TRR 170
LATE ACCRETION
ONTO TERRESTRIAL PLANETS

› Editorial

Dear Colleagues,

By now we would have hoped to write our first newsletter without discussing restrictions imposed by the Corona pandemic. Well, the pandemic is obviously still ongoing and continues to affect our lives and research. But we continue to make the best of it, and with this newsletter we want to share some of these recent developments within TRR 170.

Our TRR 170 Annual Meeting with the general assembly that took place on November 19, 2020 and more than 60 people took part virtually. In terms of content, the coordination office reported on personnel and finances, the Integrated Research Training Group, publications, some other activities (outreach, awards), infrastructure development, and the TRR database. We have also given, for the first time, the TRR 170 Outstanding Paper Award, which is given annually to a young scientist of TRR 170. The winner for 2020 is Maxime Maurice for his paper 'A long-lived magma ocean on a young Moon', which was published in Science Advances in July 2020. Hearty congratulations!! As part of the annual meeting, there also were meetings of each project area with lots of talks and scientific exchange in October and November 2020. We will continue these meetings starting in April this year.

By now all positions have been filled and three new PhD students and one new postdoc started their work within TRR 170. As always, you will find contact information and an overview of scientific and other interests of the new members in this newsletter. Special congratulations go to Tiantian, Jan, and Daniel for successfully defending their PhD. And finally, the new PhD student representatives are Jonas Schneider (WWU) and Julie Salme (FU Berlin).

We are currently planning the first TRR 170 Summer School of the second funding period. As you all know, due to the Corona crisis there has been much delay in getting this started. But we have now set the date for the first Summer School, which will take place from September 19 to 24, 2021 in Nördlingen. Due to uncertainties on how the Corona situation will develop, this will be an internal summer school, i.e., without external speakers and PhD students. Also, in case traveling would still not be allowed in September, this Summer School can be held online, so that regardless of how the Corona situation will develop, we will have our first Summer School in any event. In addition, there is also a wide range of soft skill workshops and seminars for TRR 170 PhD students planned for the next coming months.

We hope you will enjoy reading the newsletter.

All the best and stay healthy!

Sabine Hunze & Thorsten Kleine

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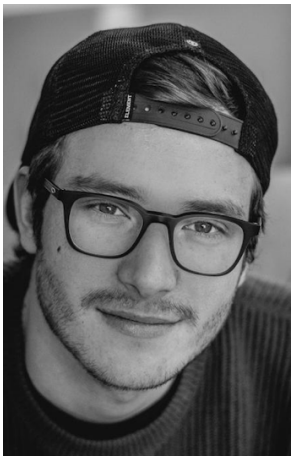
› Personnel

New PhD students



Paul Pangritz (WWU, project C1, supervisor: Arno Rohrbach)
paul.pangritz@wwu.de
The major focus of my research interest lies in the accretion history and the physicochemical evolution of terrestrial planets. My interest in geochemistry and planetology increased during my BSc thesis, where I focused on the partitioning behavior of siderophile volatile elements (SVE) and chalcophile volatile elements (CVE) between minerals and melts at high pressures. I am happy to come back to this and other interesting topics as a PhD student in the TRR. My PhD project aims at core formation and accretion modelling of terrestrial planets by the experimental study of SVE partitioning between mantle minerals and melts and the degassing behavior of those elements from Earth's precursor bodies. Besides Earth and Planetary science, I really enjoy snowboarding, cycling and music.

Max Winkler (WWU, project C3, supervisor: Andreas Stracke)
max.winkler@uni-muenster.de
I obtained my master in Geosciences at the Leibniz University of Hanover with a focus on geochemistry. My research interests range from the early evolution of the Earth over biogeochemistry to astrobiology, but also include public outreach. During the course of my PhD I will try to investigate the composition of BSE using trace element and isotope analysis. The geochemical budget of W is of special interest for the understanding of Earth's accretion history. It will also allow us to interpret the significance of the lunar μ182W value. Apart from my lab work I enjoy hiking, painting and spending time with my friends.

