Partial melting and element transfer during continental subduction-zone metamorphism: Geochemical insights from leucosome within UHP eclogite in the Dabie orogen

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Mineralgraphic observations, elemental and isotopic analyses of major and accessory minerals as well as simultaneous *in situ* LA-ICPMS analyses of zircon trace elements and U-Pb isotopes were carried out on a polymineralic leucosome (rutile + garnet + phengite + epidote + kyanite + quartz) and its host UHP eclogite from the Dabie orogen. The results are integrated to decipher the partial melting of UHP eclogite and its associated mass transfer during continental subduction-zone metamorphism. Multiphase inclusions mainly containing quartz + K-feldspar + K-rich melt ± plagioclase ± other silicate/carbonate minerals were found in garnet and epidote from both the leucosome and eclogite, indicating that the leucosome-forming fluid is a hydrous melt that is rich in K, Al and Si. Oxygen isotope analyses yield temperatures of 570-700ºC for quartz–garnet and quartz-kyanite pairs. The same minerals from the two rocks give nearly consitent $\delta^{18}O$ and δD values, suggesting that the hydrous melt was directly derived from *in situ* partial melting of the host eclogite. In comparison with the host eclogite, the leucosome is remarkably rich in phengite and epidote, indicating that the hydrous melt is associated with distinct LILE and LREE transport. Garnet and rutile in the leucosome show distinct higher contents of HREE (2.2-5.7 times) and Nb-Ta (1.8-2.0 times) than the host eclogite, indicating that these normally fluid-immobile elements are also active during partial melting of UHP eclogite. The LA-ICPMS analyses show that most zircons from the leucosome are metamorphic in origin, while the all zircons in the eclogite are residue of magmatic origin. This suggests that Zr as an incompatible element is preferrentially partitioned into the partial melt. Zircon U-Pb dating gives protolith ages of 774±45 Ma for the eclogite, and metamorphic ages of 217±2 Ma and 210±2 Ma for the leucosome. Thus, the leucosome is interprated to have formed via the partial melting of UHP eclogite during exhumation of the deeply subducted continental crust. In this regard, fluid flow and element transfer in the continental subduction zone occurred in the stage of exhumation rather than subduction.

The effects of silver nanoparticles on wastewater biofilms

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The goal of research

The objective of this research is to understand the potential effects of silver nanoparticles (Ag-NPs) on biological wastewater treatment processes.

Methods adopted

Molecular biology techniques (polymerase chain reaction — denaturing gradient gel electrophoresis, PCR-DGGE) were used to analyze the effects of Ag-NPs on wastewater biofilms, which reveals the response of various genera in the complex biofilm microbial community. Electron microscopy was also used to examnie the uptake of Ag-NPs into the biofilms.

Results and discussion

It was found that intact wastewater biofilms were highly tolerant to Ag-NPs. With an application of 200 mg Ag/L Ag-NPs for 24 h, no significant reduction of bacteria in the biofilms was detected. PCR-DGGE studies showed that microbial susceptibility to Ag-NPs is different for each genus. For instance, sulfur oxidizing bacteria *Thiothrix* sp. are more sensitive to Ag-NPs than other bacteria in the biofilms. Ag-NPs are quickly sorbed to the biofilms during incubation and trapped in extracellular polymeric substances (EPS) in the biofilms. This can be an important reason for the high tolenrance of wastewater biofilms to Ag-NPs. After the removal of loosely bound EPS, the viability of wastewater biofilms was reduced when treated under the same conditions (200 mg Ag/L Ag-NPs, 24 h).