

**Gustav-Steinmann-Medaille 2021 awarded to
Prof. Dr. Mark R. Handy**

The Deutsche Geologische Gesellschaft – Geologische Vereinigung (DGGV) honours Prof. Mark Handy from the Freie Universität Berlin with the Gustav Steinmann Medal.

Mark's contributions to geoscience are multi-faceted. He has been at the forefront of tectonic research for more than three decades, particularly in the fields of fault rheology and kinematic reconstructions, whilst remaining one of the few still-active, field-oriented generalists. In recent years, he has gravitated to geophysics, linking state-of-the-art seismological imaging of Earth's deep structure with kinematic studies of Earth's surface.

Mark grew up in New England (Boston) and graduated from Amherst College in 1980 with a BA in Geology on the structure and petrology of basement rocks in the northern Appalachians under the supervision of Jack Cheney and Peter Foose. He then moved to Switzerland, the home country of his mother, to learn more about Alpine Geology. The theme of his PhD project, supervised by Hans Laubscher (University of Basel) and Stefan Schmid (then ETH-Zürich), was the role of large shear zones during rifting of lower continental crust as exposed along the southern border of the Ivrea Zone in northwestern Italy. His structural-petrological studies covered an area that was and still is of great relevance, especially for geophysical studies in the era of reflection seismic profiling.

After obtaining his PhD in 1986 with a *summa cum laude*, he was awarded a Royal Society Fellowship to the Royal School of Mines at the Imperial College, London for a post-doc in rock mechanics with Ernie Rutter and colleagues. It was there that he launched an investigation of polyphase aggregates, a field with great significance not only for geology and geophysics, but also for materials science. This resulted in seminal papers on rock rheology, most notably on the solid-state flow of polymineralic rocks in the crust and upper mantle, and on the energetics of heterogeneous flow in crystalline materials.

It was at the University of Berne from 1988-1994 that Mark gained his first experience as a university teacher and in 1991 was awarded a research professorship by the Swiss Science Foundation (SNF). There, he led a small group of motivated diploma students in studying the evolution of an ancient continental margin (Lower Austroalpine of the Julier area, eastern Switzerland), from the rifting stage all the way to its final incorporation into an accretionary margin. At the same time, he conducted a pioneering PhD project with Marco Herwegh (now Univ. of Berne) in performing deformation experiments with see-through analogue materials, thus enabling them to study the microscopic development of crystallographic preferred orientation in mylonite. He obtained his Habilitation in 1992 in *Tectonophysics*.

In 1994, Mark was appointed Professor of Geology in the Institute of Lithospheric Research, University of Giessen (Germany), where he continued his work on microscale deformation mechanisms with Diploma students, PhDs and postdocs

(Jürgen Streit, Ulrich Riller and Claudio Rosenberg). Together with Claudio Rosenberg (now at the UPMC in Paris), he discovered how fluctuating rock strength correlates with episodic strain localization along melt channels in deforming partially melted rocks and rock-analogue materials. In parallel with this work, he and his team (including Andreas Mulch, now director of the Senckenberg Museum, Frankfurt) continued field-based work on the structure of the lower continental crust in the Southern European Alps, focusing on the effects of late- and post-Variscan structures and magmatism on Alpine tectonics.

After his appointment to a full professorship in *Tectonics and Geodynamics* at the Freie Universität Berlin in 2000, Mark increasingly applied his experience in faults and rheology to larger scales, including that of mountain belts. Together with Greg Hirth and Niels Hovius, he edited a notable book published by MIT Press in 2007, entitled “Tectonic Faults – Agents of Change on a Dynamic Earth”. At the same time, he and his research group conducted process-oriented field studies, primarily in the Alps, but increasingly in other parts of the Alpine-Mediterranean belt, the Andes and the eastern Himalayas. An outcome of these studies were widely cited papers with a PhD (Florian Füsseis, now Univ. Edinburgh) and MSc (Christoph Schrank, now Univ. Queensland, Australia) on the scale-dependence of strain-localization at the frictional-viscous transition and its bearing on earthquakes.

While fieldwork has always been a source of inspiration for Mark, he has been equally adept at fostering interaction between different subdisciplines of the Earth Sciences. His activities in the Alpine-Mediterranean realm animated him to gather colleagues in tectonics, petrology, sedimentology and geophysics in a collective attempt to reconstruct the plate motions of Alpine Tethys. This is an area “where plate tectonics doesn’t work”, as Mark jokingly likes to point out. The resulting publication in 2010 *Reconciling plate-tectonic reconstructions of Alpine Tethys with the geological–geophysical record of spreading and subduction in the Alps* was a resounding success, as attested by its high citation impact. Mark and his co-authors concluded that their reconstruction of microplate motions in the Western Mediterranean area is “surprisingly consistent”, within analytical error, with the record of subduction provided by P-wave tomography of the mantle. A follow-up paper in 2015, including a post-doc (Kamil Ustaszewski, now Univ. Jena), linked the motion paths of microplates in the Adriatic area to the kinematic and magmatic response of the crust in the Alps, Apennines and Carpathians. Since then, others, including Eline LeBreton from Mark’s group, have published more sophisticated reconstructions based on the GPlates technique. Yet, the 2010 and 2015 papers remain benchmarks for these later studies.

Spurred by advances in seismological passive-array imaging, Mark and a handful of colleagues co-founded the AlpArray initiative in 2011 to image Earth’s mantle down to the Mantle Transition Zone and beyond. This ambitious project involving 64 institutions from 17 European countries has deployed a dense network of >600 closely spaced broadband seismometers from 2015-2019. Together with colleagues in geophysics, especially at the ETH in Zürich (Domenico Giardini, Edi Kissling) and the nearby GFZ in Potsdam (Michael Weber, Frederick Tillman), Mark initiated and

coordinated the German part of this ambitious program. The fruits of AlpArray are becoming available in the form of 3D tomographic images of Earth's interior at unprecedented resolution. They show for the first time that subducting slabs of lithosphere beneath the Alps are almost completely detached from the orogenic superstructure, explaining some of the first-order topographic, tectonic and seismological features of the mountain belt. New results are appearing in papers, and a volume co-edited by an international panel headed by Mark and two of his postdocs (Emanuel Kaestle, Peter McPhee) is nearing completion. Despite (or because of) these geophysical activities, Mark has remained true to the field-aspect of his science, with recent papers on the exhumation of subducted high-pressure rocks and the arcuation of the Dinarides, co-authored with PhDs (Phillip Groß, Sylvia Favaro, Marc Grund, Andreas Scharf now at the Qaboos Univ., Oman), post-docs (Lorenzo Gemignani) and colleagues (Jan Pleuger and Joerg Giese, now at the Geol. Survey of Norway).

Mark has hosted Humboldt Researchers in his group (Stefan Schmid, Aral Okay) and is a sought-after lecturer, having taken several paid sabbaticals (Univ. Vienna, Univ. Potsdam, ETH-Zürich) and guest lectureships (Univ. of Utrecht, Univ. de Rennes) over the years. In addition to his professorship at the FU-Berlin, he is currently Lecturer in *Alpine Geodynamics* at the ETH in Zürich and will begin a 6-month sabbatical at the Univ. of Edinburgh.