Geosciences at Leibniz University Hannover

Structure of the Programme

M.Sc. Geosciences 120 CP

Compulsory: Communication of scientific results in conferences (5 CP)

Compulsory Elective (85 CP)

Modules* of the focus of study:
- Soil/Water
- Sedimentary Systems and Tectonics
- Applied Geology and Geophysics
- Mineralogy / Geochemistry

*Not all Modules are offered in english language

Projects
- Geosientific Mapping
- Independent project with Fieldwork
- Analytical Work
- Writing a Scientific Paper

Excursion

General Studies
(from B.Sc. Geoscienses and other degree programs at the Univerity)

Compulsory: Master Thesis (30 CP)

Structure of the Programme

Leibniz Universität Hannover

Major Studies

- Soil / Water (mind. 55CP)
- Sedimentary Systems and Tectonics (mind. 55CP)
- Applied Geology and Geophysics (mind. 55CP)
- Mineralogy / Geochemistry (mind. 55CP)

In order to complete a major, at least 55 CP from modules and the Master's thesis from the major must be completed.

→ The major can then be indicated on the certificate!

Structure of the Programme

Leibniz Universität Hannover

Compulsory:

- **Seminar on Scientific Work**

- participation at 12 scientific talks
- defense of the Master thesis
- 5 credits

- **Master thesis**

- admission requirements: 50 CP compulsory modules
- 6 month
- 30 CP

Compulsory elective:

- app. 30 modules that can be studied individually or as a specialization. Many modules run over 2 semesters - attendance at the beginning is important!

Module overview by focus area

Leibniz Universität Hannover

Module Boden/Wasser

Hydrogeologie/Wasser	WS+SS
Prozesse der Bodendegradation	WS
Geographische Informationssysteme B (GIS B)	WS+SS
Interface Processes in Soils (not WS 24/25)	WS
Soils as Part of Ecosystems	WS+SS
Bodenschutz und Bodennutzung	WS+SS
Environmental Mineralogy	WS
Chemically Polluted Soils	WS
Principles of Peat Sciences	WS+SS
Numerical Modelling	WS+SS
Definition und Regionalisierung von Bodeneinheiten	WS+SS
Digital Soil Mapping	WS

Module Sedimentäre Systeme und Tektonik

Tektonische Geomorphologie und Neotektonik	WS
Modellierung geologischer Prozesse	SS
Sedimentary Archives and Paleoenvironment Reconstruction	WS+SS
Geographische Informationssysteme B (GIS B)	WS+SS
Geo-Informationssysteme und Fernerkundung	WS
Quartärgeologie	SS
Geologie der Kontinenträder und Sedimentbecken: Dynamik und Geopotenziale	WS+SS
Approximation und Prädiktion raumbezogener Daten	SS
Isotope Geochemistry and Mass Spectrometry	WS
Geodynamics of mid-ocean ridge systems	SS

Module Angewandte Geologie und Geophysik

Hydrogeologie/Wasserwirtschaft	WS+SS
Modellierung geologischer Prozesse	SS
Ingenieurgeologie	WS+S
Geophysik I	W
Praktikum	S
	S
ntinenträder und Sedimentbecken: eopotenziale	S
nd Prädiktion raumbezogener Daten	SS
es	SS

Module Mineralogie/Geochemie

Interface Processes in Soils (not WS 24/25)	WS
Experimental Geochemistry	WS
Isotope Geochemistry and Mass Spectrometry	WS
Analytical methods of isotope geochemistry	SS
High resolution analytical methods	SS
Technical Mineralogy	SS
Mineral resources	SS
Environmental Mineralogy	WS
Geodynamics of mid-ocean ridge systems	SS
Grundlage der Werkstofftechnik für Geowissenschaften	SS+WS
Crystal physics and spectroscopic analysis of minerals	WS

