The important role of UHP and UHT rocks deciphering the evolution of the lithosphere: Metamorphism at extreme conditions

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Considered to represent “exotic” and generally unattainable PT-environments as recently as 35 years ago, ultrahigh-pressure (UHP) and ultrahigh-temperature (UHT) metamorphic rocks are now considered to be common and widespread. UHP-metamorphism describes equilibration at depths corresponding to PT-conditions attaining the coesite stability field, whereas UHT conditions refer to recrystallization temperatures > 900°C. A dramatic increase in current research on UHP- and UHT-metamorphism reflects their significance in deciphering lithosphere evolution, and thus about 35 years later we now have completely different views on processes such as mantle dynamics, crustal tectonics and fluid-rock interaction during subduction, collision and exhumation, crust-mantle interaction in subduction zones, geochemical recycling, etc. A completely new field of research has also developed as a result of new discoveries of UHP minerals and assemblages in ophiolitic bodies in Tibet (Luobusa) and the Polar Urals (Ray-Iz). Recent studies document that not only UHP but also UHT terranes (for instance in Inner Mongolia) can reach a lateral extent of hundreds of kilometers, which can be the result of common large-scale regional phenomena. It is intriguing to note that in SE Spain and in the Rif Belt in NW Africa, UHP mineral inclusions of microdiamond and coesite have been discovered in garnet and kyanite of UHT granulites.

Many of these new findings triggered further experimental studies and modeling, and intensified future research should allow a better understanding of processes such as the subduction of oceanic and continental lithosphere, recycling of surface carbon and fluids to mantle depths, and later ascent towards the Earth’s surface.