Colloidal retention on crystal surfaces – an experimental analogue study

MICHAEL GOCKELN[1], CORNELIUS FISCHER[12], PHILIPE KIEFER[1] AND ANDREAS LUTTGE[12]

[1]Universität Bremen, Abt. Mineralogie, Marum, Klagenfurter Str., D-28359 Bremen

[2]Rice University, Earth Science Dept, 6100 Main Street, Houston, TX 77005, USA

Quantitative predictability of nanoparticle and colloidal retention on crystal surfaces is a challenge in both technical and natural environments. Interaction forces between particles and collector surfaces and the resulting retention efficiencies can be calculated for simple collector geometries, only. Calculations are not feasible for more complex and irregular rough collector surfaces, such as crystal surfaces with pits and edges at the submicron scale. Thus, predictions about particle retention efficiency do often fail for many applications.

In order to tackle this problem quantitatively, we apply flow-through experiments and utilize collector surfaces with well-defined variability in surface roughness [1] [2]. The collector surfaces were machined using lithography techniques and consist of a regular pattern of holes with depth variation at the submicron scale. We conducted adsorption experiments under electrostatically unfavourable conditions using negatively-charged COOH-functionalized particles in order to mimic a variety of important technical and natural settings. Results show that only a narrow range of collector surface roughness is responsible for enhanced particle retention. The existence of such a critical roughness range has important consequences for multiple applications, such as reservoir engineering and reconstruction of diagenetic processes.

[1] Fischer et al. (2012), *AJS*, **312**, 885-906 [2] Fischer et al. (2014), *Appl Geoch* **43**, 132-157