Nanogeosciences: exploring natural processes at the nanoscale

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For some decades researchers are unravelling the role of nanometer sized materials in environmental processes. With roots in the traditional colloid chemistry, environmental and geochemistry, mineralogy and (micro-)biology and just recently boosted by developments in nanotechnology the Nanogeosciences are becoming a fascinating interdisciplinary field of research.
Natural colloids and nanoparticles (~ 1 nm – 1 µm in diameter) as well as nano-structured materials are ubiquitous in the Earth´s so-called „critical zone“ and present on earth for at least millions of years. They are involved in many environmentally relevant processes as soil genesis, element cycling, transport of trace components and transformation of organic matter (WIGGINTON et al. 2007).
In recent years technology is utilizing the fact that some materials change their properties as soon as their structural features (as i.e. the particle size) approaches the lower nanometer region (< 100 nm). The research and development undertaken in the field of nanotechnology has at least two implications for the Nanogeosciences: first these size-specific reactions may also occur on natural nanoparticles (MADDEN & HOCHELLA 2005) and engineered nanoparticles may have an impact on natural processes and organisms (V.D. KAMMER et al. 2008).
One of the challenges in determining the specific roles and impact of natural and engineered nanoparticles in the environment is the analysis, characterization and quantification. Here sophisticated methods have been developed to analyse particle properties as a function of size (HASSELLOV & V.D. KAMMER 2006).
The presentation will give an overview about the current state of the art in Nanogeosciences.

WIGGINTON, N.S, HAUS, K.L. & HOCHELLA, M.F. JR. (2008) : Aquatic environmental nanoparticles. - J. Environ. Monit., **9**: 1306-1316.
MADDEN, A.S. & HOCHELLA, M.F.JR. (2005): A test of geochemical reactivity as a function of mineral size: Manganese oxidation promoted by hematite nanoparticles. - Geochim. Cosmochim. Acta, **69**/2: 389-398.
HASSELLOV, M., V.D. KAMMER, F. & BECKETT, R. (2006): Characterization of Aquatic Colloids and Macromolecules by Field-Flow Fractionation. - In: WILKINSON, K.J. & LEAD, J.R. (Eds.) Environmental Colloids and Particles: Behaviour, Separation and Characterisation, IUPAC Series on Analytical and Physical Chemistry of Environmental Systems, Vol. **10**, Wiley & Sons: 224-276.
V.D. KAMMER, F., OTTOFUELLING, O., WEILHARTNER, A. & BATTIN, T., HOFMANN, T. (2008): Behavior, Fate and Effects of different TiO_2 Nanoparticles in the Aquatic Environment. - ACS Spring Meeting, New Orleans.

Contribution of GNSS data to weather forecast in Austria

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High resolution meteorological analysis of the humidity field is an important precondition for a better monitoring of local and regional extreme precipitation events and for forecasts with improved spatial resolution. Errors in the analysis occur mainly in alpine areas where the predicted models do not reproduce the mountain atmosphere correctly.
In Europe and abroad several regional project were initiated to derive the zenith wet delay (ZWD) from ground based GNSS observation data. ZWD-estimations are subsequently used as additional data source for Numerical Weather Models in order to obtain high temporal and spatial resolution of the humidity field with an improved accuracy.
The project GNSSMET makes use of continuous measurements of a regional network consisting of 8 GPS/GLONASS reference stations, located in Carinthia, Austria. This network has been extended with surrounding IGS and EUREF stations. The aim of the project is to provide GNSS based measurements of the tropospheric water vapour content with a temporal delay of less than one hour to use them within the INCA (Integrated Nowcasting through Comprehensive Analysis) system, operated by the Austrian Meteorological Service (ZAMG).

Oligocene-Neogene kinematic evolution of South-Western Central Iran

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The south-western Central Iranian block is located in the back of the Zagros fold-thrust belt and monitors accommodation of the Arabia-Eurasia collision zone. The Saghand area exposes basin-and-range morphology, which result from shortening and a major tectonic change in structural trends of the south-western Central Iran block. A NNE-trend in the north is parallel to prominent Cenozoic NNE-trending Chapedony and Post-e-Badam strike-slip faults. In the south the NNW-trending Anar and Kuh-Banan faults are parallel to general strike of the Zagros belt. Consequently, we assume a clockwise rotation of the northern block.
Results of interpretation of satellite images, and structural and geomorphic field observations show a distributed deformation pattern covering a wide domain. Morphotectonic features like linear mountain rides and intervening are interpreted to result from Neogene to Recent uplift and intervening basins (kavirs) from subsidence. Thrust faults and evidence for block tilting are common on the eastern side of mountain blocks. Three different deformation phases have been recognized in the Central Iran from the major structures and through using paleostress inversion techniques for fault slip data. The first phase occurred in the Late Paleocene to Oligocene and is characterized by a subvertical σ_1 and N-S σ_3, which indicate N-S extension associated with late stages of normal faulting possibly due to post-orogenic collapse. The second phase occurred from the Late Oligocene to the Pliocene with an NNE-SSW to NE-SW trending subhorizontal σ_1 and WNW-ESE to NW-SE trending σ_3 patterns, which indicate transcurrent deformation associated with a combination of thrusting and strike slip faulting. The third deformation phase represents mainly thrusting and is characterized by an ENE-WSW trending σ_1 axis affecting the region up to Holocene. The third deformation phase is consistent with geodetic, GPS-based kinematic data, which indicate ca. NE-SW shortening, and spectacular evidence of thrust faulting and block tilting.