Zircon and apatite fission track study on the mineralazation of Nanliang gold deposit, eastern Hebei, China

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Xiayingfang gold ore district, Hebei province, China, occurs in Xinglong-Kuancheng arcuate fold area of Yanshan platform fold belt in eastern Yinshan-Yanshan EW tectonic belt. A granite-porphyry intrusion, the principal part of magma activity in this area, is close related to the gold mineralizing process. This paper aims at studying the hydrothermal metallogenetic epoch and thermal history of Xiayingfang gold deposit, based on zircon and apatite fission track analyses for different alteration zones.

The zircon and apatite ages of six samples from ore and altered rocks range from 154 Ma to 120 Ma and from 114 Ma to 103 Ma respectively, indicating a about 22-50 Ma metallogenetic duration, and the metallogenetic time falls into early Yansan epoch. The age data and quantitative AFT modelling show that there are two stages of gold mineralization, in which the first stage is of higher temperature and rapider cooling rate than the second stage and the time and temperature of the turning point between them is about 120 Ma and 100 . The first stage of mineralization resulted from intrusion of a granite-porphyry body and took place in about 150 Ma, and second stage of the mineralization was related to both rhyolite-porphyry and magma cryptoexplosive breccia and occurred in about 135 Ma. Combined with the minerogenetic temperature of 370 290 , 230 170 and 150 80 in vanward-, main- and late-mineralization period respectively, the ZFT and AFT ages correspond to the main- and late-mineralization period separately. Since the samples from different places are heated in different degree by the metallogenetic hydrothermal solution, the less the distance from the thermal source and the long the heating time is, the lower the measured fission track age. It is demonstrated that the quartz-sericitization alteration is earlier and lasts longer than the potassic alteration. Therefore, we consider fission track analysis of the minerals is useful to researching the metallogenetic epoch and thermal evolution history of hydrothermal deposits.

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The magnitude of ocean warming during the PETM: Implications for forcing and climate sensitivity

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The Paleocene-Eocene Thermal Maximum (PETM) provides a unique opportunity to observe the global climate sensitivity to a rapid and large increase in greenhouse carbon levels. Although the exact changes in atmospheric CO_2 levels have yet to be determined, carbon isotope and deep-sea carbonate accumulation records confirm the rapid (<10 k.y.) release of several thousand gigatons of carbon. Such a massive release over such a brief period should have raised pCO_2 by hundreds of ppm or more. In theory, global temperaure should have increased, but with sea surface temperatures rising uniformily over most of the planet (i.e., in the absence of a strong ice albedo feedback). Such a response is supported by more than a dozen SST anomaly records from pelagic and shallow marine sections which show 5 to 9°C increase. Most of these SST anomaly records are based on oxygen isotopes data (from planktonic foraminifera) uncorrected for local salinity changes, and a few are based on Mg/Ca and TEX_{86}. In those few locations where multiple proxies are available, there is generally good agreement on the magnitude of SST change. The few exceptions are primarily in tropical pelagic cores where it appears the oxygen isotope based anomalies are damped. Reliable reconstructions of “absolute” SST, on the other hand, are far more limited since the low-mid latitude pelagic oxygen isotope records are compromised by diagenesis. Nevertheless, the few available records consistently show peak PETM temperatures well above modern, as high as 33°C in the mid-latitudes and 20 to 22°C in the Southern Ocean and Arctic. These SST estimates are extreme, and past attempts to simulate such high temperatures with CO_2 forcing alone required raising levels to extremes (>>3000 ppm). More recent studies demonstrate that elevated background levels of other trace gasses such as N_2O and CH_4, generated by biogeochemical feedbacks, may have amplified warming during the PETM. Given the potential implications for future warming, one of the major challenges facing the earth sciences community will be to improve the uncertainty in our estimates of SST for the PETM and other past episodes of transient global warming.