The Clay Minerals Society

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THE PRESIDENT'S CORNER

Lynda B. Williams

One of the goals of a geological society is to promote research and collaboration among its members and the wider scientific community. In our scientific pursuits, it is often difficult to pay attention to developments in other disciplines, and, therefore, important fundamental concepts can go unrecognized, sometimes for decades! Anyone who has developed a new strategy or made new discoveries knows how long it takes for that to be communicated universally. In an attempt to demonstrate the utility of studying nanometer-scale minerals (i.e. clays) to the broader scientific community, I present below a wonderful example of how our community, the Clay Minerals Society, has developed methods over years of international collaborations, that have a broad scientific impact to society.

Bentonites

Bentonites (Fig. 1) are one of the most special types of volcaniclastic deposit for clay scientists because the study of these units is fundamental for understanding many large-scale geologic processes. Warren Huff (Fig. 2) has been a pioneer in mapping bentonites worldwide, establishing their volcanic sources and stratigraphically correlating them, thereby providing a time stamp on sequence stratigraphy. To do this requires geochemical and statistical analyses that confirm the stratigraphic correlations and an understanding of how volcanic glass reacts, when buried, to produce clay minerals (glass → smectite → illite) that incorporate elements from pore fluids.

Figure 1 The Late Ordovician Deicke K-bentonite is exposed in the upper Carters Limestone near Carthage (Tennessee, USA). The Deicke bentonite is 30–40 cm thick. Exposures are widespread and can be traced through much of eastern North America. During the Taconic Orogeny (Cambrian to Silurian, mainly affecting the New England area), collision of a microcontinent at the southeastern margin of Laurentia caused horizontal compressive stress to be transmitted deep within the Laurentian craton that reactivated long-lived zones of crustal weakness. Large volumes of ash were ejected from volcanoes on the SE margin of Laurentia and were carried northwestward by the prevailing trade winds for hundreds of kilometers, to accumulate in shallow cratonic seas. The study of such bentonites can reveal aspects of the depositional, alteration, and paleofluid history. Photo by Warren Huff; includes Dennis Kolata (ISGS) and John Haynes, James Madison University (Virginia, USA).]

Figure 2 Professor Warren Huff, University of Cincinnati (USA), CMS Secretary since 2005!

Why is this important to a Geologist?

The volcanic ash layers provide a relatively homogeneous glass, without many detrital inputs that complicate the mineralogical and geochemical composition. These very fine-grained deposits have low permeability, but the pore fluids allow diffusion of elements along grain boundaries which is why K^+ commonly infiltrates the bentonite beds to promote illitization as the burial temperatures increase (see papers by George Christidis, Crawford Elliott, Paul Schroeder, Bruno Lanson). This leads to reactions that form new crystals. This understanding of crystal growth and crystal size distributions (see papers by Dennis Eberl, Jan Srodon, Victor Drits) led to realizations that the chemical compositions of different illite size-fractions (<20 nm, 20–50 nm, 50–100 nm) may reflect the paleofluid composition at the time of crystal growth. Dating using the K/Ar method on the illite size-fractions (see papers by Norbert Clauer, Jan Środoń, Miriam Wampler) indicates that the first nucleated, finest crystals of illite are generally older than the larger size-fractions that have grown new material. Thus, chemical measurements (e.g. trace elements, isotope ratios) of the finest illite size-fraction should record the chemistry of the original fluids from which the mineral first nucleated; successively larger size-fractions of illite should record successive changes in the fluid composition over geologic time.

Did you know that within one hand sample of bentonite you can get a record of over 50 Ma of chemical variations that reflect changing environmental conditions? Combined with age dating of each size-fraction, the illite from bentonites reveal the timing of distinct environmental events (hydrocarbon influx, toxic spill, climate change). It is exciting to imagine the environmental studies that await recognition of this critically important geological tool that was discovered through international communication and collaboration among pioneers in this science (more than those listed). And all were dedicated members of the Clay Minerals Society. If you are interested in learning more, come join us … and pioneer your own path.

Student membership ($35/year) qualifies you for travel and research grants up to $3,000 and includes a subscription to ***Elements*** and on-line access to ***Clays and Clay Minerals***.

