



www.dmg-home.org

### ABRAHAM GOTTLOB WERNER MEDAL TO ANDREAS MULCH



PHOTO: P. KIEFER.

Andreas Mulch explores the interface between stable isotope geochemistry, tectonic mountain uplift, and the reconstruction of past precipitation patterns. His consistently innovative applications have made him one of Germany's leading geoscientists and geochemists.

He studied geology at the University of Gießen, earned his doctorate in mineralogy and geochemistry from the University of Lausanne, worked as a postdoc in the USA (University of Minnesota, Stanford University), and held a W2 professorship at Leibniz University Hannover from 2007 to 2010. Since 2010, Andreas Mulch has been a W3 professor for paleoclimate and the dynamics of paleoenvironmental processes at Goethe University Frankfurt and, also since 2010, Vice Director of the Senckenberg Society for Nature Research in Frankfurt. He is an elected Fellow of the Geological Society of America.

Using mass spectrometry of radiogenic argon and “light” (C, O, H) stable isotopes, Andreas Mulch has dated movements in the Earth's crust and reconstructed the uplift history of mountain ranges. We owe him groundbreaking innovations in this area. Four particularly groundbreaking developments will be described in more detail here.

**How high is a mountain while shear zones are forming within it?** Andreas Mulch determined the K-Ar age of shear zones in the North American Cordillera. He then measured the hydrogen stable isotope composition of the minerals they contain. Because their isotope composition depends on atmospheric altitude, he discovered that these shear zones formed in a mountain range 4,000 meters high. Forty-nine million years ago, the mountain range was already 4 km high. The field of “paleotopography” was introduced by these methods.

**Uplift of the Andes.** Among his outstanding findings is a precise reconstruction of the uplift of the Andes. According to a combination of paleotopographic measurements from stable isotopes in paleosols, volcanic clays, and authigenic carbonates, this uplift took place between 25 million and 5 million years ago. Since then, the Altiplano and the high Andes have been established. This process has been explained by the delamination of the lithospheric mantle.

**Reconstruction of the greening of Central Asia during the Middle Eocene warm phase** using a range of modern geochemical methods (TOC and organic  $\delta^{13}\text{C}$ , *n*-alkanes  $\delta^{13}\text{C}$  and  $\delta^2\text{H}$ , XRD mineralogy,  $\delta^{13}\text{C}$ ,  $\delta^{18}\text{O}$ , and  $\Delta_{47}$  in pedogenic carbonates) Andreas Mulch and colleagues reconstructed vegetation and moisture during the warm early Eocene (57 to 44 million years ago). They were able to show that precipitation temporarily doubled and the steppe was replaced by forested ecosystems. This was attributed to the massive release of greenhouse gases during the Paleocene–Eocene Thermal Maximum. These extreme Eocene proto-monsoons offer a glimpse into the future: the abrupt changes in Central Asian precipitation and ecosystems point to future global warming.

**Terrestrial climate evolution with new isotope methods.** In the latest development, Andreas Mulch, colleagues, and his group in Frankfurt applied the so-called “clumped isotopes”  $\Delta_{47}$  to pedogenic carbonates of the Rocky Mountains to reconstruct terrestrial climate evolution during the “Miocene Climatic Optimum.” This warming phase of 17–15 million years is well documented in ocean sediment, but not for the continents. With their new work, Mulch's team found that this warm phase was not clearly pronounced in the Rocky Mountains, and that continental climate was thus decoupled from oceanic climate.

These four examples demonstrate Andreas Mulch's use of modern, innovative methods and his profound knowledge of the formation conditions of datable minerals and the isotopic fractionation between minerals and fluids. They also demonstrate his versatility at the interface between tectonics, geochemistry, mineralogy, and climate change, as well as his outstanding ability to identify and answer important geoscientific questions.

Andreas Mulch also provides general service to the German Geosciences as Vice Director of the Senckenberg Society for Natural Research, as a member of the DFG Senate Commission for Earth System Sciences, and as a former Vice President of the Geological Association GV. He continues to do so today.

