DIE model and compensation method applied in through-casing resistivity measurement

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Double-Injection-Electrodes (DIE) model and its compensation arithmetic method has been proven to be very useful for eliminating the errors caused by electrode-scale mechanical tolerances in formation resistivity measurement through metal case. In this paper, we found that even minor casing joint or casing corrosion may deteriorate the measurement accuracy. Based on theoretical analysis and self-adaptive goal oriented hp-Finite Element (FE) simulations, the compensation effects of DIE model were estimated. The calculated results from DIE model are always close to the real formation resistivity no matter the metal casing is ideal or not. Meanwhile, large errors occur in Single-Injection-Electrode (SIE) model, where the calculated formation resistivity may provide negative numbers when casing joint or casing corrosion exists. The Double-Injection-Electrode (DIE) model is predicted to have good compensation effects to many non-ideal situations with uneven metal casing besides electrode-scale mechanical tolerances.

Timing of dehydration melting and fluid flow during continental subduction-zone metamorphism in the Dabie orogen

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Dehydration melting of UHP metamorphic rocks and the possible presence of supercritical fluid during continental subduction-zone metamorphism has been revealed by microscale observations of petrology and geochemistry. However, a direct geochronologic constraint on partial melting and fluid supercriticality is still lacking. This study reports for the first time the outcrop-scale occurrence of migmatite-like structure within UHP eclogite in the Dabie orogen. Leucocratic veins and their host rocks were investigated by means of petrology and zirconology. Metamorphically grown zircons from the veins yield consistent U-Pb ages of 215±4 to 218±4 Ma; zircon trace elements indicate that they crystallized in the presence of garnet or amphibole. Ti-in-zircon and Zr-in-rutile thermometers gave variable temperatures from 537 to 758°C. Thus the veining occurred in the stage of transition from HP eclogite-facies to amphibolite-facies retrogression during exhumation of the deeply subducted continental crust. On the other hand, based on the paragenesis and trace element composition of vein minerals, vein-forming fluids are mainly composed of SiO_2 + Al_2O_3 + CaO + K_2O + FeO + MgO + H_2O and enriched in LREE, HREE, HFSE, LILE, and Pb, Th and U. The enrichment of HREE and HFSE suggests that the fluids have very high capacity of dissolving water-insoluble elements, pointing to the possible presence of supercritical fluid. While the supercritical fluid is stable in the UHP regime, it would separate into a hydrous melt and an aqueous fluid during the decompression exhumation into the HP eclogite facies. As a consequence, the vein minerals rich in the trace elements would precipitate as a product of phase separation. Thus, the dehydration melting of UHP metamorphic rocks is considered as the prerequisite for local formation of supercritical fluid in the UHP regime, whereas the phase separation of supercritical fluid during the exhumation is suggested as the basic cause for differential partition of trace elements between rock-forming and accessory minerals in the veins. Therefore, the zircon U-Pb dates on the leucocratic veins provide a temporal constraint on the lower limit of local melting during the continental collision.