Claudia Szczech (TU, project A6, supervisor: Jürgen Oberst)
Claudia.Szczech@dlr.de
As a Master student I worked at the DLR in the section for Planetary Geology for almost two years. During this time, I think that I truly found my passion for planetology. I pursued my Master degree in geosciences at University of Potsdam this year also with a planetological aspect. The TRR is giving me the great opportunity to continue this path and start a career. As a PhD student, my work will concentrate on creating comparative studies of impact basins on Mercury and Moon, with a special focus on light plains. Apart from sciences, I really enjoy being in nature, skiing, painting and (true) crime literature.

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New Postdoc

Laetitia Allibert (MfN, project C2)
Laetitia.allibert@mfn.berlin
My research at the Museum will focus on several aspects related to impacts, whether it is impact cratering or giant impacts such as the Moon forming impact. Notably, several questions remain unsolved relative to the fate of material during a giant collision and resulting chemical reequilibration processes are underconstrained. Comparing simulations from the iSALE hydrocode to SPH (smoothed particles hydrodynamics) simulations to produce a benchmark may provide further understanding towards this aim.
Besides these research interests, I also love to be involved in teaching or outreaching projects for a large public. Additionally, I am interested in Handball, hiking and all related to mountain activities.

Completed doctorates

Tiantian Liu (FU, project A4)
tiantian.liu@tu-berlin.de
Supervisors: Jürgen Oberst & Greg Michael
Date of defense: November 24, 2020
Title: Lunar megaregolith mixing by impacts: the spatial diffusion of surface material and its implications for sample interpretation

Jan Hellmann (WWU, project B7)
jan.hellmann@uni-muenster.de
Supervisors: Thorsten Kleine
Date of defense: November 27, 2020
Title: „Fractionation and mixing processes in the early Solar System inferred from tellurium isotope variations in chondrites"

Daniel Wahl (FU, project A4)
daniel.wahl@tu-berlin.de
Supervisors: Jürgen Oberst, Doris Breuer & Ulrich Hansen
Date of defense: December 18, 2020
Title: Density and porosity of the upper lunar crust from combined analysis of gravity and topography data – Evaluation of the interior structure of impact basins

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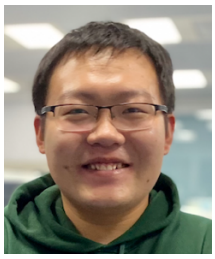
Fellows & guests

Imene Kerraouch (PhD student, host: Addi Bischoff, WWU)
Time period: February - July 2021
Home university: University of Sciences and Technology Houari Boumediene, Algeria
Imene recently discovered new unique clasts in unequilibrated ordinary chondrites, indicating that yet unsampled volatile-rich material was incorporated into meteorite parent bodies formed in the inner solar system. These clasts may provide crucial insights into mixing and transport of solids during the earliest stages of solar system evolution.



Chun Yang (PhD student, host: Christoph Burkhardt, WWU)
Time period: November 2020 – October 2022
Home university: China University of Geoscience, Beijing, China
Chun is working on Zn isotope geochemistry in evaporation processes using experimental methods, in order to determine the behavior of Zn isotopes in different Zn-rich phases during volcanic degassing.

Retirement

Addi Bischoff (WWU)
Addi Bischoff had his last official working day on January 29, 2021. We congratulate Addi for his successful, fulfilling professional life and thank him for his good cooperation and long-term commitment.
We wish Addi all the best for his retirement! And we are delighted that he will remain involved in TRR 170 even after his retirement.

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› Publications (November 2020 – February 2021)

Bischoff, A., Alexander, C. M. O'D, Barrat, J.-A., Burkhardt, C., Busemann, H., Degering, D., Di Rocco, T., Fischer, M., Fockenberg, T., Foustoukos, D. I., Gattacceca, J., Godinho, J. R. A., Harries, D., Heinlein, D., Hellmann, J. L., Hertkorn, N., Holm, A., Jull, A. J. T., Kerraouch, I., King, A. J., Kleine, T., Koll, D., Lachner, J., Ludwig, T., Merchel, S., Mertens, C. A. K., Morino, P., Neumann, W., Pack, A., Patzek, M., Pavetich, S., Reitze, M. P., Rüfenacht, M., Rugel, G., Schmidt, C., Schmitt-Kopplin, P., Schönbächler, M., Trieloff, M., Wallner, A., Wimmer, K. & Wölfer, E. (2020): The old, unique C1 chondrite Flensburg – insight into the first processes of aqueous alteration, brecciation, and the diversity of water-bearing parent bodies and lithologies. Geochim. Cosmochim. Acta 293, 142-186. https://doi.org/10.1016/j.gca.2020.10.014

