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Selenium Geochemistry and Health

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Selenium is a naturally occurring metalloid element, which is essential to human and other animal health in trace amounts but is harmful in excess. Of all the elements, selenium has one of the narrowest ranges between dietary deficiency (< 40 μg day^{-1}) and toxic levels (> 400 μg day^{-1}) making it necessary to carefully control intakes by humans and other animals hence the importance of understanding the relationships between environmental exposure and health. In animals and humans, selenium forms a vital constituent of the biologically important enzyme glutathione peroxidase (GSH-Px) and to date approximately 20 essential selenoprotiens have been identified. Selenium deficiency has been implicated in white muscle disease in animals and in a host of conditions in humans including cancer, heart disease, osteoarthropathy, immune system function, reproduction and thyroid function. In contrast, selenium toxicity or selenosis can cause 'alkali disease' in animals and vomiting, diarrhoea, hair and nail loss and nervous disorders in humans. Examples will be presented showing that geology exerts a fundamental control on the concentrations of selenium in the soils on which we grow the crops and animals that form the human food chain and the selenium status of populations, animals and crops vary markedly around the world as a result of different geological conditions. Understanding the biogeochemical controls on the distribution and mobility of environmental selenium is key to the assessment of selenium-related health risks. Although overt clinical symptoms of selenium toxicity and deficiency are rarely reported, the possible sub-clinical effects and implications of selenium status are at present poorly understood and should not be under estimated as medical science continues to uncover new essential functions for this biologically important element.