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2018 CMS PROFESSIONAL AWARD RECIPIENT SPOTLIGHT

The **2018 George W. Brindley Lecture Award** was bestowed on **Dr. Cliff T. Johnston.** He received the award and gave a talk titled "Probing the Hydrophobic/Hydrophilic Nature of Clay Minerals at the Mesoscale Scale" at the 55th CMS Annual Meeting held at the University of Illinois at Urbana-Champaign (USA) in June. Cliff Johnston is Professor of Soil Chemistry in the Departments of Agronomy and Earth, Atmospheric and Planetary Sciences at Purdue University (USA). His expertise is at the intersection of clay mineralogy, soil and water science, and environmental chemistry. The focus of his research program is directed at understanding clay–water and clay–organic interactions as they relate to the fate and transport of contaminants in the environment. He has expertise both in inorganic (As, ^{137}Cs, Pb, Cr, Cd) and organic contaminants such as dioxins, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and pesticides. During the last 10 years, he has worked closely with environmental chemists and toxicologists at the Michigan State University (USA) to assess the bioavailability of contaminants bound to soils. In addition, he has projects focused on soil organic matter, biochar (charcoal used as a soil amendment), greenhouse gas emissions from soils, and the interaction of nutrients in soils. He has active research collaborations in China, Japan, Taiwan, South Korea, Australia, Germany, Italy, Spain, Belgium and Brazil. He teaches the following graduate and undergraduate courses: Soil Chemistry, Soil Biogeochemistry, Introduction to Environmental Science, and Soil Physical Chemistry. He has served as President of the Clay Minerals Society, presently serves as the Curator of the Source Clay Repository, and is a member of the Association Internationale pour l'Étude des Argiles (AIPEA). Dr. Johnston is also a recipient of the 2001 CMS Marion L. and Chrystie M. Jackson Mid-Career Clay Scientist Award and the 2002 Marion L. and Chrystie M. Jackson Mid-Career Soil Science Award. He is a Fellow of the Soil Science Society of America.

STUDENT RESEARCH SPOTLIGHT

Congratulations to **Yayu Li** (University of Connecticut, USA) for winning the 2018 CMS Student Research Grant!

Yayu Li's work uses **^{23}Na NMR spectroscopy to study cation adsorption on montmorillonite.** Montmorillonite plays a critical role in cation retention in soils, which is directly related to soil health and safety. The cation adsorption process in montmorillonite is complex, because the clay is expansive. The interlayer spacing of montmorillonite is influenced by the cations residing in it, which will, in turn, affect its cation adsorption ability. The adsorption strength of Na^+ on montmorillonite increases in the presence of Cs^+, an ion that is widely known to cause clay collapse. According to the nanopore inner-sphere enhancement effect (which states that cations tend to dehydrate in constrained adsorption sites), the enhanced adsorption strength of Na^+ on montmorillonite in the presence of Cs^+ likely results from the dehydration of Na^+ in the collapsed interlayer space. Yayu will determine the hydration state of adsorbed Na^+ by using nuclear magnetic resonance spectroscopy. This study will help improve our understanding of the cation adsorption mechanisms on montmorillonite.

CMS MEMBERSHIP RENEWAL

DON'T FORGET TO RENEW YOUR MEMBERSHIP FOR 2019!

10th INTERNATIONAL CONFERENCE ON THE OCCURRENCE, PROPERTIES, AND UTILIZATION OF NATURAL ZEOLITES

Participants of the excursion to the Wieliczka Salt Mine.

The conference was co-organized by the Mineralogical Society of Poland (MSP) and took place 24–29 June 2018 at the Faculty of Materials Science and Ceramics in the AGH University of Science and Technology in Krakow (Poland). The organizers of the conference were Wojciech Franus (Lublin University of Technology, Poland), Tomasz Bajda (AGH University of Science and Technology) and Magdalena Wdowin (Polish Academy of Sciences, Warsaw). The honorary patronage over the conference was taken by the Rector of the AGH University of Science and Technology, Tadeusz Słomka.

The conference was attended by 140 participants from 26 countries, representing both the scientific community and industry. Forty-six oral presentations and 43 posters were presented. In the thematic sessions, the current state of knowledge on natural zeolites was presented in terms of their occurrence and formation; their mineralogy; the functionalization of their surfaces; and their applications in catalysis, engineering and environmental protection, construction, and medicine.

A meeting of the International Natural Zeolite Association (INZA) was held during the conference, where the organizer for the 2022 conference was selected: Alessio Langella (Ischia, Italy). Also, the new president, vice-president and members of the INZA board were chosen. The new president is Athanasios Godelitsas (University of Athens, Greece).

The last day of the conference was a technical field trip to the zeolite deposit in Nižný Hrabovec (Slovakia) and an excursion to the awe-inspiring Wieliczka Salt Mine. More information and memories can be found at http://zeolite2018.org/.

Magdalena Wdowin, PAS

RECENT ARTICLE PUBLISHED IN *MINERALOGIA*

In the paper entitled "Polymetamorphic Evolution of Pelites inferred from Tourmaline Zoning – The Rędziny Hornfels Case Study at the Eastern Contact of the Karkonosze Granite, Sudetes, Poland", Jarosław Majka and co-authors studied of zoned tourmalines that were discovered in hornfels rocks located around a granitic intrusion in the northern part of the Bohemian Massif. The zoned tourmalines record at least two stages of crystallization. The authors suggest that the cores and mantles of the tourmaline crystals formed during regional metamorphism, whereas the distinctively Al- and Ca-enriched rims grew during subsequent contact metamorphism caused by the intrusion of the Karkonosze Granite, which is dated to ~315 Ma. This case study shows that tourmaline can be used as a reliable petrogenetic indicator. Additionally, the authors speculate on the pressure–temperature conditions of the contact metamorphism and the emplacement depth of the neighbouring granite. If you would like to see more details of this study, please visit the website of *Mineralogia* (link to the article: https://content.sciendo.com/view/journals/mipo/ahead-of-print/article-10.2478-mipo-2018-0003.xml).