Flemetakis, S., Klemme, S., Stracke, A., Genske, F., Berndt, J. & Rohrbach, A. (2020): Constraining the presence of amphibole and mica in metasomatized mantle sources through halogen partitioning experiments. LITHOS, online, 105859. https://doi.org/10.1016/j.lithos.2020.105859

Katyal, N., Ortenzi, G., Grenfell, J.L., Noack, L., Sohl, F., Godolt, M., García Muñoz, A., Schreier, F., Wunderlich, F. & Rauer, H. (2020): Effect of mantle oxidation state and escape upon the evolution of Earth's magma ocean atmosphere. Astronomy and Astrophysics 643. https://doi.org/10.1051/0004-6361/202038779

Kerraouch I., Bischoff A., Zolensky M. E., Pack A., Patzek M., Hanna R. D., Fries M. D., Harries D., Kebukawa Y., Le L., Ito M., and Rahman Z. (2020): The polymict carbonaceous breccia Aguas Zarcas: A potential analogue to samples being returned by the OSIRIS-REx and Hayabusa 2 missions. Meteoritics & Planetary Science. https://doi.org/10.1111/maps.13620

Liu, T., Michael, G., Zuschneid, W., Wünnemann, K. & Oberst, J. (2020): Lunar megaregolith mixing by impacts: Evaluation of the non-mare component of mare soils. Icarus, 114206. https://doi.org/10.1016/j.icarus.2020.114206

Maas, C., Manske, L., Wünnemann, K. & Hansen, U. (2021): On the fate of impact-delivered metal in a terrestrial magma ocean. Earth and Planetary Science Letters 554, 116680. https://doi.org/10.1016/j.epsl.2020.116680

Manske, L., Marchi, S., Plesa, A.-C. & Wünnemann, K. (2020): Impact melting upon basin formation on early Mars. Icarus 357, 114128. https://doi.org/10.1016/j.icarus.2020.114128

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Moreau, J.-G. & Schwinger, S. (2021): Heat diffusion in numerically shocked ordinary chondrites and its contribution to shock melting. Physics of the Earth and Planetary Interiors 310, 106630. https://doi.org/10.1016/j.pepi.2020.106630

Renggli C.J. & Klemme S. (2020): Experimental investigation of Apollo 16 "Rusty Rock" alteration by a lunar fumarolic gas. JGR Planets, online. https://doi.org/10.1029/2020JE006609

Riedel, C., Michael, G., Orgel, C., Baum, C., van der Bogert, C., Hiesinger, H. (2021): Studying the global spatial randomness of impact craters on Mercury, Venus, and the Moon with geodesic neighborhood relationships. Journal of Geophysical Research: Planets. https://doi.org/10.1029/2020JE006693

Ruedas, T., Breuer, D. (2021): Electrical and seismological structure of the martian mantle and the detectability of impact-generated anomalies. Icarus, 114176. https://doi.org/10.1016/j.icarus.2020.114176

Rzehak, L.J.A., Rohrbach, A., Vollmer, C., Höfer, H.E. , Berndt, J. & Klemme, S. (2020): Ferric-ferrous iron ratios of experimental majoritic garnet and clinopyroxene as a function of oxygen fugacity. American Mineralogist 105, 1866-1874. https://doi.org/10.2138/am-2020-7265

Schneider, J.M., Burkhardt, C., Marrocchi, Y., Brennecka, G.A. & Kleine, T. (2020): Early evolution of the solar accretion disk inferred from Cr-Ti-O isotopes in individual chondrules. Earth and Planetary Science Letters 551, 116585. https://doi.org/10.1016/j.epsl.2020.116585

Steenstra, E.S., Berndt, J., Klemme, S., Snape, J.F., Bullock, E.S. & van Westrenen, W. (2020): The fate of sulfur and chalcophile elements during crystallization of the lunar magma ocean. Journal of Geophysical Research: Planets 125, 11. https://doi.org/10.1029/2019JE006328

Zhu, K., Moynier, F., Schiller, M., Alexander, C. M. O'D., Barrat, J.-A., Bischoff, A. & Bizzarro, M. (2021): Mass-independent and mass-dependent Cr isotopic composition of the Rumuruti (R) chondrites: Implications for their origin and planet formation. Geochimica et Cosmochimica Acta 293, 598-609. https://doi.org/10.1016/j.gca.2020.10.007

