Impact of nitrogen fertilizers on natural weathering processes: evident role on CO_2 consumption

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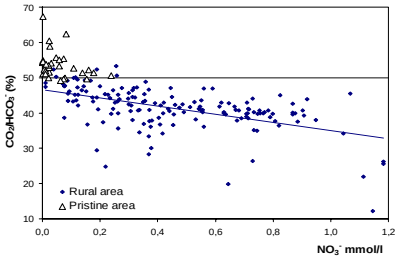
The flux of atm./soil CO_2 consumed by chemical weathering of continents can be estimated from bicarbonates river fluxes taking rock types into account (Amiotte Suchet and Probst, 1993). The amount of CO_2 consumed during natural continental weathering of carbonates is equivalent to the CO_2 released to the atmosphere after reprecipitation of marine $CaCO_3$. However, other acids than carbonic acid such as natural organic acids from plant roots (Drever, 1994), or anthropic sulfuric and nitric acid from acid rain (Amiotte-Suchet et al., 1995), can take part in chemical weathering and may modify this equilibrium. Although 11% of the continental areas are used for agricultural practices and thousands of tons of fertilisers are spread onto soils, nitric acid produced by N-fertiliser nitrification has not yet been taken into account in weathering reactions.

The water composition of carbonated watersheds of the intensively cultivated Gascogne region (south-western France) has been compared to that of literature data and local data from low anthropic pressure areas. In areas of intensive agriculture, the molar ratio $(Ca+Mg)/HCO_3$ in surface waters is significantly higher (>0.6) than in areas of low anthropic pressure (0,5). This difference could be related to the nitrification reactions of NH_4^+ (from N-fertilisers) occurring in soils and the substitution of carbonic acid by nitric acid in carbonate weathering reactions.

The contribution of atm./soil CO_2 to the total river alkalinity (CO_2/HCO_3) must represent 50% in carbonated basin according to the stoichiometry of the carbonate-dissolution reaction. But in rural areas, this contribution is less than 50% and it is decreasing when the nitrate concentration in surface waters increases (see fig.).



Relationship between the contribution of atmospheric/soil CO_2 to the riverine alkalinity and the nitrate content in river waters.

Amiotte Suchet P. & Probst J.L., 1993, *CR Acad. Sci. Paris*, 317, 615-622.
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