

Zoned zircon from eclogite lenses in marbles from the Dabie-Sulu UHP belt: A clear record of ultra-deep subduction and fast exhumation

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Eclogite lenses in marbles from the Dabie-Sulu ultrahigh-pressure (UHP) terrane are deeply subducted meta-sedimentary rocks. Zircons in these rocks have been used to constrain the ages of prograde and UHP metamorphism during subduction, and later retrograde metamorphism during exhumation. Inherited (detrital) and metamorphic zircons were distinguished on the basis of transmitted light microscopy, cathodoluminescence (CL) imaging, trace element contents and mineral inclusions. The distribution of mineral inclusions combined with CL imaging of the metamorphic zircon make it possible to relate zircon zones (domains) to different metamorphic stages. Domain 1 consists of rounded, oblong and spindly cores with dark-luminescent images, and contains quartz eclogite-facies mineral inclusion assemblages, indicating formation under high-pressure (HP) metamorphic conditions of $T = 571\text{--}668\text{ }^{\circ}\text{C}$ and $P = 1.7\text{--}2.02\text{ GPa}$. Domain 2 always surrounds domain 1 or occurs as rounded and spindly cores with white-luminescent images. It contains coesite eclogite-facies mineral inclusion assemblages, indicating formation under UHP metamorphic conditions of $T = 782\text{--}849\text{ }^{\circ}\text{C}$ and $P = 5.5\text{ GPa}$. Domain 3, with grey-luminescent images, always surrounds domain 2 and occurs as the outmost zircon rim. It is characterized by low-pressure mineral inclusion assemblages, which are related to regional amphibolite-facies retrograde metamorphism of $T = 600\text{--}710\text{ }^{\circ}\text{C}$ and $P = 0.7\text{--}1.2\text{ GPa}$. The three metamorphic zircon domains have distinct ages; sample H1 from the Dabie terrane yielded SHRIMP ages of $245 \pm 4\text{ Ma}$ for domain 1, $235 \pm 3\text{ Ma}$ for domain 2 and $215 \pm 6\text{ Ma}$ for domain 3, whereas sample H2 from the Sulu terrane yielded similar ages of $244 \pm 4\text{ Ma}$, $233 \pm 4\text{ Ma}$ and $214 \pm 5\text{ Ma}$ for domain 1, 2 and 3, respectively. The mean ages of these zones suggest that subduction to UHP depths took place over 10–11 Ma and exhumation of the rocks occurred over a period of 19–20 Ma. Thus, subduction from about 55 km to more than 160 km deep mantle depth took place at rates of approximately 9.5–10.5 km/Myr and exhumation from depths about 160 km to base of the crust at about 30 km occurred at approximately 6.5 km/Myr. We propose a model for these rocks involving deep subduction of continental margin lithosphere followed by ultrafast exhumation driven by buoyancy forces after break-off of the UHP slab deep within the mantle.

Relationship between Hg and sulfur in coal from Huaibei coalfield, China

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Many authors have reported that Hg in coal can exist in solid solution within pyrite. Correlations between sulfur and Hg are often attributed to this mode of occurrence and are most common in coals that are extremely enriched in Hg.

The result of this study shows that coal samples from the Huaibei coalfield have relatively low sulfur values (average 0.59%). The correlation coefficient between ash and sulfur is -0.08, indicating that sulfur in the Huaibei coals has an intermediate (organic and inorganic) affinity. In a study of 29 coal samples from the Huaibei coalfield, we observed that organic sulfur is the dominant sulfur form when the total sulfur is near 0.5%. Some literatures report that organic sulfur compounds can capture Hg and result in the enrichment of Hg in coals.

The conclusion shows the relationship between Hg and sulfur in all 29 coal samples that we examined; note that the correlation coefficient is only 0.17 ($n=29$). Interestingly, and it shows a significant positive correlation between Hg and sulfur ($n=21$, $R=0.64$, $p<0.05$) is obtained by excluding the eight samples from the No. 5 and 7 coal seams, which were influenced by a magmatic intrusion. This suggests that the magmatic intrusion not only increased the concentration of Hg in seams 5 and 7, but also changed the mode of Hg occurrence in these seams. The significant, positive correlation between Hg and sulfur in coals from the No. 3, 4, and 10 seams suggests that Hg in these coal seams is bound to both organic sulfur moieties and within sulfide minerals.