Lithogeochemistry of Lower Cambrian black shales in West Qinling orogen (China): implications for metal source of sediment-hosted gold deposits

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The Qinling orogen in central China, one of the most important Phanerozoic orogens worldwide, is endowed with over 200 sediment-hosted gold deposits. The source of gold for most deposits, however, remains hotly debated. The prevalent opinion is that gold is derived from underlying metal-rich sedimentary rocks by metamorphic devolatilization associated with the Triassic orogenesis involving the continental collision between the Yangtze and North China cratons. Black shales are widely distributed or underlain across the orogen and have been considered as the most important gold source, but solid evidence is lacking. Here we present preliminary results of lithogeohemistry of pristine black shales of the Lower Cambrian Taiyangding Group, which are excellently exposed in the western part of the West Qinling orogen, to show their fertility in gold and associated trace elements. The rocks commonly contain elevated Au (0.01-0.02 ppm), As (28.50-41.50 ppm), Sb (6.30-12.60 ppm), Ag (0.85-2.65 ppm), Hg (0.30-5.20 ppm), Mo (4.05-5.40 ppm), Ni (10.30-21.05 ppm), V (204-237 ppm), U (6.15-10.35 ppm), Se (12.40-13.40 ppm) and Ba (1022-4969 ppm). The black shales contain abundant diagenetic pyrite, which is the most important carrier of the above-mentioned trace elements as revealed by LA-ICP-MS analysis. The trace element association in the black shales is well comparable to gold ores of several major sediment-hosted gold deposits over the Qinling orogen. Such a similarity indicates that gold of these deposits may have sourced from deep-seated black shales as represented by the Taiyangding Group and/or its equivalents that have subjected to greenschist facies metamorphism during the orogenesis. This view is supported by sulfur isotope data of gold-bearing pyrite in many sediment-hosted gold deposits, indicating a sulfur source predominantly from marine sedimentary rocks.