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› TRR 170 database TRR170-DB

Open Access of published TRR 170 data – DFG requires to make research data that was generated with DFG funding openly accessible, so other researchers can use it and build on this knowledge. Aligned with this mandate, we are committed to support all TRR 170 members to fulfill these requirements. Currently 65% of the published TRR 170 data are not generally accessible (mostly because of pay walls). We are in the process of contacting authors to help storing their published (and if required also unpublished) data in the TRR 170 database and making it accessible.

If you want to learn more: advice and support on good practices for sharing data is available on the TRR 170 database website.

Online Seminar - Are you keen to learn more about research data management (RDM) and how to share your data but don't know how? We plan to offer a half-day online seminar during the ***third week of May***. This online seminar will introduce you to the concept of research data management (RDM) and using the TRR 170 database to take an active approach to RDM. We will mail you a Doodle for scheduling a date. We are planning a second online seminar with a different focus for the ***second half of October***.

If you have any questions, please contact Elfrun Lehmann (Elfrun.lehmann@fu-berlin.de) or Harry Becker (hbecker@zedat.fu-berlin.de).

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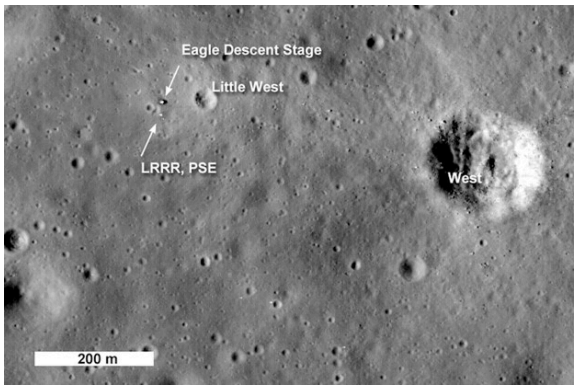
› Outreach

Widely used Lunar Chronology Function is correct!
BBC magazine "Sky at Night" published an article " How scientists estimate the ages of planetary surfaces" about the initial results of the TRR A2 project taking place in the University of Münster. The article is based on the work of Wajiha Iqbal and Harald Hiesinger originally published in the journal "Icarus". The comprehensive studies to test the lunar cratering chronology proposed by Gerhard Neukum in 1983 found this model to be accurate to determine the ages of the unsampled geological units throughout the Solar system bodies.

How scientists estimate the ages of planetary surfaces
How do we know the age of Earth and other planetary bodies? A new study reveals our current techniques are bang-on.
By Lewis Dartnell (Sky at night Magazine)
May 20, 2020 at 8:47 am
When planetary scientists are trying to understand the surfaces of planets and other worlds in our Solar System, and the processes that form and shape them, the ages of different features is a crucial detail. It's straightforward to deduce the relative chronology of different plains of volcanic rocks or sedimentary deposits by looking to see which one appears to lie on top of or cut across the other, but this only tells you that one splodge of rock is older or younger than its neighbouring formations. What would be so much more useful to know is the absolute age of particular surfaces – for example, this volcanic plain is 200 million years old, but that one erupted only 60 million years ago.



Position of Apollo 11 landing module shown on LRO NAC data.

https://www.skyatnightmagazine.com/space-science/how-scientists-estimate-ages-planetary-surfaces/

Original Publication:
Iqbal W., Hiesinger H., van der Bogert C.H. (2019): Geological mapping and chronology of the lunar landing sites: Apollo 11. Icarus, Vol. 333, pp. 528-547. 10.1016/j.icarus.2019.06.020

