Institute of Geological Sciences Kolloquium Seminar

Monday, 29th April 2024

at 16:15 Studer Auditorium, 2 OG

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"New achievements in environmental science by implementation of cutting-edge synchrotron technologies"

Environmental science faces several challenges. One of them is the characterization of micro- and nanoscale processes in complex samples. The implementation of cutting-edge high-resolution techniques, such as synchrotron radiation, has led to a significant advance in identification and characterization of 1) surface properties, 2) mineral structure, 3) mineral reactions, 4) contaminant mobility and 5) water-rock interactions. The versatility of synchrotron techniques allows their application to different types of samples (liquids, powder, solved, rocks) at a broad range of physico-chemical conditions (temperature, pressure, pH, redox). In this presentation, I will show examples where I implemented synchrotron techniques such as High Energy X-ray Diffraction (HEXD) and X-ray Absorption Spectroscopy (XAS) to study the behavior of contaminants and critical raw materials in acid mine draining settings as well as during natural weathering at the atomistic scale. In particular, I will show that toxic elements such as As and Se are efficiently retained through double covalent bonding with Fe- and Al-nanominerals forming at acidic pH. Rare earth elements as an example of critical raw materials display less affinity with these nanominerals, and mainly adsorb through single covalent bonding at circumneutral pH. This information is crucial for assessing the mobility of toxic elements as well as the enrichment of critical raw materials in such settings.