Short biography of Professor Thilo Hofmann

Professor Thilo Hofmann received his Ph.D. in aquatic geochemistry from Bremen University in 1998. From 1999 he was first a post-doctoral scholar, and then Assistant Professor at Mainz University. Since 2005 Prof. Hofmann has been Full Professor and Chair for Environmental Geosciences at the University of Vienna. His group works in nanogeosciences, environmental impact of nanotechnology, investigates trace contaminants and sorption to carbonaceous materials and microplastic, and in hydrogeology, including vulnerability analysis. Prof. Hofmann served as Vice Dean of the Faculty for Earth Sciences, Geography and Astronomy from 2006 to 2012 and then as Dean of the Faculty until 2016. He is director of the University of Vienna's Environmental Research Network, which he established in 2014; the network includes more than 130 scientists from the natural sciences, the social sciences, the humanities, law, and economics, aiming to tackle today's environmental challenges. In March 2019 he was one of the founding members of the new Center for Microbiology and Environmental System Sciences at the University of Vienna.

Prof. Hofmann has published more than 150 peer-reviewed papers. He has received awards from the German Academic Scholarship Foundation, Berlin Technical University (the Erwin-Stephan Prize), and the German Water Chemical Society. In 2017 he was appointed Adjunct Full Professor in the Department of Civil and Environmental Engineering at Duke University (US). In 2018 he was honored as Guest Professor at the College of Environmental Science and Engineering at Nankai University, Tianjin (China).

Last update February 2019

Biography of Professor Thilo Hofmann

Professor Thilo Hofmann received his B.Sc. degree in 1992 from the Free University of Berlin and his M.Sc. degree in 1995 from the Technical University of Berlin, both in Earth Sciences. For his Master's thesis he specialized in hydrogeology, working for two years in Columbia and Brazil on projects relating to groundwater abstraction and salinization. He received his Ph.D. in aquatic geochemistry from Bremen University in 1998, working on the transport of colloid-bound contaminants during artificial groundwater recharge.

From 1999 he was first a post-doctoral scholar and then Assistant Professor at Mainz University. He completed his habilitation in 2002 working on colloidal transport, the transport of nanoparticles within the unsaturated zone, and sorption of contaminants to carbonaceous materials. At the same time he worked as a consultant on groundwater remediation projects.

Since 2005 Prof. Hofmann has been Full Professor and Chair for Environmental Geosciences at the University of Vienna. His group works in nanogeoscience, is investigating trace contaminants and their sorption to carbonaceous materials, investigates the role of microplastic, and is working in hydrogeology, including vulnerability analysis. Projects are funded by the European Commission's FP7 and Horizon 2020 programs, by the OECD, by industry, and by national scientific foundations and agencies, among others.

Hofmann was Vice Dean of the Faculty for Earth Sciences, Geography and Astronomy from 2006 to 2012 and then Dean of the Faculty until 2016. He is director of the University of Vienna's Environmental Research Network, which he established in 2014; the network includes more than 130 scientists from the natural sciences, the social sciences, the humanities, law, and economics, aiming to tackle today’s environmental challenges and to advance environmental research in all directions. In March 2019 he was one of the founding members of the new Center for Microbiology and Environmental System Sciences at the University of Vienna.

Hofmann has published more than 150 peer-reviewed papers with over 5.000 citations, and has made more than 250 contributions to conferences including many invited and keynote lectures. He has received awards from the German Academic Scholarship Foundation (which sponsors outstanding students) and from the Berlin Technical University (the Erwin-Stephan Prize for an outstanding M.Sc. thesis and M.Sc. degree). His Ph.D. received a "summa cum laude" and was awarded by the German Water Chemical Society for its distinguished contribution to water science, as well as by industry. Hofmann was further endowed with the society medal from the German Water Chemical Society for his contribution to water chemistry research. He has advised more than 50 Bachelor's and Master's students, 18 Ph.D. students and 17 postdoctoral researchers, some of whom now hold leading positions in academia and industry. His present group consists of 8 postdoctoral researchers and 9 Ph.D. students. Since 2017 he has been Adjunct Full Professor in the Department of Civil and Environmental Engineering at Duke University (NC). In 2018 he was honored as Guest Professor at the College of Environmental Science and Engineering at Nankai University, Tianjin (China).

