



British  
Geological  
Survey

## The link between geo- chemistry and health

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Many minerals that are essential to human health in small doses can be toxic if ingested in excess. These minerals enter the human population via the plants, animals and water that make up our food supply and through the ingestion and inhalation of dusts derived from our living environment. Animals and plants depend ultimately on soil, water and rock for the provision of minerals hence the link between geochemistry and health. This link is particularly important in developing countries where people are often totally dependent on subsistence agriculture for their dietary needs. The inability of the local environment to provide the correct mineral balance can lead to serious health problems and disease.

Through the UK Department for International Development (formerly the Overseas Development Administration) and the European Community, the British Geological Survey is investigating geochemistry and disease problems in several countries around the world. A holistic approach, investigating the relationship between levels of minerals in the rock, soil, water, foodstuffs and human population is essential to formulate



Woman suffering from iodine deficiency related goitre, Sri Lanka.

effective remediation strategies. In central Africa, for example, airborne dusts and direct exposure to soil through its deliberate or inadvertent ingestion have been demonstrated to significantly influence exposure to potentially toxic trace elements during studies of endemic infantile heart disease and its relationship to cerium. In this case, the drying of cassava and millet on soil was shown to increase the concentrations of cerium in the derived processed foods by at least one to two orders of magnitude. Similarly the practise of geophagia (the deliberate eating of soil) within exposed populations must be studied and quantified if an accurate assessment of exposure pathways and risk is to be made.

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The occurrence of elevated concentrations of naturally occurring uranium and radium in the semi-arid environments of North Africa and the Mediterranean Basin countries is being investigated. Analysis of data indicates that significant levels of excess risk can be attributed to the presence of these radionuclides in a number of water sources and

indoor environments, and that levels of these trace elements should be determined on a routine basis during the development of water resources and the urban environment.

Selenium deficiency and toxicity diseases are under investigation in China and Sri Lanka. In China, selenium deficiency has been linked to an endemic heart disease (Keshan Disease), a bone and joint disorder (Kashin-Beck disease) and oesophageal cancer. Selenium toxicity is less widespread and causes hair and nail loss. Studies show that the mobility and chemical form of selenium in soil is crucial to predicting the risk of selenium disease. In Sri Lanka, the relationship between selenium deficiency and iodine deficiency disorders (IDD) is being investigated. Iodine deficiency affects the function of the thyroid gland (a condition known as goitre) and can lead to mental deficiency (cretinism) and growth retardation in the foetus and children. The World Health Organisation estimates that at least one billion people are at risk from IDD in the world today. An understanding of the geochemical controls on these diseases provides essential information which can be used to help reduce their prevalence in the future.

## Disease