The particles carried by ascending gas in fractures of deep ore deposits

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Etiope and Malmqvist proposed that ascending gas may flow through fractures and matter were transported by ascending gas bubbles[1,2]. But, it is still not very clear how does the particles carried by ascending gas migrate from the deep concealed ore bodies to the Earth's surface. In our work, the particles carried by ascending gas in fractures of ore bodies in different depths beneath the surface in the Dongshengmiao polymetallic pyrite deposit, Inner Mongolia, China were sampled using two kinds of ways. One way was that devices were embedded in deep fractures. The particles were sampled by the devices in which ascending gas naturally flow through the sampling plate. Another way was that particles were sampled by a vacuum pump pumping the ascending gas in fractures through the sampling plate. The particle samples were analyzed using a Tecnai G2 F30 S-TWIN transmission electron microscopy.

It was found that there were nano-scale or nearly nano-scale metal sulphate and oxide particles in ascending gas in fractures of the deep ore bodies. It is the first discovery of metal particles in ascending gas in fractures of deep ore deposit. The particles have single particle and aggregation composed of many particles with crystalline substance or amorphous substance. They have chemical compositions such as Pb, Cu, Fe, S, O, which were generally consistent with those of the concealed ore bodies. This shows that the particles are related to the concealed orebodies. Moreover, fractures are the ascending channels that the particles migrate. Because ascending gas have higher speed, the particles carried by ascending gas can quickly migrate from the deep concealed ore bodies to the Earth's surface. On the basis of characteristics of the chemical constituent, shape, and ultrastructure of the metal particles as well as relation between particles, which were captured in soil gas, we can predict concealed ore bodies.

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[1] Etiope *et al* (2002) *Physics of the Earth and Planetary Interiors* **129**, 185–204 [2] Malmqvist *et al* (1999) Nuclear Instruments and Methods in Physics, Research Section B: *Beam Interactions with Materials and Atoms* **150**, 484–490