The impacts of coal on human health

ROBERT B. FINKELMAN

Department of Geosciences, University of Texas at Dallas, Richardson, TX 75080

Although all forms of energy use can impact human health none can match coal for the long history of use, breath and severity of the impacts or for the number of misconceptions. Particulates and noxious gases released from coal combustion have caused health problems for centuries but recent technological advances have significantly reduced the health threat from coal use. Nevertheless, combustion of coals containing high concentrations of trace elements such as As, F, Se, and Hg still, under certain circumstances, adversely impact health. Balkan endemic nephropathy, an irreversible kidney disease, is related to leaching of toxic organic compounds by groundwater passing through lignite deposits. When the water is ingested, these compounds contribute to the health problem. Although there is limited information on uncontrolled coal fires, it is probable that their emissions cause health problems for both the miners and villagers. Recent studies have shown that the most widely recognized disease of coal miners, 'black lung disease,' may be initiated by inhalation of finely divided pyrite liberated by coal mining. Concerns over the health impact of radioactivity from coal and coal combustion byproducts are unjustified. The levels of radioactive material in virtually all coals and most coal combustion byproducts are in the same range as most surficial rocks and soils. Direct health problems caused by coal and coal use are generally local but potentially severe. Once identified, practical solutions are available. For people living in areas where high quality coal is burned in modern boilers using the best available pollution control technology and sensible coal combustion byproduct disposal practices, the health threat is minimal. Human health problems caused by coal combustion-induced climate change may be a topic for future research.

Are rock dissolution rates predictable from lab experiments?

CORNELIUS FISCHER[1,2], ROLF S. ARVIDSON[1] AND ANDREAS LUTTGE[1]

[1]Rice University, Houston TX, 77005, USA
[2]Georg-August-Universität, D-37077 Göttingen, Germany (cornelius@rice.edu, rolf.s.arvidson@rice.edu, aluttge@rice.edu)

Inhibition processes such as formation of secondary minerals or microbial activity will modify mineral reaction rates in nature. Here we investigate occurrence, amount, and scale of surface reactivity anisotropy and consequences on mineral weathering kinetics.

Calcite dissolution rates [1] show variations of about 3 orders of magnitudes on crystal surface sections of 5 µm x 5 µm compared to only minor variation for sections of 100 μm x 100 μm. We conclude that the frequency distribution of crystal lattice imperfections may result in an anisotropy of surface reactivity and topography up to the micron scale. This has important implications for the evolution of porosity and permeability in rocks and, moreover, the predictability of dissolution kinetics of minerals in the environment.

A comparison of the discussed calcite dissolution rate range to the dissolution rate of fine-grained, very low-permeable, calcitic microcrystalline limestone shows significant differences even after normalization of the sub-micron surface area via roughness parameters [2]. This underlines the importance of an anisotropic surface reactivity for the propagation of fluid-accessibility to high-reactivity domains in mineral aggregates and rocks.

[1] Morse *et al.* (2007) *Chem. Rev.* **2007**, 342–381. [2] Fischer & Luttge (2007) *Amer. J. Sci.* **307**, 955–973.