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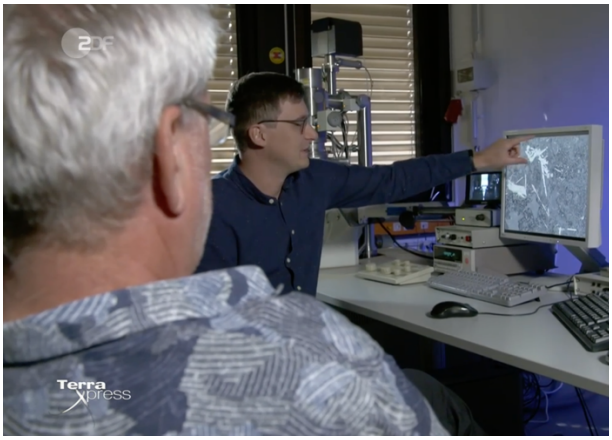
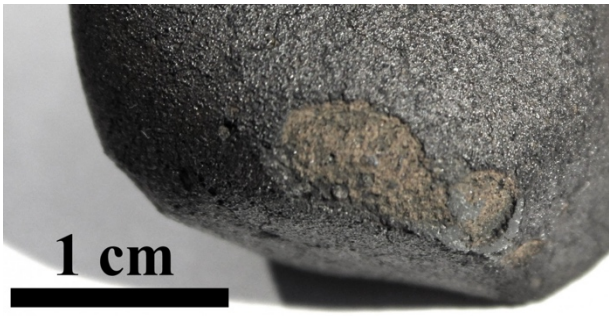


ZDF Terra Xpress (January 03, 2021)
Wilhelm Jacobs suddenly sees a bright glow on his cutter on the North Sea. An emergency missile? Countless calls make the sea rescue active. Until a kite video and a garden find suggest that it could have been a meteorite.
With Addi Bischoff, Markus Patzek and Ulla Heitmann (WWU Münster).
https://www.zdf.de/wissen/terra-xpress/mysterioeses-deutschland-was-geschah-in-dieser-stunde-100.html
(starting from minute 8:00)



Flensburg meteorite with black fusion crust: Parts of the fusion crust were lost during the flight through the atmosphere. The small fragment, weighing 24,5 grams, is about 4.5 billion years old.
© Markus Patzek

Oldest Carbonates in the Solar System/
International research group determines age of Flensburg meteorite
A meteorite that fell in northern Germany in 2019 contains carbonates that are among the oldest in the solar system; it also evidences the earliest presence of liquid water on a minute planet. The high-resolution Heidelberg Ion Probe – a research instrument at the Institute of Earth Sciences at Heidelberg University – provided the measurements. The investigation by Heidelberg's Cosmochemistry Research Group led by Prof Mario Trieloff was part of a consortium study coordinated by the University of Münster with participating scientists from Europe, Australia and the USA.

For further details see: https://www.uni-muenster.de/news/view.php?cmdid=11498&lang=de

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Online Vortrag im LWL Museum für Naturkunde Münster am 02. Februar 2021
Von Adi Bischoff
Meteorite – spektakuläre Boten ferner Himmelskörper

https://www.youtube.com/watch?v=QRWPDsla2ZE

Generell gesagt sind Meteorite Bruchstücke ferner Himmelskörper, insbesondere der Asteroiden, und gelten als die ältesten Gesteine unseres Sonnensystems. Durch die Forschung an Meteoriten wollen Meteoritenforscher etwas über die Entstehung der ersten festen Bestandteile unseres Sonnensystems, sowie über die Bildung und Entwicklung kleiner Körper und Planeten lernen.
In seinem Beitrag wird Herr Bischoff über die grundlegenden Dinge der Meteoritenforschung berichten und insbesondere auf die letzten Meteoritenfälle in Deutschland (Neuschwanstein (2002), Braunschweig (2013), Stubenberg (2016) Renchen (2018), Flensburg (2019)) eingehen. Nachdem es nach dem Meteoritenfall von Neuschwanstein für etwa 11 Jahre keinen weiteren Meteoritenfall gab, erfolgten vier Meteoritenfälle nach 2013: Große Glücksfälle für die Meteoritenforschung!!
Der letzte Meteorit „Flensburg“ ist von besonderem Interesse, da er Minerale enthält, die sich unter der Beteiligung von Wasser in der Frühphase unseres Sonnensystems gebildet haben. Somit kann ein Teil des ursprüngliche Mutterkörper von Flensburg (oder ein sehr ähnlicher Körper) als möglicher Baustein der Erde angesehen werden, der in der Frühphase der Planetenentwicklung unserer Erde auch das Wasser gebracht haben könnte.