Module overview

Leibniz Universität Hannover

01.01.2025

Module Overview Master Geosciences

Module Titel	language	Credit Points	Focus Area	Semester	Course work	Assesment Type
Hydrogeologie/ Wasserwirtschaft	german	7	S/W and AGG	WiSe+SoSe		HA o.MP o. K
Prozesse der Bodendegradation	german	6	S/W	WiSe	1	VbP (P)
Geographische Informationssysteme B (GIS B)	german	8	S/W and SST	WiSe+SoSe		K (60) oder VbP50%
Interface Processes in Soils	english	6	S/W and M/G	WiSe	1	HA o. MP o. K o. VbP
Soils as Part of Ecosystems	english	8	S/W	WiSe+SoSe	1	MP oder K 70% + HA 30%
Bodenschutz und Bodennutzung	german	6	S/W	WiSe+SoSe	1	HA oder MP oder K
Environmental mineralogy	english	8	S/W and M/G	WiSe	2	HA (50%) + VbP (50%)
Chemically Polluted Soils	english	6	S/W	WiSe	1	K ode
Principles of Peat Science	english	6	S/W	WiSe+SoSe	1	K ode
Numerical Modelling	english	6	S/W	WiSe+SoSe	2	HA oc
Definition und Regionalisierung von Bodeneinheiten	german	6	S/W	WiSe+SoSe	2	K ode
Digital Soil Mapping	english	5	S/W	WiSe+SoSe	1	VbP o
Tektonische Geomorphologie und Neotektonik	german	7	SST	WiSe+SoSe	1	K
Modellierung geologischer Prozesse	german	8	SST	SoSe	1	K
Quartärgeologie	german	9	SST and AGG	SoSe		K 50%
Sedimentary Archives and Paleoenvironment Reconstruction	english	7	SST	WiSe	1	K und
Geologie der Kontinenträänder und Sedimentbecken: Dynamik und Geopotenziale	german	7	SST and M/G	WiSe	1	K (80
Approximation und Prädiktion raumbezogener Daten	german	5	SST and M/G	SoSe	1	MP
Isotope geochemistry and mass spectrometry	english	9	SST and M/G	WiSe	1	HA oc
Geodynamics of mid-ocean ridge systems	english	6	SST and M/G	SoSe		VbP
Modellierung geologischer Prozesse	german	8	AGG	SoSe	1	K
Ingenieurgeologie	german	6	AGG	SoSe		HA oc
Geophysik I	german	5	AGG	WS		MP
Geophysik II mit Praktikum	german	7	AGG	SoSe		MP (
Mineral resources	english	8	AGG and M/G	SoSe	1	HA oc
Experimental geochemistry	english	7	M/G	WS	1	HA oc
Technical Mineralogy	english	5	M/G	SoSe		VbP (60%) + K (40%)
Crystal physics and spectroscopic analysis of minerals	english	5	M/G	WS		VbP (80%) + K (20%)
High resolution analytical methods	english	6	M/G	SoSe	1	VbP (PR)
Grundlage der Werkstofftechnik für Geowissenschaften	german	6	M/G	SoSe	1	HA oder MP oder K
Analytical methods of isotope geochemistry	english	6	M/G	SoSe	2	HA oder MP oder K
Major Field Trip	eng/ger	5	all areas	WiSe+SoSe	1	
Project: Mapping in Geoscience	eng/ger	7	all areas	WiSe+SoSe		ST
Project: Independent Analytical Work	eng/ger	7	all areas	WiSe+SoSe		ST
Project: Independent Project with Field Work	eng/ger	7	all areas	WiSe+SoSe		ST
Project: Writing a Scientific Paper (Focus Soil/Water)	eng/ger	7	all areas	WiSe+SoSe		ST
Seminar zum Wissenschaftlichen Arbeiten (compulsory)	eng/ger	5	all areas	WiSe+SoSe	1	VbP
Master Thesis (compulsory)	eng/ger	30	all areas	WiSe+SoSe		MA
General Studies: e.g. Language Courses from LLC, Modules from other degree programs of the Faculty of Natural Sciences and Civil Engineering and Geodesy.	eng/ger	max.20		WiSe+SoSe		

Focus Areas: Soil/Water (S/W), Applied Geology and Geophysics (AGG), Sedimentary Systems and Tectonics (SST), Mineralogy/Geochemistry (M/G)

LLC = Leibniz Language Center

LEGEND:

WiSe = winter semester
SoSe = summer semester

K = written exam
MP= oral exam
HA = term paper

VbP = Course-accompanying examination
ST= Independent assignment
MA = Master thesis

coordination office: Nadja Piersu (piersu@nat.uni-hannover.de)
make an appointment