For his creative research at the interface between isotope geochemistry and tectonics, as well as his great commitment to the scientific community in Germany, the DMG awards Andreas Mulch the Abraham Gottlob Werner Medal.

**Friedhelm von Blanckenburg** (FU Berlin)

### 20<sup>th</sup> FREIBERG SHORT COURSE IN ECONOMIC GEOLOGY

#### *Mineral Systems and Metals Endowment of the Variscan Orogeny*

1–5 December 2025

Iñigo Borrajo, Spain; Mathias Burisch, US  
Eimear Deady, UK; Matthieu Harlaux, France  
Uwe Kroner; Jens Gutzmer; Marie Guilcher; Jan Cerny; Germany  
Helmholtz-Institute Freiberg for Resource Technology, Germany in co organisation with TU Bergakademie Freiberg, Germany

**Registration by 31.10.2025. First come, first serve!**

[www.hzdr.de/eg\\_shortcourse](http://www.hzdr.de/eg_shortcourse)

A large portion of economically important ore deposits in Central and Western Europe is hosted by Neoproterozoic to Palaeozoic rock series that can be assigned to the Variscan Orogeny. For centuries, the exploitation of these ore deposits has contributed significantly to economic development—without them, the Industrial Revolution in Europe would not have been possible. With the current increase in global demand, especially for so-called critical raw materials, many of the historic mining districts of the Variscan orogeny once again attract the interest of both the exploration industry and academia. Whilst results of recent research confirm many common traits shared between the different mining districts, they also reveal that every region has its unique geological and tectonic history, resulting in (subtle) variations in the nature and metal endowment of mineral systems. The 20<sup>th</sup> Freiberg Short Course in Economic Geology will pay tribute to the ore deposits of the Variscan orogeny. Invited speakers will discuss current knowledge about the Variscan mineral systems of the Iberian Peninsula, the Massif Central, and Cornwall, with a particular focus on our own back yard, the Erzgebirge/Krušné hory region.

The short course will take place on 1–4 of December 2025, with two post-workshop excursions on the 5<sup>th</sup> of December to the historic Ag-Pb-Zn Freiberg District and to the Li-Sn-W deposits of the Altenberg District.

**FEES:** Students (BSc, MSc): **110 Euro**;

PhD candidates, postdocs, senior researchers: **320 Euro**;

Industry representatives: **500 Euro**;

Additional costs for excursions, for more information, visit [www.hzdr.de/eg\\_shortcourse](http://www.hzdr.de/eg_shortcourse).

**DMG** and **SGA** sponsor this course.

**ORGANISERS:** Jens Gutzmer, Sebastian Tappe, Sam Thiele, Sandra Birtel, Manuela Wagner, [contacthif@hzdr.de](mailto:contacthif@hzdr.de)








www.hzdr.de/eg\_shortcourse

## 20<sup>th</sup> FREIBERG SHORT COURSE IN ECONOMIC GEOLOGY

Dec 1-5, 2025

### Mineral Systems and Metals Endowment of the Variscan Orogeny

I. Borrajo, SP; M. Burisch, US  
E. Deady, UK; M. Harlaux, FR  
U. Kroner, J. Gutzmer, M. Guilcher, J. Cerny, GE






Prof. Dr. Jens Gutzmer | Prof. Dr. Sebastian Tappe | Dr. Sam Thiele | Dr. Sandra Birtel | Manuela Wagner  
 Helmholtz Institute Freiberg for Resource Technology | Chemnitz, Straße 40 | 09599 Freiberg/Germany | contact@hzdr.de  
 Division of Economic Geology and Petrology, Institute of Mineralogy, TU Bergakademie Freiberg, Brennhaugasse 14, 09596 Freiberg/Germany

## DMG SHORT COURSE AT RUHR UNIVERSITY BOCHUM – REPORT

### 22<sup>nd</sup> DMG Short Course “Solid-state NMR Spectroscopy,” 10–13 June 2025

From June 10<sup>th</sup> to 13<sup>th</sup>, 2025, the DMG Short Course on the Application of Solid-State NMR Spectroscopy in Geosciences took place for the 22<sup>nd</sup> time at the Institute for Geosciences at Ruhr University Bochum. Supervised by Dr. Michael Fechtelkord, seven participants from various disciplines took part in the event—including three master’s students, three doctoral students with research focuses in geosciences and cement research, and an industrial employee with NMR experience from Tübingen, Potsdam, Munich, and Ludwigshafen.

