A possible long-term CO_2 sink through submarine weathering of detrital silicates

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The weathering of silicate minerals exposed on the continents is the largest sink of atmospheric CO_2 on time scales of millions of years. The rate of this process is positively correlated with global mean temperature and atmospheric CO_2 concentration, resulting in a negative feedback that stabilizes Earths' climate [1]. Detrital silicates derived from the physical denudation of the continents are a major component of marine sediments [2]. However, their geochemical behaviour is poorly understood and they are considered to be unimportant to the long-term carbon cycle. We show that in organic matter-rich sediments of the Sea of Okhotsk detrital silicates undergo intense weathering. This process is likely favoured by microbial activity, which lowers pore water pH and releases dissolved humic substances, and by the freshness of detrital silicates which originate from the cold, poorly weathered Amur River basin. Numerical simulations of early diagenesis show that submarine weathering rates in our study area are comparable to average continental weathering rates [3]. Furthermore, silicate weathering seems to be widespread in organic matter-rich sediments of continental margins, suggesting the existence of a significant CO_2 sink there. These findings imply a greater efficiency of the silicate weathering engine also at low surface temperatures, resulting in a weakening of the negative feedback between pCO_2, climate evolution and silicate weathering.

References

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