2022 IMA MEDAL OF EXCELLENCE TO PATRICIA M. DOVE

The IMA is delighted to present its 2022 Medal of Excellence to Patricia M. Dove, Distinguished Professor and C.P. Miles Professor of Science at Virginia Polytechnic Institute and State University, USA. She has been praised as a "world leader in the field of mineral reactivity and biomineralogy" and a pioneer who "has combined key advances and development of new techniques at the atomic level with major insight into large-scale processes including the long-term evolution of biomineral systems."

Patricia completed her BSc and MSc studies at Virginia Tech, USA (1981 and 1984, respectively), and earned her doctoral degree from Princeton, USA, in 1991. In the past 30 years, she has built an impressively successful research career at the crossroads of mineralogy, aqueous geochemistry, biochemistry, surface physics, and environmental science—first at Georgia Tech and, since 2000, at Virginia Tech. Recognizing the critical role of interaction between rocks and biota in the critical zone, Professor Dove embarked on studying some of the least-understood aspects of that interaction, including the atomic-scale kinetics and molecular dynamics of dissolution and precipitation at mineral surfaces, and focused her research efforts on biologically relevant systems (quartz, amorphous silica, calcite, and amorphous $CaCO_3$). She pioneered the use of atomic force microscopy (AFM) for in situ molecular imaging to observe crystal growth and resorption under carefully controlled conditions (Dove and Hochella 1993; Dove and Platt 1996). The parameters of these experiments ranged from ambient temperature and pressure to methodologically challenging simulated environments, which required ingenious experimental apparatuses—e.g., a hydrothermal mixed-flow reactor for direct measurements of reaction rates at steady-state conditions (Dove and Crerar 1990) and fluid-tapping AFM for studying microbial interactions with minerals (Grantham and Dove 1996). This work was foundational to constraining the effects of physicochemical parameters on the kinetics of crystal growth and dissolution and to the development of quantitative molecular models describing these processes in surficial, hydrothermal, and bio-mediated environments (e.g., Dove 2010; Dove et al. 2008, 2019). Another important outcome of Professor Dove's research was the collaborative discovery of crystallization by particle attachment (De Yoreo et al. 2015). This "non-classical" crystallization mechanism has since been documented increasingly in synthetic and natural systems, yielding over 170 citations of the original publication annually! These papers have far-reaching implications not only for our understanding of how minerals form and dissolve, but also for the interpretation of rock textures, paleoclimate reconstructions, evolutionary biology, and such practically important areas as nanotechnology and crystal design. Professor Dove's outstanding contribution to science has been recognized through many awards and honors, including the F.W. Clarke Medal from the Geochemical Society (1996); Dana Medal from the Mineralogical Society of America (2014); fellowships in the Mineralogical Society of America (2000), American Geophysical Union (2008), and Geochemical Society (2010); and the US Department of Energy Best University Research Award (1999 and 2005).

Professor Dove is an award-winning educator and promoter of science, who has shared her passion for biomineralogy with hundreds of university and school students through National Science Foundation programs, Virginia Tech's CurVinci Living Learning Communities, Kids Tech, and other outreach platforms. At Georgia Tech and Virginia Tech, she has developed and taught an impressive spectrum of courses, from *Resources of the Earth* to *Oceanography* and *Biomimetic Materials and Design*.

We congratulate Professor Dove on this prestigious award and look forward to reading about her new exciting discoveries in biomineralogy and beyond!

REFERENCES

De Yoreo JJ and 14 coauthors (2015) Crystal growth. Crystallization by particle attachment in synthetic, biogenic, and geologic environments. Science 349: aaa6760, doi: 10.1126/science.aaa6760

Dove PM (2010) The rise of skeletal biominerals. Elements 6: 37-42, doi: 10.2113/gselements.6.1.37

Dove PM, Crerar DA (1990) Kinetics of quartz dissolution in electrolyte solutions using a hydrothermal mixed flow reactor. Geochimica et Cosmochimica Acta 54: 955-969, doi: 10.1016/0016-7037(90)90431-J

Dove PM, Han N, Wallace AF (2019) Systematic dependence of kinetic and thermodynamic barriers to homogeneous silica nucleation on NaCl and amino acids. Journal of Materials Research 34: 442-455, doi: 10.1557/jmr.2018.474

Dove PM, Han N, Wallace AF, De Yoreo JJ (2008) Kinetics of amorphous silica dissolution and the paradox of the silica polymorphs. Proceedings of the National Academy of Sciences 105: 9903-9908, doi: 10.1073/pnas.0803798105

Dove PM and Hochella MF Jr (1993) Calcite precipitation mechanisms and inhibition by orthophosphate: in situ observations by scanning force microscopy. Geochimica et Cosmochimica Acta 57: 705-714, doi: 10.1016/0016-7037(93)90381-6

Dove PM and Platt FM (1996) Compatible real-time reaction rates of mineral dissolution by atomic force microscopy (AFM). Chemical Geology 127: 331-338, doi: 10.1016/0009-2541(95)00127-1

Grantham ME and Dove PM (1996) Investigation of bacterial-mineral surface interactions using Fluid Tapping Mode™ Atomic Force Microscopy. Geochimica et Cosmochimica Acta 60: 2473-2480, doi: 10.1016/0016-7037(96)00155-X