The Clay Minerals Society

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THE PRESIDENT'S CORNER

Thanks to the vagaries of CMS's Annual Meeting calendar, this is (already) my last President's Corner. The end of my (short) term brings retrospective remarks to mind, but the contents of this page draw me to the future instead. The research that our recent Student Travel Grant recipients presented at our recent Annual Meeting sampled the clay science that CMS members have advanced for the past 50 years and will for the next 50. Their research embraces geology, environmental chemistry, and crystallography. It spans basic and applied science. It is international. It is a microcosm of CMS. It bodes well for the future of clay science, and for CMS as a major meeting place for clay scientists. CMS's second half-century is off to a most promising start!

With that, I bid you farewell. I look forward to seeing you in College Station at our 51st Annual Meeting. Best wishes,

Michael Velbel (velbel@msu.edu)
President, The Clay Minerals Society

STUDENT RESEARCH SPOTLIGHT

Congratulations to **John Ross Harper** (Colorado School of Mines), **Sabrina Sharmeen Alam** (Texas A&M University), **Xiaoli Wang** (Freiberg University of Mining and Technology), and **Andras Fehervari** (Monash University) for winning a CMS Student Travel Grant award!

John Harper's research aims to elucidate the **provenance and depositional history of organic matter within unconventional shale deposits**. In particular, he is examining the Smoky Hill Member of the Niobrara Formation, which was deposited in the Western Interior Seaway during the Late Cretaceous and is hypothesized as an oceanic anoxic event, a rapid, global deposition and concentration of organic-rich marine facies. John's mineralogical and isotopic results reveal the distribution of carbon and nitrogen among inorganic phases, organic particulates, and expandable interlayers of layered clay minerals (smectites). His results support the hypothesis of an oxic to anoxic transition over time. Improved understanding of the accumulation of organic material and the progression of anoxia in marine sediment can assist scientists in pursuing similar formations in the exploration of unconventional hydrocarbon deposits.

Sabrina Alam's research aims to evaluate the **performance of smectite clays in removing aflatoxin during biofuel production**. Contamination of corn ethanol by the mycotoxin aflatoxin is a significant concern in biofuel production. Aflatoxin can be removed by adsorption on smectite. Sabrina's experimental results show that smectite maintains most of its capacity to adsorb aflatoxin in ethanol and glucose solutions. As compared with adsorption in pure water, at least 90% of the clay's aflatoxin adsorption capacity is preserved in the presence of up to 20% ethanol. No remarkable changes in the Fourier transform infrared spectroscopy bands of smectite–aflatoxin complexes are observed even with higher amounts of ethanol and glucose. Variable-temperature X-ray diffraction (XRD) results show that high temperatures have little influence on the *d*-spacing of smectite–aflatoxin complexes treated with ethanol and glucose solutions.

Xiaoli Wang's research aims to develop advanced techniques for the **XRD analysis of the structural parameters of dioctahedral smectites** by the Rietveld method. X-ray powder diffraction is one of the most common methods used for analysis of the structural properties of smectites. The Rietveld structure refinement technique provides the possibility of obtaining structural parameters from XRD powder patterns of natural or impure samples, such as bentonites and clays. Unfortunately, almost all smectites show a turbostratic disorder that leads to strongly asymmetric peak broadening and makes the use of conventional structural models impossible. Xiaoli's project aims to determine how much structural information (such as iron content, layer charge density, and the proportion of *trans*- and *cis*-vacant structures) can be obtained from powder diffraction patterns of dioctahedral smectites, particularly in mixtures such as bentonite.

Andras Fehervari's research aims to develop improved **robust hydraulic barriers capable of retaining hypersaline leachates**, which are produced mainly by the mining industry in Australia and worldwide. Andras has combined bentonites with various cyclic organic carbonate modifying agents to develop organo-mineral nanocomposites that are resistant to osmotic contraction under high ionic strength conditions. Glycerol carbonate (GC) and its derivatives are identified as promising inexpensive additives that yield robust bentonite-based hydraulic barriers. Glycerol carbonate can be produced using a "green chemical" method from glycerol and urea (both abundant waste resources) with a polymeric zinc monoglycerolate catalyst. Characterization of GC-bentonite using geotechnical techniques (swell index, fluid loss tests) and XRD measurements indicates effective hydraulic barrier performance to saline leachates as strong as 5 M of NaCl or 7.5 M of $CaCl_2$.