Structure of the Programme

Leibniz Universität Hannover

➡ Compulsory elective :

- **projects**
  - four project modules are offered (different contents), 7 CP each
  - a maximum of three Projects can be selected
  - Duration: 210 hours within 6 months

- **General Studies** max. 20 CP
  - Graded modules from the B.Sc. Geosciences or modules from other
  - Modules from other degree programmes
  - Key competencies and language courses at Leibniz Language Center (LLC)
  - German courses a recommended, early registration at the LLC required

- **Excursion**

Introduction to the Major Soil / Water

Coordination: Prof. G. Guggenberger

Leibniz Universität Hannover

Institute of Earth System Sciences

Section Soil Science

3 Research Groups

- Soil Biophysics (Stephan Peth)
- Soil Chemistry (Georg Guggenberger)
- Digital Soil Mapping (Sabine Chabrillat)

https://www.soil.uni-hannover.de/en/

Institute of Earth System Science (IESW)

Section Soil Science

- **Research focus:** Interactions of physical and biological processes in soils; Identification of the transformation and stabilization processes of soil organic matter; Analysis and specification of effective physicochemical parameters and their effect on hydraulic properties in soils; Methodical developments for the determination of key variables of the topsoil based on remote sensing data.
- **Engaged in Study Programmes:** BSc & MSc Geosciences, BSc Biology, MSc Plant Biotechnology, Landscape Science, Environmental Engineering, Plant Science, Landscape Architecture & Environmental Planning
- Job market opportunities: Research positions (University; Research Institutes, e.g., Thünen), Laboratory Services (e.g. LUFA), State Institutions (e.g. Chamber of Agriculture; LBEG, BGR; Forestry Office), Engineering Offices, Companies (e.g. Deutsche Bahn)
- Recent publications:
  - Felde, V.J.M.N.L., Schweizer, S.A., Biesgen, D., Ulbrich, A., Uteau, D., Knief, C., Graf-Rosenfellner, M., Kögel-Knabner, I. & Peth, S. 2021. Wet sieving versus dry crushing: Soil microaggregates reveal different physical structure, bacterial diversity and organic matter composition in a clay gradient. European Journal of Soil Science, 72, 810–828.
  - Liebmann, P., Mikutta, R., Kalbitz, K., Wordell-Dietrich, P., Leinemann, T., Preusser, S., Mewes, O., Perrin, E., Bachmann, J., Don, A., Kandeler, E., Marschner, B., Schaarschmidt, F., and Guggenberger, G. (2022). Biogeochemical limitations of carbon stabilization in forest subsoils, Journal of Plant Nutrition and Soil Science, 185, 35–43.
  - Chabrillat, S., Ben-Dor, E., Cierniewski, J., Gomez, C., Schmid, T., & van Wesemael, B. (2019). Imaging spectroscopy for soil mapping and monitoring. Surveys in Geophysics, 40, 361-399.

Institute of Earth System Science (IESW)

Soil Biophysics - Peth Group

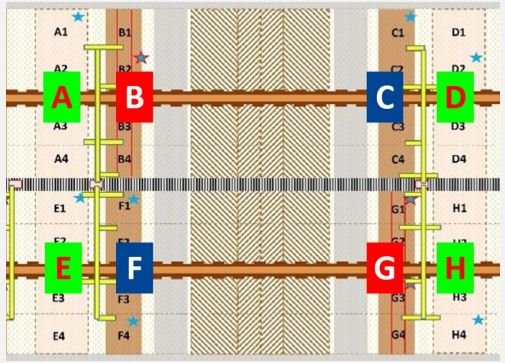
- Research focus:
  - Hydraulic and mechanical soil processes and properties
  - Root-Soil interactions
- Special expertise, methods, instrumentation etc.:
  - Imaging and analysis of soil structure using X-ray CT and digital microscopy
  - Mechanical (Rheometry, oedometer, etc.) and physicochemical lab (Goniometer)
- Master thesis examples :
  - Baubedingte Auswirkungen des Erdkabelbaus auf die Belüftungseigenschaften und das Bioporennetzwerk eines Lössboden
  - Modellierung und Vorhersage von Bodenfeuchte-Verläufen im Wurzelraum von Straßenbäumen der Stadt Hannover
  - Effects of microplastic aging on its detectability and physico-chemical properties in loess and sandy soil

