Scanning Electron Microscopy of Cherts in Relation to the Oxygen Isotopic Variation of Soil Quartz

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Abstract: Quartz isolated from soils by the pyrosulfate-H_2SiF_6 method and chert samples of various origins were examined with the scanning electron microscope. Quartz isolates of the 20 – 50 μm from the A2 and B2lt horizons of the Baxter soil (AR), with quartz $\delta_{18}O$ of 18 · 2 and 19 · ‰, respectively, showed a mixture of detrital quartz particles and chert clusters of aggregates of fine euhedral quartz crystals. The 2 – 5 μm fractions of both horizons consisted mainly of euhedral quartz particles. The 21 – 50 μm fraction from the underlying chert, with a $\delta^{18}O$ = 29 · 6‰, consisted of aggregates of euhedral quartz particles 1 – 10 μm dia. and of subhedral particles 0 · 1 – 0 · 5 μm dia. In the soil fractions, the size and shape of the quartz particles as well as oxygen isotope data indicated that the aggregates were from the underlying chert but that irregular, unaggregated grains were detritally admixed loess, particularly in the medium and coarse silt fractions. This mixing of chert (of low temperature origin and heavy oxygen) with detrital quartz (of high temperature origin and light oxygen) gave rise to the intermediate $\delta^{18}O$ values in the soil quartz. The SEM of cherts of different geological ages showed different morphologies. Prismatic, polyhedral microcrystalline quartz of 1 – 10 μm size as well as submicron, euhedral particles were observed in cavities. Submicron, subhedral particles and interlocking quartz grains were characteristic of Precambrian chert. Quartz grains more than 100 μm in size isolated by HCl from Ordovician dolomite (WI) had large (many microns) subhedral overgrowths and attached clusters of 0 · 1 – 0 · 5 μm microcrystalline quartz. A Danish flint formed in chalk had calcite-lined cavities (x-ray emission determined) in which spheroidal fibrous chalcedony occurred.

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