4.5.P03

Chemical weathering rate of chlorite determined in the chinese loess - paleosol sequences

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Laboratory and field laboratory studies of rates of silicate weathering are now generating high quality kinetic data that allow for meaningful comparison between laboratory and field determinations[1]. Field studies have focused on the controls of river chemistry, here we present another approach through the Chinese loess studies.

Chlorite is one of common and the most susceptible minerals to weathering in the loess and the upper continent. In order to determine the chemical weathering rate of silicates under various climates, we analyzed chlorite from four selected loess-paleosol sequences of China by XRD, chemical analysis and diffuse reflectance spectroscopy methods. The four sections, Luochuan, Xifeng, Lingtai and Baoji, are located in the central part of the Loess Plateau, where the present mean annual temperature and precipitation are from 8°C to 13°C and 400 mm to 700 mm, respectively. The most upper parts of the sections studied were sampled, which recorded spatial changes of chemical weathering and climate for the last glacial-interglacial cycle. The chronology of these loess-paleosol sequences was developed by combination of TL dating and comparison with the SPECMAP δ^{18}O records.

The results show that the chlorite content was consistently high for the less weathered loess layers, and slightly lower in the weathered paleosol samples. Such changes are consistent with higher precipitation and temperature and increased chlorite weathering during interglaciation and lower precipitation and temperature and decreased chlorite weathering during glaciation[2]. The chemical weathering rate of chlorite determined ranges from about 1×10^{-14} mol/cm^2/sec to 5×10^{-14}mol/cm^2/sec, and displays a strong dependence of chlorite dissolution on precipitation in loess sequences. Because the Chinese loess composition is strikingly similar to the average composition of the upper continental crust and the age of the loess sequences is well defined, the long continuous loess sequence in the Chinese loess plateau offers an unique opportunity for estimating the average weathering rate of continental silicate in a wide range of climatic conditions over the past Quaternary time.

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References

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4.5.P04

Calcium isotopic fractionation during weathering and precipitation of calciumcarbonates

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The chemical composition of carbonates formed in lakes in the area of Clairvaux, French Jura (eastern France), reflect changes in climate, vegetation and soil formation around the lakes. The oxygen and carbon isotope composition and Mg/Ca ratio of the lake deposits show a large variability, synchronous to major climate events between 15,000 and 10,000 calendar years BP. This variability can be partly ascribed to the development of surrounding soils on top of calcareous morenes (~20,000-18,000 calendar years BP).

We measure the calcium isotopic composition (δ^{44}Ca) in order to determine the behaviour of calcium during the weathering of the Jurassic marine carbonate bedrock, the development of vegetation and soils, and the subsequent precipitation of $CaCO_3$ in the lakes. The relative contribution of temperature, soil exchange processes, and biological processes to the fractionation of calcium isotopes and the rate of calcium redistribution is unknown.

We combine the ^{43}Ca-^{48}Ca double spike method on TIMS to measure ^{44}Ca/^{40}Ca ratios, with the high resolution MC-ICPMS technique to measure ^{44}Ca/^{42}Ca. Preliminary results indicate a resolvable difference between lake carbonates formed during the Younger Dryas cold period and those formed during the early Holocene.