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Paul Niggli Medal 2016 awarded to Matthias Meier

The Paul Niggli Medal is Switzerland's most prestigious award for young earth scientist who made outstanding contributions in the research fields of mineralogy, geochemistry, petrology, resource geology or solid-earth geophysics. The Paul Niggli Medal honours and supports young ambassadors of Swiss geoscience, who are either Swiss citizens or have obtained at least two of their academic degrees in the Swiss university system (BSc or MSc and usually their PhD).

The Board of the Paul Niggli Foundation has decided, in their session of 10 May 2016, to award the Paul Niggli Medal for the year 2016 to Dr. Matthias M. M. Meier, in recognition of his outstanding research contributions to the study of fossil meteorites and of noble gases in extraterrestrial samples.

Christoph Heinrich, on behalf of the Foundation Council of the *Paul Niggli Stiftung*.

1 Citation

Matthias Meier obtained his diploma in Natural Sciences at ETH Zürich in 2006. Between 2007 and 2011 he worked on his PhD thesis in my group at the Department of Earth Sciences of ETH, primarily studying noble gases on two very diverse types of very small extraterrestrial particles: individual chromite grains extracted from otherwise fully fossilized meteorites or micrometeorites, and pre-solar grains in primitive meteorites—matter from previous star generations. After completing his PhD, he joined the group of Birger Schmitz at the University of Lund (Sweden), where he continued to study extraterrestrial chromites in sediments worldwide. In 2014 Matthias joined Bernard Marty's group at the Centre de Recherches Pétrographiques et Géochimiques in Nancy (France) where he studied mercury in meteorites. Since 2015, an Ambizione Grant by the Swiss National Science Foundation allows him—together with a PhD student—to continue his research back at the Earth Science Department at ETH Zurich.

Since his PhD student years, Matthias Meier's research has had a strong focus on noble gases in extraterrestrial matter. In several key contributions, he and his collaborators could show that extraterrestrial dust is found in very high concentrations in sediments worldwide in exactly the same stratigraphic position where fossilized meteorites are abundant in a quarry in Sweden, testifying of a collision of two major asteroids, a cosmic catastrophe 470 million years ago. At present he is searching for traces of a similar collision involving a known asteroid (Veritas) in 8 million year old sediments. His unique noble gas analyses on individual pre-solar graphite grains are part of a research direction aptly termed "Astrophysics in the laboratory", allowing to reveal or confirm the stellar origin of many of these grains, e.g., as condensates in outflows after a supernova explosion. An improved understanding of how meteorites travel from the main asteroid belt (or beyond?) to Earth is another major research goal of Matthias. His work on mercury revealed unusually large variations of the abundance of this highly volatile element even in primitive meteorites, testifying of complex parent body processes.

Matthias Meier has an impressively wide range of interests. Already as an undergraduate he had set up a well attended website and blog about astrophysical and

planetary science topics. Let me name just a few more topics he has been or is about to publish. Based on high-precision chronology data of meteorites he has critically evaluated the idea by others that half-lives of radioactive nuclides may slightly depend on the distance from the sun. Similarly, he is using the latest high-precision ages of terrestrial impact craters to study the claim of a 26 Ma periodicity in the collision frequency of asteroids or comets with our planet. Among his best known contributions is his work about the hypothesis that the Earth's moon was formed in a Giant Impact. The fact that the Moon and the Earth's mantle are isotopically and geochemically very similar in many respects, although numerical models invariably predicted the Moon to consist mainly of material from the impactor, is a well-known problem. Matthias' idea that this might be explained if the impactor had an icy mantle surrounding a rocky core led to a set of new simulations in collaboration with Andreas Reufer and Willy Benz in Bern. In 2012, this resulted in the first of several new publications on the topic, and up to this day several groups simulate Giant Impacts exploring an expanded parameter space.

As his PhD thesis advisor, collaborator and friend, it is my great pleasure to congratulate Matthias Meier for the very well-deserved 2016 Paul Niggli medal. I wish him all the best for a fruitful continuation of his scientific career!

