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Trace element distribution and enrichment patterns of Ediacaran-early Cambrian, Ziyang selenosis area, Central China: Constraints for the origin of Selenium

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Abstract:

Ziyang County is one of the two major regions in Central China exposed to selenium (Se) poisoning. To understand the origin of anomalous Se enrichment strata of the Ediacaran-early Cambrian period (ca. 635-520 Ma) in the area of Ziyang affected by selenosis, major and trace elements were analyzed for 468 samples collected from the Lujiaping Formation in Ziyang County, Central China.

Se is the most highly enriched trace element in the Lujiaping Formation of the Ediacaran-early Cambrian period. Selenium concentrations vary from 0.03 to 303 ppm, with an average of 16 ppm, or more than 324 times the concentration found in the upper continental crust. The average Se content of Bed 6 (approximately 63 m thick) is the highest, at 49.20 ppm (1.45-154 ppm). The Lujiaping Formation is highly enriched in Cd ($\times 53$), S ($\times 31$), Mo ($\times 22$) and As ($\times 13$), compared to the upper continental crust. It is slightly enriched in V ($\times 8.07$), Ba ($\times 7.65$), Ga ($\times 7.24$), Zn ($\times 7.22$), U ($\times 5.43$), Cu ($\times 4.02$), Bi ($\times 2.55$), Tl ($\times 2.16$), Ni ($\times 1.75$), P ($\times 1.03$), and depleted in Pb (0.97), Cr (0.96), Sr (0.81), Li (0.79), In (0.69), Sc (0.69), Be (0.38), Cs (0.36), Co (0.30), Rb (0.29), and Th (0.27).

All Eu/Eu* for the forty anomalous Se-enrichment samples (Se=42-303 ppm) of the 1st Member (1.09-2.09, average=avg=1.40), 2nd Member (1.20-1.38, avg=1.29), 3rd Member (1.12-4.00, avg=2.38) and 4th Member (2.51-4.48, avg=3.56), show positive Eu anomalies and an increasing trend upward. However, Eu/Eu* of two samples are 0.90 (HSBY324, Bed 4 of 1st Member) and 0.95 (HSBY401, Bed 6 of 1st Member), which indicate that they are characterized by hydrothermal sediments, except HSBY324 and HSBY401 of 1st Member. Based on these elements' geochemical and petrographic characteristics, we conclude that these samples are of hydrothermal origin. There is also a strong positive correlation between Se and Ba ($R_{Se-Ba}=0.738^{**}$, $n=40$). In three point X-ray energy spectrometric analysis of black shale mineral anomalous Se-enrichment samples (HSBY601), the nor.C measurements of Ba (L Series) are 55.50 wt.%, 54.94 wt.% and 27.20 wt.%, respectively, with the corresponding Atom. C of 14.80, 14.50 and 5.72 at.%. Thus, the main Se source were derived from hydrothermal fluids, of anomalous Se-enrichment strata of Ediacaran-early Cambrian (ca. 635-520 Ma) of South Qinling Mountain.

Key words: Lujiaping Formation, Selenium, Hydrothermal activity, South Qinling Mountain.

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