Geochemistry and Human Selenium Imbalances in China

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Se is a naturally occurring non-metallic trace element which is essential to human and other animal health in small doses (0.04 µg/g) but is harmful in excess (> 4 µg/g). China possesses one of the best epidemiological databases in the world on Se related diseases which has been used in conjunction with geochemical data to demonstrate a significant geological control on human Se exposure. Se deficiency in soils and crops has been linked to an endemic cardiomyopathy (Keshan Disease (KD)), osteoarthropathic disorders (Kashin-Beck Disease) and oesophageal cancer whereas selenium toxicity causes hair loss and nail deformation. However, the precise geographic areas at risk, the geochemical factors controlling environmental Se levels and human Se status are poorly defined and appropriate remediation strategies have yet to be established.

A multi-diciplinary project involving the IRMA, the Chinese Ministry of Public Health and the BGS aims to devise a strategy for the prediction and remediation of Se responsive diseases. Soil, grain, drinking water and human hair samples have been collected from three regions of China to investigate the relationships between environmental levels of Se and KD, oesophageal cancer and human selenosis. Within each region samples were collected from areas with high, moderate and low disease incidence. In the region of high KD incidence, levels of total Se in soil are higher than anticipated. Levels of Se in grain, water and hair decrease with increasing incidence of KD as expected. It is provisionally concluded that the Se in soils is complexed by organic matter and is this unavailable to plants and the subsequent food chain.