Late Cenozoic carbon cycle driven by increasing denudation of sedimentary cover

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Late Cenozoic carbon fluxes associated with rock weathering, sediment burial and volcanic degassing are calculated by an inverse model coupling of marine isotopic records of carbon, strontium and osmium [1]. The result shows nearly constant volcanic degassing (±10%) during the last 20 Ma, consisting with the stable production and subduction rates of ocean floor over this period [2]. Dramatic increase in marine carbonate sedimentation rate as a result of increasing carbonate weathering over the past 15 Ma is observed, which matches very well with the low resolution record previously integrated from ocean basins worldwide [3].

The accelerated rise (two fold) in carbonate weathering is most likely caused by the exhumation of the sedimentary cover induced by tectonic uplift and/or growth of glacial erosion since it is coincident with the most intensive period of Tibetan uplift [4] and global cooling [5]. Oxidation of organic-rich rocks associated with the unroofing released large amount of CO_2, which is balanced by concomitant increase in silicate weathering and organic carbon burial.

Importantly, we demonstrate a clear decoupling of modelled silicate weathering rates from global temperature over the last 15 Ma. This is inconsistent with the temperature (and associated runoff) mediated mineral dissolution acting as the key mechanism facilitating the $p\mathrm{CO}_2$-silicate weathering feedback process. However, we instead observed a clear coupling (positive correlation) between modelled silicate weathering, organic carbon burial, and atmospheric CO_2 concentration [6]. We suggest that CO_2 fertilization effects on terrestrial biomass productivity and plant weathering could have represented a major negative feedback process helping to balance atmospheric CO_2 during the Cenozoic ice house periods.

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The chemical weathering of carbonates in Eolian substances

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Introduction

Grain-size measurements and acid leaching with 0.5 mol/L acetic acid were conducted for Quaternary loess (L1), paleosol (S5) and Tertiary red clay (RC) samples from DuanJiaPo section, China. The acid-soluble material represents the carbonate component of the aerosol [1].

Discussion of Result

The $^{87}Sr/^{86}Sr$ ratios of the acid extracted carbonate were measured. In both loess and paleosol samples, the $^{87}Sr/^{86}Sr$ ratios are low in coarse grain samples and are high in fine grain samples [2]. The variation of $^{87}Sr/^{86}Sr$ ratios of loess samples is larger than that of paleosol samples between different grain sizes. The paleosol was developed under warm and humid condition, with strong chemical weathering. The dissolution and recrystalization of carbonate is more extensive. This leads to comparatively small variation of $^{87}Sr/^{86}Sr$ ratios between paleosol samples with different grain size. The red clay was formed under even warmer and more humid condition with stronger chemical weathering. The secondary carbonate may dominate both coarse and fine red clay samples. Therefore, the $^{87}Sr/^{86}Sr$ ratios variation is very small in red clay samples with different grain sizes.

Conclusions

The change of Sr isotope compositions of carbonate in samples with different grain sizes indicates the degree of chemical weathering of the aerosol. The Sr isotope compositions can be used as a good indicator for chemical weathering.

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