MUHAMMAD MUQEET IQBAL, PHD

Research statement

Groundwater chemistry and transport through porous media

I study how groundwater flow, mineral-water reactions and colloids influence which substances move through the subsurface and which are retained. I combine laboratory experiments, reactive transport modeling and time-resolved X-ray microtomography to connect reactions at mineral surfaces with transport through pore networks.

1. How mineral surfaces shape groundwater chemistry

My doctoral work examined how rare earth elements interact with quartz and goethite. I used batch and column experiments, spectroscopy and surface complexation models to investigate adsorption, redox behavior and transport. I want to build on this work by testing how changes in recharge, flow and water chemistry alter the mobility of dissolved and particle-associated elements.

2. How colloids change transport and flow

My research on iron-organic matter colloids examined their influence on rare earth element transport through saturated porous media. I extended this work through flow experiments and 4D X-ray imaging. I aim to quantify when particles are retained or remobilized and how their accumulation changes permeability.

3. Connecting pore-scale processes with water systems

A longer-term goal is to connect experimentally constrained subsurface processes with aquifer and watershed observations. Collaborative studies could combine groundwater levels, water chemistry and recharge records to examine how hydrologic variability affects groundwater quality and its exchanges with surface water.

Selected publications

Iron-organic matter colloids and rare earth element transport (2026)

Facet-dependent adsorption onto goethite (2024)

Reactive transport through quartz porous media (2023)