The first day began with an introduction to the physical principles of NMR spectroscopy, its historical development, instrumental design, and typical pulse sequences for measuring spin-lattice relaxation times. The focus then shifted to the detailed theory of proton relaxation (1H), including the BPP equation for describing dynamic processes. In the afternoon, the theory was applied directly in practice using temperature-dependent T1 experiment on tetramethylammonium iodide (TMEAI). Under supervision, the participants conducted initial experiments on the NMR spectrometer, determined relevant parameters, such as pulse lengths and RF field strengths, and evaluated the obtained data using traditional semi-logarithmic paper. Activation energies and correlation times were determined from the T1 data. The evening concluded with a social gathering in the “Filou” pub at Buscheyplatz.



Participants of the 22<sup>nd</sup> DMG short course on Solid state NMR spectroscopy in front of the Bochum NMR Spectrometer. PHOTO: RUB.

The second day was devoted to the fundamentals of magnetic interactions—in particular, homonuclear and heteronuclear dipolar coupling and chemical shift. Following the theoretical introduction, the concept of magic angle spinning (MAS) as an averaging technique was presented. In the subsequent practical session, participants conducted MAS NMR experiments on synthetic minerals (<sup>1</sup>H, <sup>19</sup>F, and <sup>29</sup>Si), including aluminum-rich F/OH phlogopite. The spectra were analyzed in the afternoon using DmFit2023 software. The focus was on fitting line shapes, incorporating sidebands, and interpreting chemical shifts.

The third day of the workshop focused on the application of multi-pulse techniques. After an introduction to the Hahn echo, various correlation experiments were discussed, including cross-polarization magic angle spinning (CPMAS), the Incredible Natural Abundance Double Quantum Transfer Experiment (INADEQUATE), and heteronuclear coupling. In the practical session, participants conducted contact-time-dependent CPMAS experiments on kaolinite. Among other things, the Hartmann-Hahn condition was established and pulse lengths and RF field strengths were determined. In the evaluation section, H–Si distances were calculated using the second moment and graphically presented using Excel. This was complemented by an in-depth introduction to spectral analysis using DmFit2023, focusing in particular on anisotropies and line shape parameters.

The final day addressed the theoretical and experimental challenges involved in investigating nuclei with a nuclear spin  $I > 1/2$ . After an introduction to quadrupole interactions and their effects on spectra under MAS conditions, various NMR methods were presented, including:

- Double Rotation (DOR)
- Multi-Quantum Magic Angle Spinning (MQMAS)
- Satellite Transition Spectroscopy (SATRAS)

In the practical section, participants conducted <sup>23</sup>Na MAS experiments on selected salts and a <sup>27</sup>Al SATRAS measurement on corundum. The subsequent spectra analysis with DmFit2023 enabled a detailed analysis of quadrupole line shapes and satellite transitions.

In the concluding discussion, impressions were gathered, suggestions discussed, and the results of the intensive four days were reflected upon. Participants’ feedback was consistently positive. The balanced combination of theory and practice, the high level of expertise, and the lively and vivid presentation by Dr. Fechtelkord were particularly emphasized.

Overall, the workshop offered a balanced mix of theoretical knowledge and practical experience. The diverse applications of solid-state NMR spectroscopy were presented comprehensively and in a practical manner. Thanks to the clearly structured organization, the lively presentation style, and the memorable, comparison-based explanations, even complex processes could be understood and the enthusiasm of all participants was aroused.

**Isabelle Hartleib & Felix Reinhard** (Tübingen),  
**Nimo Radtke** (Potsdam)