Soil Biophysics – Research Project

https://www.suedlink.com/

- SuedLink: Underground transmission of wind energy TenneT

Monitoring of construction-related disturbance and regeneration of soil structure at three test sites (Start 2022, monitoring run time 4 years)



Standard test parameters

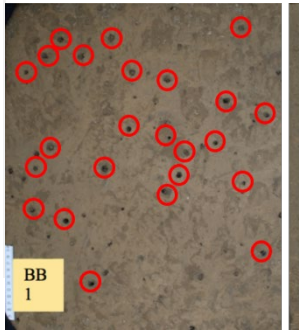
- Bulk density
- Saturated hydraulic conductivity
- Water retention
- Air conductivity
- C, N content
- Mineralized N
- pH
- Soil respiration

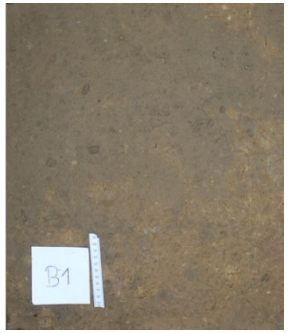
Test site design:

A, E, D, H = Reference plots

B, G = Cable trench plots ,
heated to simulate heat emission by cable

C, F = Cable trench plots, not heated





Institute of Earth System Science (IESW)

Soil Chemistry - Guggenberger Group

- Research focus:
  - Soil organic matter dynamics coupled to other element cycles (e.g. Fe, P)
  - Biodiversity and soil resilience in extreme habitats
- Special expertise, methods, instrumentation etc.:
  - Stable isotopes, biomarker analysis, mineral-organic matter-associations
  - X-ray photoelectron spectroscopy, mass spectrometry, ion & gas chromatography
- Master thesis examples :
  - Mapping the thickness of the active layer of permafrost soils on Greenland using georadar
  - Significant contribution of subsoil carbonates to CO2 emissions due to fertilization and acid transport in agroecosystems
  - Degradation of permafrost soils: Understanding the dynamics of pedogenic iron phases and associated soil organic matter
  - Weathering as a driver of soil properties in the Atacama Desert

Soil Chemistry – Research Project

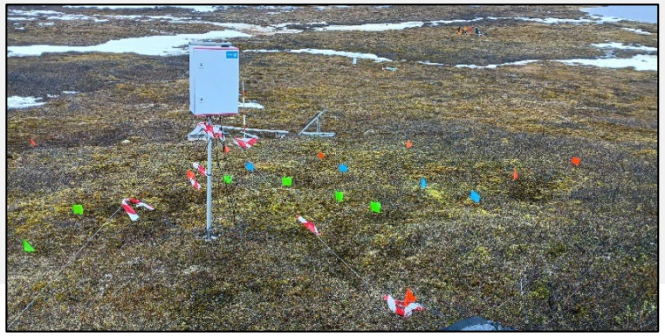
Greenland – Project MOMENT (2022-2025)

Picture: Susanne Liebner

"Permafrost research on the way to integrated observation and modeling of the methane budget of ecosystems"

Picture: Christian Knoblauch

- ✓ Focus on iron dynamic in thawing permafrost
- ✓ Iron-Organic matter associations
- ✓ Organic matter stabilization

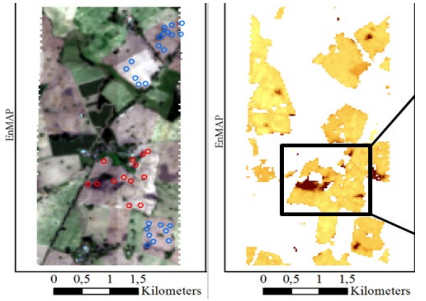


Institute of Earth System Science (IESW)

