Erosion rate estimated from surface and profile of cosmogenic ^{36}Cl in carbonates in China

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This study attempted to quantify long-term subaerial erosion of bare carbonate rock surfaces by using in situ-produced cosmogenic ^{36}Cl in carbonates. Carbonate samples were collected from the topmost 5 cm of exposed pinnacles at several non-glaciated karst or carbonate areas in modern monsoon (Guizhou), arid (Gansu) and transition (Beijing) regions in China. Samples from a 30m-depth profile were also collected in Guizhou karst area. Concentrations of natural Cl and ^{36}Cl in carbonates were determined by accelerator mass spectrometry with isotope dilution with ^{35}Cl-enriched carrier spike. Local ^{36}Cl production rates are calculated on the basis of geomorphological locations and chemical compositions of carbonates. The total Cl concentrations in carbonates were in range of 10-200 ppm. The ^{36}Cl nuclide concentrations were of the order of 10^5–10^7 atom g^{-1}, and converted to total erosion rates averaged over a 10^5 yr-timescale of chemical and physical processes acting on the karst surfaces. The erosion rates were 20–50 mm kyr^{-1} in Guizhou. Variations and mechanisms of the local erosion rates are discussed and the results are compared with the existing observations obtained by other measurement techniques.

U-Pb dating, and Lu-Hf property of zircon from granitic leucosome within orthogneiss from Sulu UHP terrane, Eastern China

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Granitic leucosomes as thin veins are widely distributed within orthogneiss in the Sulu UHP terrane, eastern China. A combined study of mineral inclusions, cathodoluminescence (CL) images, U-Pb SHRIMP dates, and *in situ* trace element and Lu-Hf isotope analyses of zircons provided insight into the nature and timing of partial melting in these rocks. Zircons from orthogneisses have three distinct domains: (1) inherited magmatic cores with Coe + Phe + Ap inclusions, which record a Neoproterozoic protolith age of 790-750 Ma, (2) mantles with Coe + Phe + Ap inclusions that record Triassic UHP age of 230-225 Ma, and (3) rims with Qtz inclusions that record retrograde metamorphism at 215-210 Ma. In contrast, zircons from granitic leucosomes have only two distinct domains: (1) the central UHP domains with Coe + Phe + Ap iclusions record Triassic UHP age of 230-225 Ma, and outmost rims with Qtz + Kfs + Ab + Ap inclusions record partial melting time of 214-210 Ma. Theses data indicate that partial melting in the Sulu UHP orthogneisses took place during late retrograde amphibolite-facies metamorphism. Inherited magmatic zircon cores from orthogneisses give uniform ^{176}Hf/^{177}Hf of 0.28187 ± 0.00003 corresponding to εHf (t) and Hf model ages of about -16.3 and 2.41 Ga, respectively. This is consistent with the generation of its protolith by reworking of Paleoproterozoic to late Archean crust. In contrast, UHP zircon domains from orthogneisses and granitic leucosomes are characterized by low Lu/Hf (<0.006), low Th/U (<0.1) and significantly higher ^{176}Hf/^{177}Hf (0.28233 ± 0.00002) than the inherited magmatic cores. The uniform but significantly different Hf isotope composition between the UHP and inherited zircon domains indicates equilibrium of the Lu-Hf isotope system only within the UHP metamorphic mineral assemblage. Zircon domains crystallized during partial melting at 214-210 Ma in granitic leucosomes have a Hf isotope composition indistinguishable from that of the UHP zircon domains. This suggests that only Hf (and Zr) equilibrated during UHP metamorphism was remobiliazed during partial melting while inherited magmatic zircons remained stable or was not accessible.