

Presentation of the Dana Medal of the Mineralogical Society of America for 2020 to Daniela Rubatto

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The dating of events and studying the timescales of processes are central objectives of Geosciences. Technological advances now make it possible to determine the concentrations of radioactive decay products, and hence dates, with an ever-increasing accuracy from sample volumes that are becoming smaller by the day. Thus, a rapid sequence of short-lived events may now be dated separately and accurately from in-situ samples (i.e., without the need for dissolution, maintaining the spatial textural contexts) with remarkable spatial resolution. In this effort, the most challenging step remains the need to associate each date with a specific geological event—in brief, to know: What is it that we are dating? It is in this challenging field that Daniela Rubatto established herself rapidly as a leader, and it would not be far-fetched to say that she was one of a handful of people who were instrumental in initiating what has now come to be known as a separate area of research—Petrochronology (a topic of a *RiMG* volume in 2017). What is remarkable is that some of the key papers that led to this development were published only a few years after the completion of her Ph.D., during the early days of her post-doctoral research work.

People supporting Daniela's nomination have discussed different sets of papers and their impact on the field. Today I will single out the astute choice of problem that is a sign of the scientific maturity that Daniela demonstrated coming right out of graduate school. While the need to relate dates to events has been a well-known issue to tackle, one could choose any number of different systems in which to explore the problem. Daniela picked garnets and zircons, recognizing that the pair is by far the most widely used mineral system for the determination of pressure-temperature conditions of formation (garnets) and dates (zircons), respectively. Therefore, connecting the two would considerably multiply the insights gained from either one by itself and provide a much more comprehensive picture of metamorphism than had been possible until then.

As is often the case, solving challenging problems requires interdisciplinary approaches that borrow methods and skills from different areas. Daniela did just that, marrying isotope geochemistry with phase petrology as well as experimental petrology (the last part in collaboration with Jörg Hermann, another recipient of a Dana Medal). The process was initiated with her sole authored paper in *Chemical Geology* in 2002. Path-breaking research is defined by the quality that such work not only solves a long-lasting problem but also that the idea it germinates triggers a whole new direction of research. In this case, others began to apply ideas introduced in the 2002 paper to other accessory minerals used for geochronology (monazite, allanite) and to major rock-forming minerals used to determine conditions of formation (e.g., plagioclase, amphiboles). Daniela would not be Daniela if she were to rest on her laurels—she herself took a very active part in the process as well and has gone on to establish herself as the expert on accessory mineral dating and

petrochronology. Her highly cited studies using monazite, allanite, or rutile are not her most visible contributions only because they are in competition with her extraordinary oeuvre of contributions on zircon. Indeed, the development of such new approaches has to run in parallel with new developments in analytical methods and instrumentation, and Daniela has not shied away from those either.

Providing such major tools to the community would be accomplishments worthy of recognition by themselves, but Daniela has contributed more. She has always been curious to test how the tools developed by her perform in the field and what insights they offer. For this, she has teamed up with scientists from all over the world and from many different areas (petrologists, geochemists, structural geologists, and more) to address research problems that span the entire history of the earth (from very early Earth events to products of the most recent tectonic processes) and about a dozen different orogens (Alps, Himalaya, SE Spain, Bohemian Massif, Kokchetav, Rajasthan, Tianshan, Reynolds Range, New Caledonia, Limpopo Belt). She has traveled widely to field areas in all corners of the world to carry out this research. This last aspect, in particular, takes on a different significance when one considers that she has balanced raising children and a very active dual career family at the same time, demonstrating along the way how it can be a lot of fun!

Daniela's work has demonstrated that metamorphic processes can occur at rates comparable to those of plate motions. However, it has also revealed more nuanced variations that show that the processes are pulsed and are probably related to individual events of dehydration or fluid flux. Thus, a need to correlate dates to not just pressures and temperatures of formation but also fluid-related events has emerged, and Daniela's current research is aimed at exploring such connections.

Daniela's broad spectrum of contributions is a result of her dynamic nature, her excellent team-building capabilities, and her highly disciplined management of projects. Beyond her own science, she has contributed to the community in many different ways. She is an untiring mentor to young scientists (she has advised over 25 Ph.D. students and mentored many more early career researchers). As one of her letter writers noted, it is in her interactions with her students and postdocs that her intensity, excitement, and dedication to science shows most prominently. She has been involved in editorial activities of several leading journals in the field, has been a contributor to *RiMG* volumes and *Elements*, was chair of the science committee of the Goldschmidt conference in 2018, and was an MSA distinguished lecturer, in addition to being a Keynote lecturer at a number of high-profile international conferences.

Daniela has established herself as a leading metamorphic geochemist of our time and has been a driving force behind the emerging field of petrochronology. She is one of the leading experts on isotopic studies of accessory minerals. She has accomplished this in a remarkably short time, with an exemplary work-life balance. It is my pleasure and privilege to present to you the awardee of MSA's Dana Medal for 2020—Daniela Rubatto.

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