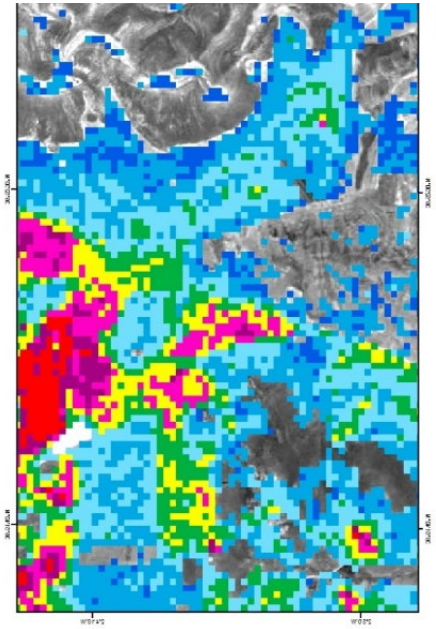
Digital Soil Mapping - Chabrillat Group

- Research focus:
  - Quantifying soil parameters at high spatial resolution (hyperspectral analysis)
  - Development of new and automated methods for analyzing hyperspectral images
- Special expertise, methods, instrumentation etc.:
  - Satellite image processing
  - Model development based on remote sensing
- Key publications:
  - Kokhanovsky, A., Brell, M., Segl, K., & Chabrillat, S. (2024). SNOWTRAN: A Fast Radiative Transfer Model for Polar Hyperspectral Remote Sensing Applications. Remote Sensing, 16(2), 334.2
  - Chabrillat, S., Ben-Dor, E., Cierniewski, J., Gomez, C., Schmid, T., & van Wesemael, B. (2019). Imaging spectroscopy for soil mapping and monitoring. Surveys in Geophysics, 40, 361-399.
  - Castaldi, F., Chabrillat, S., Don, A., & van Wesemael, B. (2019). Soil organic carbon mapping using LUCAS topsoil database and Sentinel-2 data: An approach to reduce soil moisture and crop residue effects. Remote Sensing, 11(18), 2121.

Organic carbon



Texture



Introduction to the Major: Sedimentary Systems and Tectonics AND Applied Geology and Geophysics

Coordination: Prof. U. Heimhofer and Prof. J. Winsemann

Leibniz Universität Hannover

Institute of Earth System Sciences

3 Research Groups

Section Geology

- Tectonics, Structural Geology and Tectonic Geomorphology (Andrea Hampel)
- Sedimentology, Stratigraphy and Palynology (Ulrich Heimhofer)
- Quaternary Geology, Clastic Sedimentology , Basin analysis / Basin modelling, Neotectonics (Jutta Winsemann)
- Geophysics (Seismics, Gravimetry, Magnetics, Geoelectrics and Electromagnetics) (Gerald Gabriel, Mike Müller-Petke)

https://www.geologie.uni-hannover.de/en/

Leibniz Universität Hannover

Tectonics, structural geology and tectonic geomorphology – Hampel Group

- **Research topics:** Active tectonics and tectonic geomorphology, interaction of tectonics and Earth surface processes, geodynamics of subduction and continental collision zones, response of faults to climate-induced mass changes on the Earth's surface, numerical modelling of earthquake cycles; tectonics and geology of the European Alps

- **Special expertise:** Numerical modelling of tectonic processes (finite-element software ABAQUS), low-temperature thermochronology, cosmogenic nuclides (exposure dating and erosion rates)

- **Master thesis examples**:
  - Verhalten von Störungen bei glazial-interglazialen oder anthropogen induzierten Auflaständerungen
  - GIS-Analyse von digitalen Geländemodellen über Salzstrukturen
  - Analyse des ko-und postseismischen Spannungstransfers an Störungszonen

Leibniz Universität Hannover

Sedimentology & Stratigraphy – Heimhofer Group

- **Research focus:**

  Mesozoic sedimentary rocks & continental and marine paleoclimate archives

- **Special expertise and instrumentation**

  Shallow water carbonate research; Stratigraphic palynology and vegetation reconstruction;

  Stable isotope laboratory for C/O analysis of carbonates, organic matter

- **Master thesis examples**:

  - Geothermische Reservoir-Charakterisierung von dolomitisierten Bereichen innerhalb der Korallenoolith Fm.
  - Vergleichende Untersuchung der lithofaziellen Ausbildung des Roten Salztons (z4RT) im NDB
  - Palynologie und Isotopenstratigraphie von distalen Ablagerungen des Wealden (Unterkreide) im NDB

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Quaternary Geology & Neotectonics Winsemann Group

