How can geochemistry save the world?

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The world faces numerous challenges going forward. The resources of many essential elements will be depleted over the next 10 to 100 years. Many of the remaining deposits are located in environmentally sensitive locations. The carbon concentration of the atmosphere has been increasing dramatically over the past few decades; this increase has been linked to global warming [1]. The combination of limited petroleum resources and higher energy demand lead to an oil price spike in 2008. The twin concerns of global warming and increasing oil prices lead to an explosion of bio-fuel production using land that could otherwise have been used for food production. Land pressure and a large increase in the cost of phosphate resulted in a dramatic rise in food prices and increased starvation worldwide [2]. As an alternative to expensive and environmentally damaging petroleum, nuclear energy has again become a popular option, reopening the question of nuclear waste storage.

These global challenges form the greatest opportunity for geochemistry since its development as a distinct discipline. Our field holds the key to finding and exploiting our remaining resources in an environmentally secure manner, and managing pollution, water, carbon, etc. The key to playing our vital role in addressing these challenges lies in properly communicating to the public their severity and how we can help address them. An excellent example of the role of public awareness is global warming. Public concern forced our governments to provide grant funding, oblige industry to collaborate with academic researchers, and motivate many in our community to orient their research programs towards generating new innovative solutions for carbon capture and storage on a global-scale.

It is critical that our community, in part through our scientific societies, better reach out to the public and government decision makers to inform them of 1) the consequences of the limited global resources and 2) how use geochemistry to make improved decisions on how to manage our planet.

[1] Oelkers & Cole (2008) *Elements*, **4**, 305-310. [2] Oelkers & Valsami-Jones (2008) *Min. Mag.*, **72**, 337-340.

The weathering of basaltic rocks and their effect on global chemical cycles

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The chemical and mechanical weathering rates of 8 basaltic catchments in NE Iceland have been determined for the past 44 years from elemental riverine fluxes [1]. Weathering rates increased dramatically over this time peroid, which coinsides with the recent global climate change [2]. Detailed analysis of these data demonstrates that increased temperature is the major cause of the feedback between climate and basalt weathering rates [3]. Of the riverine fluxes to the oceans, the transport of suspended material is far more affected by climate than the transport of dissolved species.

The fate of suspended material in the oceans was evaluated by dissolving both riverine suspended material and sediments collected from Icelantic estuaries in both natural and Si-free artifical seawater. Estimates of the overall dissolution rates of the basaltic material suggest from 1 to 10% will dissolve annually, though the major element chemistry of the ocen water is little changed due to secondary mineral precipitation. In contrast, REE distributions, and Nd and Sr isotope ratios of sea water are found to be strongly influenced by basaltic sediment-seawater interaction. Corresponding experiments performed using Amazon River estuary sediments agree previous experimental results [4] confirming that Si-rich sediments have a far lower effect on ocean chemistry than basaltic sediments.

Taken together these observations demonstrate 1) the strong link between basaltic rock weathering and global chemical cycles, and 2) that past basalt weathering rate variations can be evidenced by seawater isotopic composition.

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