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Presentation of the Dana Medal of the Mineralogical Society of America for 2011 to Ross Angel

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One of the happiest aspects of being part of the MSA community is that there are opportunities to recognize and enjoy the career development of friends and colleagues. It is appropriate that we occasionally congratulate our fellow mineralogists, petrologists, and geochemists for their singular contributions to our science. The Dana Medal is "intended to recognize continued outstanding contributions through original research in the mineralogical sciences by an individual in the midst of their career", and it is particularly appropriate that the award for 2011 should go to Ross Angel.

Ross is well known as a prolific and energetic scientist working in the field of high-pressure crystallography, crossing the boundaries between mineralogy, solid-state physics, and solid-state chemistry. He has published ~200 papers so far and a few highlights are picked out in this citation. Ross completed his Ph.D. in Cambridge on pyroxene/pyroxenoid relationships in 1986, under the supervision of Andrew Putnis. He became interested in mullite at about the same time through interaction with Volker Heine and Desmond McConnell and, after he moved to Stony Brook, he published the first modern refinement of the incommensurate structure. At Stony Brook, he teamed up with Nancy Ross and then moved to the Geophysical Lab with Charlie Prewitt. While he was at the Geophysical Lab, YBCO superconductors appeared abruptly on the scene, and he was part of the team that solved the structures of some of the early phases. The experience of dealing with relatively complex mineral structures must have been a big advantage in this context. Ross's main effort at the time, however, was on the behavior of feldspars at high pressures and his 1988 paper on "Comparative compressibility of end-member feldspars" is a classic, which also showed that phase transitions can occur at high pressures in anorthite. The correct characterization of the high-pressure phase later led to the realization that minerals such as feldspars (and also clinopyroxenes) can exhibit two thermodynamically distinct phases with the same symmetry and structural topology but distinct conformations. He also worked extensively on Al/Si ordering and his interest in feldspars continues to this day.

When Ross was at UCL, he and Nancy established a world-leading high-pressure crystallography lab and his range of interests expanded further. An important contribution of this period was his discovery of the high-pressure phase transition in clinoenstatite, which has implications for the structure and stability of $MgSiO_3$ in the Earth's mantle. By the time that he moved to the Bayerisches Geoinstitut in the University of Bayreuth, however, he appears to have become somewhat frustrated with some of the inherent lack of precision in the methods then in use for determining equations of state using diffraction and the diamond-anvil cell. During his years at the BGI, he put substantial energy into finding new ways of calibrating pressure, worrying about pressure media, allowing time for the cell to fully relax before collecting diffraction data, and applying rigorous methods for fitting equations of state. His 1997 paper on "The use of quartz as an internal pressure standard in high-pressure crystallography" and his 2000 paper on "Equations of state" from this period are significant outcomes from these efforts.

In 2001 Ross moved to Virginia Tech and again set up a new high-pressure crystallography facility. At some point, probably due at least in part to Nancy's influence, he had become interested in perovskites. Through collaborations with many people who have beaten a pathway to his lab, he has worked on the systematics of the response of perovskites to high pressures, including $GdAlO_3$, $GdFeO_3$, $CaSnO_3$, $LaAlO_3$, $PrAlO_3$, $MgSiO_3$, and $(La,Nd)GaO_3$. This list of materials that are not minerals serves to highlight the fact that the impact of his work is not restricted to Earth sciences. His list of publications includes plenty of minerals (including spodumene, cummingtonite-grunerite, lawsonite, stishovite, wustite, sillimanite, etc.) but also many other phases, such as lead phosphate, octakis(trivinylsilyl)octasilicate, and lead scandalate tantalite. Many groups around the world collaborate with Ross because of the rigor of his approach to collecting and analyzing high-pressure data.

It should be emphasized that the Dana Medal is awarded to someone at the mid-point of his or her career. In other words, more is expected in the future, and there is no doubt that in Ross's case this will be prolific and of the highest scientific quality. It was a personal privilege to have had the opportunity of introducing him at the special symposium arranged in his honor at the recent Goldschmidt Conference in Prague, where he gave a deeply insightful presentation on the complex geometry of the feldspar structure and its response to changes in temperature, pressure, and composition.

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