Last update February 2019

Research at the Hofmann Lab (http://umweltgeologie.univie.ac.at/hofmann-group/)

The Hofmann Lab takes an interdisciplinary approach to the investigation of aquatic processes that control the environment at the Department for Environmental Geosciences, University of Vienna. Chemical, physical, and geoscientific concepts and methods are applied to experimental work and field observations in order to arrive at molecular scale mechanistic understandings of these processes, together with quantitative modelling.

Do nanoparticles have a major impact on contaminant relocation and toxicity? What is the behaviour and fate of organic pollutants in water and soil? How can we effectively protect and utilize our water resources in a sustainable manner? These are some of the questions that Prof. Hofmann´s group are trying to answer through research in the fields of nanogeoscience, environmental pollutants, and hydrogeology. Field experiments and controlled laboratory investigations, combined with modern high performance analytics and numeric modelling, form part of our approach meeting these challenges. Our overall goal is to understand the processes that control natural environments and to use these fundamental insights to develop solutions to some of the pressing environmental problems for today and tomorrow.

Nanogeoscience

Nanoscale particles (colloids) are abundant in all environmental compartments. These nanophases may consist of natural organic matter (e.g. humic substances), biota (e.g. viruses and bacteria, including pathogens), inorganic particles (clays, oxides or carbonates), or man-made particles originating either from engineering (nanotechnology) or from wear, combustion, or corrosion. They span a broad size range from some fractions of a nanometer to several micrometers, and a natural colloidal system therefore typically consists of a wide variety of macromolecules and particles. This heterogeneity places high demands on analytical equipment and analysis strategies. In contrast, engineered nanoparticles are typically well defined, but they occur in extremely low concentrations which makes them difficult to distinguish from natural particles. Nanoparticles are involved in natural processes such as soil development and nutrient cycling, but can also act as vehicles for contaminant transport or alter the bioavailability of substances, and hence their toxicity. The anticipated future nanotechnology market of several hundred billion US dollars will result in a widespread release of specially designed nanoparticles into natural environments. At present we do not know adequate about the behavior of those materials, but it is clear that they have characteristics that are quite different from those of bulk materials, and that some may penetrate skin, cell membranes, and the blood-brain barrier. Future nanogeoscience research at the University of Vienna does focus on three main topics covering the characterization, environmental processes, and behavior of engineered nanoparticles.

Environmental Contaminants

Understanding the fate of organic contaminants following their release into the natural environments is fundamental to obtaining an accurate assessment of their environmental behavior and predicting the associated risks. Such an understanding is essential if we are to ensure the safe use of both existing and yet-to-be-developed products, and is also required in order to be able to design efficient and economically viable remediation strategies for contaminated soil and water. Both natural and engineered colloidal systems are considered, including carbonaceous nanoparticles (e.g., fullerenes, carbon nanotubes), metallic nanoparticles (e.g., nanoscale zero-valent iron), and natural colloids (humic acids, clays, and oxides). We have also started to work intensively with microplastics, with special attention to the release of additives and plasticizers, to tire wear, and to adsorption phenomena.

Sorption and degradation are key processes affecting the fate of organic contaminants and interactions with colloids are known to significantly affect those processes. However, colloidal systems are technically challenging to investigate and there remains only a poor understanding of the mechanisms underlying these interactions. Our group is involved in developing and combining a range of suitable approaches for studying these complex systems (e.g. passive sampling, column experiments, etc.). Our research aims to elucidate the mechanisms involved in interactions between organic contaminants and both natural and synthetic sorbents, to develop prediction methods for situations where experimental data are not available, and to analyze consequences in terms of environmental fate and remediation strategies.

Hydrogeology

All forms of life depend on water. Providing safe drinking water will be one of the major challenges of this century. Apart from any quantitative problems, groundwater contamination is a major environmental concern. Such contamination can derive from inorganic, organic, or biological sources. Hydrogeology involves all processes from groundwater recharge to discharge into springs and rivers or oceans. It includes investigations into the fate and behavior of contaminants and trace elements in subsurface aquatic environments. Within the Department of Environmental Geosciences at the University of Vienna we cover projects that range from groundwater recharge modeling, hydrogeological modeling, isotope hydrogeology, artificial recharge of groundwater, to the modelling of groundwater flow using numerical codes (e.g. with Modflow or Feflow). We are also studying the behavior of organic and inorganic substances in relation to the leaching of contaminated and recycling materials, mining activities, colloidal transport of trace substances, and are using trace contaminants as tracers to understand subsurface flow.

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