The Clay Minerals Society

www.clays.org

THE PRESIDENT'S CORNER

David Laird

Last fall's headlines, at least in science-oriented publications, read, "Daniel Shechtman Awarded the Nobel Prize in Chemistry for Discovering Quasicrystals." Shechtman, a researcher at Technion (the Israel Institute of Technology in Haifa), started on the road to a Nobel Prize back in 1982 when he first observed atomic-packing patterns in rapidly cooled metal alloys that did not and could not have three-dimensional periodicity. Conventional crystallographic wisdom at the time said such structures were impossible, and Shechtman's peers, egged on by none other than Linus Pauling, accused him of disordered thinking. But Shechtman persisted, finding support in pure mathematics, Penrose tiles, and the aperiodic mosaics of the Alhambra Palace, until at last his critics were humbled. What he had discovered were three-dimensional "crystal" structures that followed mathematical rules but never repeated, a concept that strikes at the very heart of what it means to be a crystal.

The appreciation of disordered quasicrystalline structures is also at the heart of clay mineralogy. Clay mineralogists have long recognized "short-range ordered" mineral phases such as allophane, imogolite, and ferrihydrite. The term *quasicrystal* was in fact coined by Lance Aylmore and James Quirk[1] to describe smectites, which have two-dimensional periodicity but lack ordered structure along the *c* crystallographic axis due to turbostatic stacking of the individual 2:1 phyllosilicate layers. In preceding publications, Aylmore and Quirk and other clay mineralogists struggled with the term *crystal* as they came to realize that smectite layer stacking is random from the dearth of *hkl* peaks in X-ray diffraction patterns.

I once prepared an oriented specimen of Ca-saturated synthetic fluro-hectorite on a ceramic heating tile and mounted it in the X-ray diffractometer. Analysis of the specimen at ambient temperature and humidity revealed a pronounced 15 Å 001 peak with over 50,000 cps. I then passed a little current through the heating tile without otherwise touching or changing the specimen. At 90 °C, I reran the diffractometer and observed nothing. There was no 001 peak at 15 Å, 12.5 Å, 10 Å, or anywhere else. By partially dehydrating the Ca-flurohectorite, I had created an utterly random stacking sequence, presumably composed of 0-, 1-, and 2-layer hydrates. After turning the current off on the heating tile and giving the specimen time to cool and imbibe water from the atmosphere in the X-ray lab, the 15 Å 001 peak was restored with nearly (but not quite) the same intensity as before.

I congratulate Daniel Shechtman for his well-deserved Nobel Prize and for being the first to recognize three-dimensional nonrepeating crystalline structures in metal alloys and related solids! But despite the headlines, disorder in crystalline solids is nothing new to clay mineralogists. We long ago struggled with the word *crystal* and coined the word *quasicrystal* in recognition of the fact that three-dimensional periodicity was often lacking in quasicrystalline clay minerals, nature's nanoparticles.

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1 Quirk JP, Aylmore LAG (1971) Domains and quasi-crystalline regions in clay systems. Soil Science Society of America Proceedings 35: 652-654

STUDENT RESEARCH SPOTLIGHT

Congratulations to **Keith Morrison** for winning a CMS Student Research Grant award. Keith is a PhD candidate in geochemistry at Arizona State University. He received his BS in environmental toxicology and MS in Earth sciences at the University of California, Riverside. His current research is focused on antibacterial clays that have the ability to kill antibiotic-resistant strains of bacteria. Keith has recently begun investigating the antibacterial mechanism using scanning transmission X-ray microscopy at the Advanced Light Source (Berkeley, California) to map the uptake and redox chemistry of soluble transition metals interacting with fully hydrated bacteria and biofilms.

STUDENT RESEARCH GRANTS AND TRAVEL AWARDS

The research grant program is designed to provide partial financial support (up to $3000) to graduate students in clay science and technology doing master's or doctoral research. The travel grant program provides partial financial support to graduate students to attend the annual meeting of the Clay Minerals Society and present results of their research. All student members of the Clay Minerals Society are eligible to apply for a travel grant. See the CMS website for more information: www.clays.org. **The application deadline is 30 April 2012.**

6th BIENNIAL REYNOLDS CUP COMPETITION

The 6th biennial Reynolds Cup competition for quantitative mineral analysis is now open. You can register your interest for the contest by sending an e-mail to ReynoldsCup2012@csiro.au. Information about the competition, including guidelines and previous winners, can be found at www.clays.org. The competition is free for all to enter; however, those who are not members of the CMS are encouraged (but not obliged) to become members. **Results must be submitted by 15 May 2012.**