

Application of NIR, IR, XRD and XPS in the study of ore deposits

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As we all know, only a small amount of mature spectrum technologies have been widely applied in the geology, such as the atomic absorption spectrometry (AAS) or atomic fluorescence spectrometer (AFS). According to the studies in the last two years, we successively analyzed some primary ores or debris in deposit by means of the near-infrared (NIR), infrared spectrum (Fourier, FTIR), X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS). It suggests that such techniques have many unique advantages in the study of deposit. In 2009, we analyzed the deep-fault gouge using the FTIR in Fankou lead-zinc deposit, Guangdong province. Then, the deep oxidized ore of Dongshengmiao polymetallic sulfide deposit were analyzed in 2013. The FTIR can reflect the peak characteristics of hydroxyl-oxygen (—OH), carbon-oxygen (C—O), silicon-oxygen (Si—O) and sulfate groups (SO_4^{2-}) etc. in samples. Meanwhile, we can speculate the difference in environment of each ore minerals. In the later study, we analyzed surface soil of some concealed polymetallic deposits with the NIR and the hydrogen groups was the target. The spectrogram results indicated the main minerals, especially the altered minerals, in quaternary mantle. It is great significance for the research of altered conditions and the preliminary prospecting. Furthermore, we tested the deep-fault gouge and quaternary covering of several metal deposits in Inner Mongolia using the XRD. This in-situ analysis can better reflect the occurrence state and composition of some fragmental materials in deposits. More important is that we can speculate some ore information through fragmental materials (mineral crystal) which may be created from ore-body. Further, analyzing the chemical states of crystals using the XPS can determine what chemistry happens to some ore mineral. The last, we can estimate size distribution of some mineral particles according to the XRD peaks. It helps to explain there are nano mineral particles exist in concealed ore-body and migrate to surface, which have been affirmed by the “Geogas” theory. Compared with the traditional research methods, the above spectrum techniques have the advantages include simpler operation, lower costs and only small damage for samples.

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