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› Events

Upcoming TRR 170 events			
PhD online workshop	Effective presentations	March 23+25, 2021	Celeste Brennecka (Perfecting Papers, Livermore, USA)
Gender equality online seminar	The game of power	April 20, 2021	Marion Knaths (sheboss, Hamburg)
Data management seminar	Introduction in the management of research data I	May 17-21, 2021 (1/2 day)	Elfrun Lemann (FU Berlin)
PhD online workshop	Python (basics)	Sept 2021 (2 days)	Simon Schneider (Universiteit Utrecht, NL)
Summer School #1 Nördlingen (presence/online)	Impact processes in the solar system	Sept 19-24, 2021	TRR 170 staff (due to the situation for TRR 170 members only)
Summer School #2 (Bingen?)	Origin of the Earth-Moon System	planned for May 2-6, 2022	TRR 170 staff & international guests

Please note these events in your calendar!

The next upcoming **international (virtual) conferences** which cover aspects of TRR 170 are

- Lunar and Planetary Science Conference LPSC (March 15-19, 2021) and
- European Geosciences Union EGU (April 19-30, 2021).

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› Other

Compensation of CO2 emissions in research funding and projects
DFG-funded recipients can compensate for CO2 emissions caused by business trips in a funded research project by purchasing CO2 certificates on their own responsibility. For projects that have already been approved, the compensation payments can be financed from the available DFG funds.
https://www.dfg.de/download/pdf/dfg_magazin/aus_der_forschung/forschung_magazin/2020/forschung_2020_4.pdf

Kompensation von CO_2-Emissionen in Forschungsförderung und -projekten

Ausgleichszahlungen für Umweltbelastungen durch Dienstreisen künftig möglich

Die DFG leistet einen weiteren Beitrag zu mehr Nachhaltigkeit in ihrer Förderarbeit und in den geförderten Forschungsprojekten. Künftig sind für alle CO_2-Emissionen, die durch Dienstreisen in den Förderprojekten sowie von DFG-Beschäftigten, -Gremienmitgliedern wie auch Gutachterinnen und Gutachtern entstehen, Ausgleichszahlungen möglich. Grundlage hierfür ist ein Beschluss der Gemeinsamen Wissenschaftskonferenz des Bundes und der Länder (GWK), die damit einer Initiative der Allianz der Wissenschaftsorganisationen in Deutschland unter Federführung der DFG zustimmte.

„Die DFG befasst sich bereits seit Langem auf verschiedenen Feldern mit Fragen der Klimaneutralität und Ressourcenschonung. Nicht nur die Förderung spezifischer Forschungsprojekte oder die kontinuierliche Befassung in den DFG-Gremien oder -Senatskommissionen unterstreichen den hohen Stellenwert des Themas Nachhaltigkeit in unserem Förderhandeln. Die CO_2-Kompensationen sind nun ein wichtiger Schritt für einen verantwortungsvolleren Umgang mit Reisen und den damit verbundenen Umweltbelastungen", sagte DFG-Präsidentin Professorin Dr. Katja Becker.

Für jede durch Flugreisen, Pkw- und Bahnfahrten emittierte Tonne Kohlendioxidäquivalent kann künftig ein CO_2-Zertifikat erworben werden. Diese Zertifikate müssen aus Projekten stammen, die nach UN-Regeln unter dem Mechanismus für umweltverträgliche Entwicklung (CDM) zertifiziert worden sind oder gleichwertigen Standards entsprechen.

Die DFG-Geförderten können CO_2-Emissionen, die durch Dienstreisen in einem geförderten Forschungsvorhaben entstehen, in eigener Verantwortung durch den Erwerb von CO_2-Zertifikaten kompensieren. Für bereits bewilligte Projekte können die Ausgleichsleistungen aus den vorhandenen DFG-Mitteln finanziert werden. Für neu geplante Vorhaben können die Mittel als Teil der Reisekosten beantragt werden. Die Kompensation der Dienstreisen von Gutachterinnen und Gutachtern, Gremienmitgliedern und Beschäftigten wird durch die DFG-Geschäftsstelle abgewickelt.

www.dfg.de/pm/2020_59

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› Impressum

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Photos: Pangritz, Winkler, Szczech (p. 2), Allibert, Liu, Hellmann, Wahl (p. 3), Kerraouch, Yang, BIschoff (p. 4), NASA (p. 8), ZDF, Patzek (p. 9), LWL Naturkundemusem Münster (p. 10)