# Sedimentary Limonite Deposit in Black Shale and Mechanism for Adsorption of Mo and Zn in the Lushi Area, North China Craton

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Sedimentary iron deposits mainly consist of hematite and magnetite, with rare limonite. However, sedimentary iron deposits in black shale have not been reported, as well as the adsorptive Mo-Zn mineralization in sedimentary iron deposits. The Lushi area is located at the southern margin of the North China Craton, where iron mineralization is associated with high concentrations of Mo, Zn, and other elements. The mineralization occurs in Sinian carbonaceous metamorphic silty sand. The iron deposit is of sedimentary origin and is mainly composed of limonite and secondary hematite. Orebodies suffered strong transformation during post-mineralization weathering, thus concealing hypogene ore characteristics and making an understanding of genesis of the deposit difficult.

Collected samples all plot in the passive continental margin field on diagrams of rock chemistry. The rocks are characterized by $\omega(SiO_2)/\omega(Al_2O_3)<5$, $\omega(K_2O)/\omega(Na_2O)>1$, $\omega(Al)/\omega(Al+Fe+Mn)>0.5$, $\omega(Al_2O_3)/\omega(Al_2O_3+Fe_2O_3)=0.6\sim0.9$, and $\omega(MnO)/\omega(TiO_2)<0.2$. The rocks are enriched in large-ion lithophile elements such as Rb, Ba, and K, and high field strength elements such as Th, U, Ta, P, Nd, Zr, Hf, and Pb. They are depleted in the large-ion lithophile element Sr and high field strength elements such as Nb and Ti, with ratios of $Sr/Ba<1$, $Ni/Co>3$, and $U/Th<1$. The ore and surrounding rocks have similar REE distributions, with weak Eu anomalies and no pronounced Ce anomaly.

Black shale and limonite are products of the same process of sedimentation. They originated from the denudation of an ancient continental block on two sides of a sedimentary basin. The ore-bearing formation was formed in a continental margin setting within a semi-enclosed shallow to sub-abysmal marine basin. It is a relatively stable, partially disturbed sedimentary environment that underwent repeated alternation between oxidation and weak reduction. Sedimentary limonite deposits in carbonaceous black shale, with inorganic carbon, were formed in this specific depositional environment.

It is inferred that the iron is transported as a hydroxide colloid, with mica and quartz in the sedimentary environment, and amorphous-form humic acids play an important role in the anticoagulation system during the migration process. Molybdenum, Zn, and other elements, which exist in the form of ions absorbed toy iron colloids and organic matter, are transported to a specific deposition site. The Mo and Zn are adsorbed on limonite in ionic form. It is difficult to find these elements in independent minerals. Therefore, the Mo and Zn mineralization are of limited economic significance, and the value of the limonite orebody is also limited. It needs to be carefully evaluated in follow-up exploration investment.