

NEWS

Scientists discover more about the process of rock matrix diffusion

Tuesday, 2 July 2020

New research investigating crystalline rocks is helping us to understand the extent to which groundwater may access the rock matrix as it travels through fractures in the rock.

Contaminants can be carried by groundwater flowing in fractures through the rock, but processes such as diffusion into the adjacent rock may either temporarily delay the movement of contaminants, or prevent them from moving any further by effectively 'holding on to them'.

This process of rock matrix diffusion was the focus of a study led by Manchester University, together with a consortium of researchers, including the British Geological Survey (BGS).

Prior to the study, it was often assumed that voids within the rock far from open conductive fractures, could act as a 'sink' for any contaminants transported in water.

The new research, published in [Scientific Reports](#), shows that in fact, the spatial extent of this process is probably specific to each rock, and even a specific sample.

Differences in the distances of matrix diffusion are caused by spatial variations in the sizes of a rock's pores and the extent to which they are connected.

The volume and connectivity of the pores depend on the alteration history of the rock in the fracture walls. In some cases, the distance over which matrix diffusion operates may be minimal.

The conclusions are based on a thorough analytical programme, including a suite of advanced, cutting edge techniques.

The authors say that the presence of these 'sinks' cannot always be assumed, because voids within the rock were found to be occupied by tiny calcite crystals.

Dr Lorraine Field, a BGS petrologist, was involved in the research programme. She explains:

“The crystals were found to clog many of the microfracture pathways within the matrix of the rock, meaning there are effectively less open routes available to the groundwater.

“This may reduce the accessibility of the rock matrix, in some cases, to contaminants diffusing from groundwater flowing in the adjacent conductive fractures, and the distance over which they can penetrate into, interact with, and be retarded (held onto) by the rock matrix.

“This is important because it has potential to influence thinking around the issue of the extent of rock matrix diffusion in the implementation of safety cases around deep geological disposal, and can be considered in other environmental applications.”

The work was completed by a consortium of researchers from UK academia including the University of Manchester and the University of Leeds, the BGS, and two environmental consultancies, Quintessa and NSG.

The research was funded as part of collaborative work with Radioactive Waste Management (RWM).

A wide range of techniques were used in the study, starting with a thorough petrographic characterisation including an evaluation of porosity distribution, using optical microscopy and scanning electron microscopy at the BGS laboratories.

The work at BGS helped to lay the foundation for the research, for example, in identifying the location of natural radioactivity, carried out using digital and etch-track autoradiography techniques.

This fundamental characterisation programme enabled scientists to apply advanced techniques included analysis on the beamlines at the Diamond Light Source in Harwell, Oxfordshire, in which BGS staff were involved, and micro X-ray tomography carried out at the University of Manchester.

Access to the full research paper can be found in [Scientific Reports](#).

Ends

For further information contact Hannah Pole, BGS press office

hapo@bgs.ac.uk | 07565 297 132



British
Geological
Survey

REF No

