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Controls on the distribution of selenium in the soils of East Anglia, UK

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The naturally occurring element selenium (Se) is essential to human and animal health, in trace amounts, but can be harmful in excess. The intake range between dietary deficiency and excess is very narrow (UK Lower Reference Nutrient Intake (RNI): 40 µg day^{-1}; safe upper-intake level: 450 µg day^{-1}). Dietary-Se is important because the element plays a key role in a number of metabolic processes, including; antioxidant systems, thyroid hormone metabolism, immune function and reproduction. In most cases, food forms the main source of Se because concentrations in water and air are generally low. The Se-content of foodstuffs depends primarily upon the Se concentration of the soil on which the raw-foods were grown or reared. Hence, there is an importance in understanding the relationships between environmental exposure and health. Evidence suggests that Se intake in the UK has fallen from 60 µg day^{-1} in the 1970s, to 30-40 µg day^{-1} in recent years; levels below the RNI values. Bread is an important source of Se in the UK diet; therefore, one of the main reasons for the decline is thought to be a switch from North American bread-making wheat to wheat from the UK and European Union grown on low-Se soils. North American wheat tends to contain more Se as it is grown over black shale and volcanic tuff rock types on the prairies, which are rich in the element. Despite the importance of Se to human health, information on its distribution in the environment is limited as historically Se has been a difficult element to analyse. However, recent improvements in analytical methods now permit the routine determination of Se in large systematic geochemical surveys. The British Geological Survey's Geochemical Baseline Survey of the Environment (G-BASE) recently released a dataset of 5,700 total-Se concentrations in soils from the agriculturally important area of East Anglia. Concentrations ranged from < 0.2 – 9.4 mg kg^{-1}. However, soil-Se concentrations in the major wheat growing areas were low (median 0.3 mg kg^{-1}). The Se in these soils is also predicted to be of low bioavailability to cereal crops based on soil Ca concentrations; pH and organic matter content. Areas dominated by non-cereal growing had higher Se concentrations, particularly over the very organic-rich Fenland soils of the region.