The Clay Minerals Society

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SAU-1: UNIQUE AUSTRALIAN BENTONITE NOW PART OF THE SOURCE CLAYS REPOSITORY

The Clay Minerals Society (CMS) Source Clay Repository has a new source clay on offer. It is called SAu-1 and is a unique magnesian–sodic bentonite from the Arumpo deposit of New South Wales (Australia). Discovered in the early 1990s, this economic bentonite formed from an ~3Ma regional volcanic ash deposit in (then) coastal brackish/estuarine waters (Gardam et al. 2009).

Bentonite SAu-1 is >90% dioctahedral smectite (montmorillonite) (Fig. 1) with 10%–20% interstratified illite (Churchman et al. 1999; Churchman et al. 2002; Gates 2004). Associated non-smectite minerals include anatase and dune-derived quartz sand.

Bentonite SAu-1 differs from other source clays (Table 1) by having a low pH (<6), a very fine particle size, high exchangeable magnesium (related to volcanism), and an appreciable amount of illite–smectite (IS) interstratification (Raven et al. 2017; Liu et al. 2019). Major oxides content (Table 2) and X-ray diffraction results (Fig. 1) indicate that

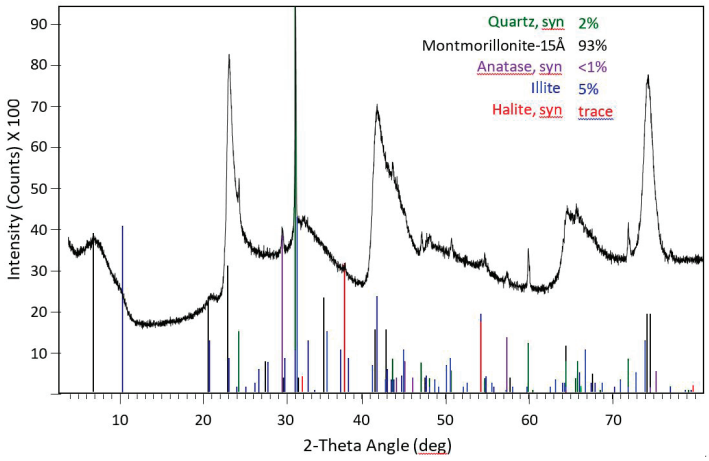

Figure 1 X -ray diffraction of the new, "as received", micronized, SAu-1 source clay.

SAu-1 has 10%–20% interstratified illite–smectite. Estimated structural formulae (Table 3) indicate that ~45% of the layer charge is tetrahedral, likely related to the I:S content. Compared to SWy-2, SAu-1 is a low-swelling clay, but activation with soda ash and adequate hydration time improves swelling and thus enhances geotechnical properties, such as permeability, fluid loss and viscosity.

Visit https://cms.clays.org/sourceclayproforma.html to purchase SAu-1 ($US100 for 250g) or the many other source clays, specialty clays and Reynolds Cup reference mixtures.

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Table 1 Particle size and indicative exchange properties of bulk SAu-1.

	Bulk material
Fraction < 2 µm (%)	85
Fraction < 0.2 µm (%)	75
Cation exchange capacity ($cmol_+$/kg)*	69.0
Exchangeable Ca^{2+} ($cmol_+$/kg)	<0.4
Exchangeable Mg^{2+} ($cmol_+$/kg)	16.0
Exchangeable Na^+ ($cmol_+$/kg)	45.0
"Exchangeable" K^+ ($cmol_+$/kg)	3.5

$cmol_+$ = centi-molar equivalence of mono-ionic charge

Table 2 Major oxides content of bulk clay and the calcium-exchanged < 2 µm and < 0.2 µm fractions of SAu-1 on a 105°C-dried basis.

(%)	Bulk	<2 µm	<0.2 µm
SiO_2	60.39	57.66	57.82
TiO_2	0.58	0.61	0.46
Al_2O_3	20.55	20.71	20.94
Fe_2O_3*	4.35	4.48	4.56
MnO	<0.01	<0.01	<0.01
MgO	5.17	4.02	4.00
CaO	0.02	2.49	2.53
Na_2O	1.41	0.11	0.11
K_2O	1.36	1.12	1.09
LOI**	6.1	8.8	8.5
Sum	99.98	99.99	99.99

* Iron is ferric; ** LOI = Loss on ignition

Churchman J and 6 coauthors (1999) Arumpo bentonite: nature and origin of deposit, properties and uses. In: Stewart R (ed.) Murray Basin Mineral Sands. Extended Abstracts of Papers Presented at a Conference held in Mildura, 21–23 April, 1999. Australian Institute of Geoscientists Bulletin 26: 29–33

Churchman GJ and 5 coauthors (2002) Geotechnical properties indicating environmental uses for an unusual Australian bentonite. Applied Clay Sciences 20: 199-209