- **Research focus:**

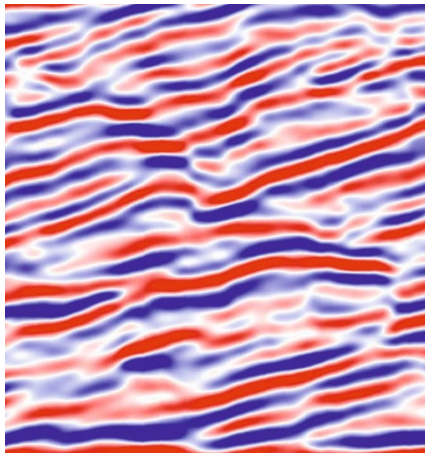
  Quaternary Geology, Clastic Sedimentology, Basin Analysis, Neotectonics

- **Special expertise, methods, instrumentation etc.**

  Geological field techniques, Interpretation of seismic and GPR data, Fault analysis, Analog modelling, 3D-subsurface modelling, Clastic Sedimentology, Quaternary Geology, Sequence Stratigraphy, Basin Analysis, Earth History

- **Master thesis examples**:
  - Untersuchung von feinkörnigen Silt-dominierten Tiefseefächern anhand von Bohrkernen
  - Paläogeographische Rekonstruktionen von pleistozänen Eisstauseen in Mitteleuropa
  - Rekonstruktion von Akkretionsprozessen an fossilen Subduktionszonen

Neotectonic disaggregation band in Pleistocene delta-foreset deposits (outcrop and GPR profile)



Section Geology

- **Teaching:** Engaged in study programmes BSc and MSc Geosciences including field-oriented courses

- **Job opportunities**:
  - Hydrogeology & engineering geology
  - Geothermal energy exploration
  - GIS applications
  - Authorities (BGE, BGR…)

Introduction to the Major Mineralogy/Geochemistry

Coordination: Prof. F. Holtz

Leibniz Universität Hannover

Institute of Earth System Sciences

Section Mineralogy

3 Research Groups

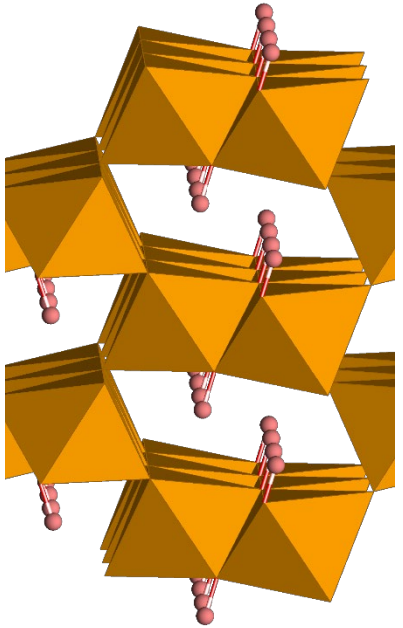
- Soil Mineralogy (Christian Mikutta)
- Geochemistry (Stefan Weyer)
- Petrology (François Holtz)

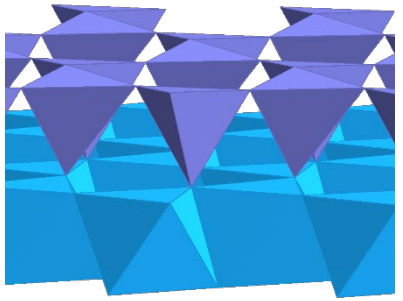
https://www.mineralogie.uni-hannover.de/en/

Leibniz Universität Hannover

Soil Mineralogy – Mikutta Group

- Mineral assemblages of soils, impact of minerals on soil biogeochemical element cycles, inorganic soil contaminants, soil organic matter, and redox dynamics of soils
- Latest key publications:
  - Evaluation of the Rietveld method for determining content and chemical composition of inorganic X-ray amorphous materials in soils. Am. Min.
  - Redox cycling of straw-amended soil simultaneously increases iron oxide crystallinity and the content of highly disordered organo-iron(III) solids. Geochim. Cosmochim. Acta
  - Interactions of manganese oxides with natural dissolved organic matter: Implications for soil organic carbon cycling. Geochim. Cosmochim. Acta
- Special expertise: Synchrotron techniques (e.g., X-ray absorption spectroscopy), surface complexation modelling, X-ray diffraction
- Master thesis examples: Contaminant mobilization from an abandoned polymetallic sulfide mine, Mt. Bobija, Serbia, Impact of dissolved organic matter on Mn(II)-induced transformation of δ-MnO_2, Mineral controls on organic carbon dynamics in tropical Vertisols