Reiner Wieler (ETH Zürich)

2 Response

I feel very honored and grateful to be this year's recipient of the Paul Niggli medal of the Swiss Society of Mineralogy and Petrology. I would first like to thank the committee of the Paul Niggli foundation, and my anonymous colleagues who nominated me. This medal is a very welcome recognition of my work in the (almost) ten years since I started my PhD, and also an encouragement to continue on building my scientific career. Of course, I have never been alone on this path, and my scientific career would not be the same—or not exist at all!—if it weren't for the many people who have supported me in many ways over the years. I always found it important to remember that each line in a CV hides beneath it a much longer, more complicated and more personal story, which I can only begin to tell here.

First and foremost, I would like to thank Rainer Wieler, who I am happy to call not only my former supervisor, but also a good colleague and friend. His lecture about meteorites and planets captured my attention and imagination before I even started to study Earth Sciences (I was a first-year physics student at the time). He then became the supervisor on my first semester project, for which I chose the somewhat exotic (and possibly premature) topic of "asteroid mining". After a second semester project (this time with Ghylaine Quitté, on nickel in iron meteorites, leading to my very first and still second-most-frequently cited paper), I eventually decided to also do my diploma thesis under Rainer's supervision. During that time, Veronica Heber was instrumental in teaching me how to use the noble gas machines at ETH Zurich, and how to be very skeptical with the data produced from the effort. In the fall of 2006, just before I left for a long voyage to the wonders of South America, Rainer and me agreed with a simple hand-shake that I would come back as his PhD student in the following spring, and so it was. Thank you again, Rainer, for your continuous support and encouragement, and especially for always asking the "good" questions where and when they are necessary.

Another scientist who supported me, during my PhD and beyond, is Philipp R. Heck, whom I had the pleasure of visiting several times at the Max-Planck Institute for Chemistry in Mainz (Germany) and later again at the Field Museum of Natural History in Chicago, where we worked together on noble gases in presolar grains. When my PhD in Zurich drew to a close, Birger Schmitz made things very easy for me by inviting me to join his group at the University of Lund (Sweden) and to work with him on fossil meteorites and micrometeorites, which I of course gladly accepted. Birger has a great talent to see the signatures of extraterrestrial events in the Earth's history, long before anyone else can see them. I admire the tremendous achievements he and his group have reached in the last decades, and I am proud and thankful to have been part of it (also, thank you Birger for introducing me to the most questionable elements of Swedish cuisine… I will definitely never forget that). I also would like to thank Carl Alwmark (also from Lund University), who has been a good colleague and friend over many years, who taught me never to lose my good spirits even if things are looking dire, and who also introduced me to the value of a good long talk over a beer (or, perhaps, two).

After leaving Lund, I had the great pleasure of working with Bernard Marty and Christophe Cloquet, who invited me to come to the CRPG in Nancy, France, to work on mercury (the chemical element, not the planet, as I keep explaining) in meteorites. Bernard and Christophe also helped me to finally discover the power of caffeine in a scientist's life. I could not miss the chance of accepting a SNF Ambizione fellowship, which brought me back to ETH in spring 2015, and allows me to work on my own ideas on how to bring heaven and Earth together (scientifically speaking, of course). Here, I have to thank Maria Schönbächler (herself a Paul Niggli medalist) and Henner Busemann for helping me realizing my project, and supporting the supervision of my first PhD student.

Last, but certainly not least, I would like to thank my friends and my family for their continuing interest and support. In particular my parents, who have always supported me wherever my interests would take me, and never expected more of me than to find myself a job which makes me feel happy and fulfilled. I am also very thankful to my wife Stephanie, who came to Sweden with me and now probably knows more about noble gases in meteorites than most people who have ever lived. Stephanie, I don't know how I could have done it all without your love and support.

Matthias Meier (ETH Zürich)