Gardam M, Mason AJ, Reid AF, Churchman GJ, Raven M (2009) Arumpo bentonite deposits: distinctive indicators of past volcanic events in the Murray Basin, southeastern Australia. Australian Journal of Earth Science 55: 183-194

Gates WP (2004) Crystalline swelling of organo-modified clays in ethanol–water solutions. Applied Clay Science 27: 1-12

Liu Y, Gates WP, Bouazza A (2019) Impact of acid leachates on microtexture of bentonites used in geosynthetic clay liners. Geosynthetics International 26: 136-145

Raven MD, Self P, Gomez-Camacho R, Gates W, Hillier S (2017) Characterisation of two Australian smectite clays for possible submission to the CM Source Clays Repository. 54th Annual Clay Minerals Society Conference, Edmonton, Canada, 2–8 June 2017. Abstract and presentation.

Table 3 Indicative structural formula on an O_{22} basis; structural charge after excluding anatase. Illite:smectite is included in the calculation.

	Tetrahedral		Octahedral			Layer charge		
	Si	Al	Al	Fe	Mg	Tetrahedral	Octahedral	Total
<2 µm	7.62	0.38	2.84	0.45	0.79	–0.38	–0.54	–0.92
<0.2 µm	7.60	0.40	2.85	0.45	0.78	–0.40	–0.53	–0.93

International Association of GeoChemistry

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STUDENT RESEARCH SPOTLIGHT

Congratulations to Jake Roberson (Sul Ross State University, Texas, USA) and Erin Gibbons (McGill University, Canada) for winning 2020 CMS Student Research Grants!

Jake Roberson

Jake studies the **effect of clays on acoustic signals**. The lower Rio Grande River (USA) is monitored by the US Geological Survey to understand invasive and native vegetation impacts on sediment transport and depositional processes along the river over time. Multifrequency side-looking acoustic-Doppler profiler instruments have been used to provide sediment load estimations at two locations in the Big Bend National Park (Texas), demonstrating a unique relationship between clay- and silt-sized particle concentration and an attenuation coefficient associated with the acoustic signals. Jake's primary aim is to investigate a possible correlation between a specific clay mineral and that unique relationship by X-ray diffraction analysis of suspended sediment samples taken in the lower Rio Grande. Results of the study will help US Geological Survey researchers understand how these acoustic signals interact with clay- and silt-sized particles.

Erin Gibbons

Erin studies **how evidence of possible past life on Mars may be preserved in the planet's ancient rocks and how it may be detected**. Because clay minerals are important agents of fossil preservation on Earth, Erin is working to develop new techniques to improve our ability to identify and characterize clays on Mars. She is currently exploring an approach known as "data fusion", which integrates geochemical and mineralogical information collected from multiple sensors on the Mars rovers to better understand the geological environment. Erin hopes that this strategy will contribute to more accurate mineral estimations and help guide the rover to compelling astrobiology sampling sites. She looks forward to the day when we discover extraterrestrial life.

OPEN CALL FOR IACG EMERGING INVESTIGATOR SERIES

We, the International Association of GeoChemistry (IAGC), are delighted to announce the Emerging Investigators Series in our society's journal, *Applied Geochemistry*. The aim of the series is to highlight excellent work done by independent researchers early in their career and which brings new insights into the field of geochemistry or that promotes geochemical applications. Multidisciplinary work related to applied geochemistry, biogeochemical processes, and environmental geochemistry are also highly welcomed. Featured articles and information about the authors will be extensively advertised to diverse disciplines and communities through multiple platforms of the journal and the IAGC. The selected "emerging investigators" will also be considered as candidates for an early career honor bestowed by the IAGC and be offered editorial engagements with *Applied Geochemistry*.

Application Procedure

Applicants should have completed their PhD (or equivalent degree) within the last 10 years and have an independent career in order to apply to the Emerging Investigators Series. Interested researchers should contact **Editors-in-Chief Michael Kersten** and **Zimeng Wang** with the following information:

1. Up-to-date CV with full name, affiliation, contact information. The CV should be no longer than 3 pages and include education and career, a selected list of publications, professional achievements, honors and awards, and a website featuring the applicant's group (if available).

2. A synopsis of the article intended to be submitted to the series, including a tentative submission date. Please see www.journals.elsevier.com/applied-geochemistry for more information on the manuscript types and instructions to authors. Regular research article, rapid communications, feature articles, and critical reviews are all acceptable to the series.

Reviewing Criteria

Applications will be reviewed by the editors and the advisory board of *Applied Geochemistry* based on the following four criteria: 1) the originality and novelty of the research; 2) the scientific quality of the research; 3) the potential for significant impact; and 4) balancing factors related to inclusion and diversity. The selected applicants will receive a formal invitation from the journal to submit their featured articles. Please note that submitted articles for the series will still undergo the same rigorous peer-review process as regularly submitted papers.

Schedule

This is an ongoing series, and featured articles will continuously be added into the collection of the Emerging Investigator Series and will be displayed on the journal's media pages, on the IAGC website, and across social media platforms.