An XPS study on the valence states of arsenic in arsenian pyrite: implications for Au deposition mechanism of the Yangshan gold deposit, Western Qinling Belt, central China

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The Yangshan gold deposit is a typical sediment-hosted disseminated type recently exploited in the Western Qinling Orogen, central China. Determination of gold chemical states is difficult due to its low concentrations of ppm level in the major Au carrier, arsenian pyrite. It is well known that the enrichment of Au in pyrite is usually associated closely with the enrichment of arsenic in the mineral.

Here we obtained pristine surfaces of arsenian pyrite from the Yangshan ore by sputtering with Ar^+ beam in the vacuum chamber of an X-ray photoelectron spectroscopy (XPS). The XPS results indicate that the predoinant state of arsenic is As^-, wherea As^{3+} is the oxided state likely formed during sample preparation, which only distributed on the surface.

The new observations suggest that the enrichment of Au in arsenian pyrite is not due to the double substitution of As^{3+} + Au^+ for 2 Fe^{2+} as previously proposed[1], but because significant substitution of As^- for S^- resulting in structure loosening facilitates Au entering the pyrite lattice[2].

[1]Deditius *et al*.. (2008) Geochimica et Cosmochimica Acta 72, 2919-2933. [2]Liang *et al*..(2013) Journal of Asian Earth Sciences 62, 363-372

Spontaneously-Ignited Gangue Hill – a Potential Source for Global Mercury Inventory

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Coal gangue is a waste mining material mingled with small amount of coal. It is of little value for reproduction and mostly piled up into gangue hills [1]. The total stock of coal gangue in China is documented over 5 billion tons to date with an annuanl increment of 2,000 million tons [2]. Due to the mingled coal content, gangue hill is believed to share a similar spontaneous ignition process to coal fire. In China, spontaneously-ignited gangue hill cases are quite common in coal mining areas [1,3].

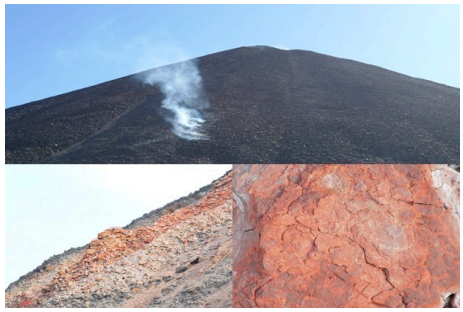

Figure 1: landscapes of spontaneously-ignited gangue hill

This study focused on a giant gangue hill with a height about 50 meters in Wuda coal field , Inner Mongolia. Red clinkers were scattered on the surface, indicating multiple spontaneous ignition in history. Three large burning sites and several vents were around the hillside. Atmospheric mercury concentrations were measured on each burning sites and vents, and the average is 12,438 ng/m^3 (min: 319, max: 31,754, n=12), which is around 7,000 times of background level of atmospheric mercury (1.6-1.8 ng/m^3).

Gangue hills are prone to intermittent self ignition, which releases mercury both in coal and surrounding clay or rocks. The long-term mercury inventory from gangue hill and potential impact on local environment requires further study.

[1] Pan et al.. (2005) Resources and Industries. 7, 46-49. [2] Ao et al.. (2005) J. Chin. Coal Soc. 30, 656-660. [3] Zhang et al.. (2011) Clean Coal Technol. 17, 97-100.

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