greenschist-facies conditions. Relative enrichment of incompatible trace elements coupled with negative U-Th and Nb-Ta anomalies in all samples from the intrusion provide evidence that the parental magma assimilated granitoid rocks in the lower crust. The presence of abundant marble xenoliths, now decarbonatized to diopside-rich skarns, and chemical indices such as high CaO/SiO₂, indicate that the magma assimilated carbonate on reaching its present site. This contamination may be linked to the formation of the Ni-Cu platinoid ores. We propose that the assimilation of carbonate-rich fluids increased the oxygen fugacity of the magma and led to the segregation of metal-rich sulfides.

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