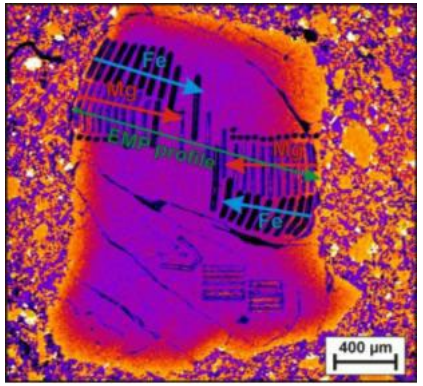




Geochemistry – Weyer Group

- Research focus: Development/application of isotope-geochemical tools in high- and low-Temp. geochemistry (e.g. magmatic processes, ore formation, redox evolution of the Earth's atmosphere and oceans); understanding the mechanisms of metal stable isotope fractionation
- Special expertise: Metal stable isotope fractionation, high precision solution (MC-ICP-MS) and in situ analyses of metal isotopes with femtosecond-LA-MC-ICP-MS

- Topics for Master thesis:
  - Stromatolites and Iron/Manganese Formations as archive for ancient seawater in deep time (of trace elements and metal isotopes)
  - In situ S isotope analyses with LA-MC-ICP-MS to trace sulfur source of deposits
  - Mobility of trace elements and Sb isotope fractionation during weathering (of e.g. ophiolites)
  - Diffusion-driven Fe-Mg or Li isotope fractionation in minerals for the determination of magmatic or metamorphic rates



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Petrology – Holtz Group

- Investigation of high temperature processes in geosciences : implication for the formation of magmatic rocks and volcanic processes, for differentiation of oceanic and continental crust
- Exploring the distribution of metals between fluids, melts and minerals: implication for the formation of magmatic/hydrothermal ore deposits
- Special expertise: Experimental laboratory for simulation of high pressure . High temperature processes (up to 500 MPa and 1300 °C)
- **Master thesis examples**: many opportunities with BGR

Pre-eruptive conditions in the magma reservoirs of the Laacher See volcano eruption (13 ka): Experimental approach

Development of an analytical protocol for the determination of Fe^{2+} / Fe^{3+} ratio in silicate glasses using electron microprobe JXA-iHP200F

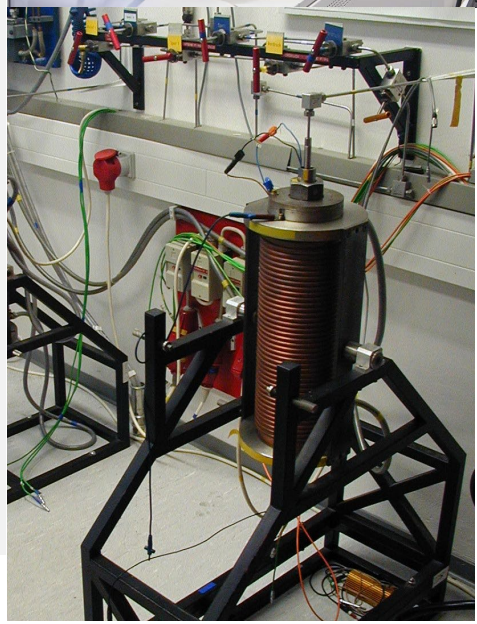
Redistribution of rare metals (Nb-Ta-Sn-W) as a result of partial melting of gneisses: Example of Abu Rusheid, Egypt" (mit BGR)

Mineralogisch - geochemische Charakterisierung von devonischen und karbonischen Gesteinen aus Bohrkernen des NW-Harzes und Ableitung von Erkenntnissen zur Genese hydrothermaler Pb-Zn-Erzgänge" (BGR)

Section Mineralogy

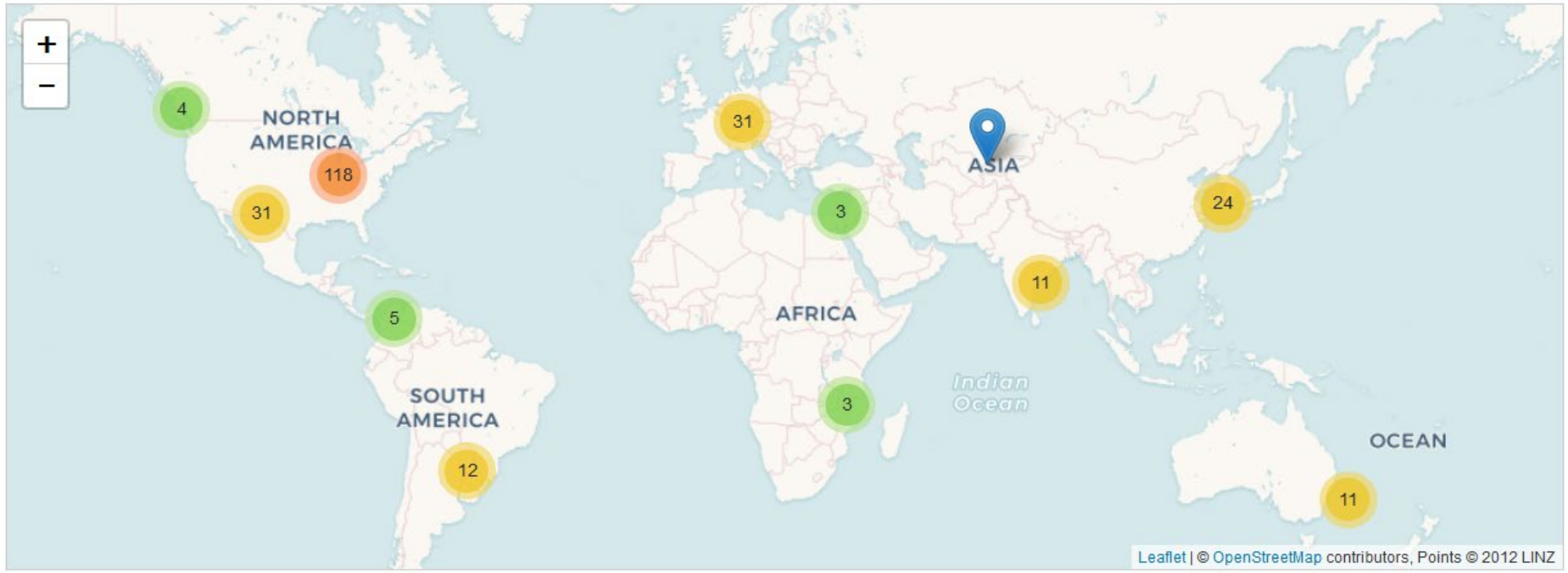
- **Teaching:** field-oriented courses, analytical methods (Festkörper-Analytik, Isotopen), experimental methods
- **Job opportunities**:

- Engineering offices / management of analytical laboratories (Altlast-Schadstoff-Sanierung, Zement…): e.g., FUGRO, Dr. Moll
- TÜV, Baustoffprüfstellen Authorities and Research Institutions : BGR, LBEG, BGE (Bundesgesellschaft für Endlagerung), Geomar, AWI, GFZ Potsdam
- Large Companies: e.g., Deutsche Bahn, RWE, Omexon (Planung Erdkabel), Bundeswehr
- Companies focussing on reserach and development of instruments: e.g , e.g. Baker Hughes, Bruker (analytik), Wille (Petrophysics)
- Many Opportunities for PhDs in fundamental and applied research



→ See also FdGH: https://www.fdgh.uni-hannover.de/de/aktivitaeten/news-und-veranstaltungen/list

Exchange Opportunities



https://hannover.adv-pub.moveon4.de/report-page-1587/

Countries	Relations	Programmes
36	269	8

Show Map

Kredite für Internationale:www.lendorse.com
DAAD Ausland Stipendien: www.auslands-stipendien.de
https://www.studieren-weltweit.de/content/uploads/2020/06/mit-stipendium-ins-ausland.pdf
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