

BASELINE STUDIES OF THE CLAY MINERALS SOCIETY SOURCE CLAYS: INTRODUCTION

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INTRODUCTION

Clay minerals share a basic set of structural and chemical characteristics (e.g. they are largely aluminosilicates with layer structures) and yet each clay mineral has its own unique set of properties that determine how it will interact with other chemical species. The variation, in both chemistry and structure, among the clays leads to their applications in extremely diverse fields. Common and important industrial applications of clays are in the manufacture of paper, paint, plastics and rubber. One of their more recent and most economically important applications is in the pet-litter industry where their adsorptive and deodorizing properties are used. Specialty uses include clay additive to chicken feed to boost nutritional uptake by the chicken, and in using clay as fillers and major ingredients in pharmaceuticals and cosmetics. Clays are used for their catalytic properties and for their ability to adsorb greases, fats and other organic materials. Those who exist with scarce resources frequently collect clays from local deposits and ingest them as a source of dietary minerals. It is difficult for a day to go by without using a product incorporating clay minerals, as we all use ceramics such as dinnerware and sanitaryware.

Despite this widespread use of clay minerals, many research and technical scientists who have little or no training in clay mineralogy frequently use uncharacterized clay minerals in their experiments, assuming that all clay minerals are alike. Similarly, uncharacterized clay minerals may be used as fillers because of the belief that they are inert. Neither belief is correct. Parallel, but otherwise identical experiments using a high-charge smectite and a low-charge smectite will likely produce very different results. The importance of using correctly identified and well-characterized minerals cannot be overemphasized.

To assist scientists who use clay minerals in their experiments, The Clay Minerals Society has assembled and made available a collection of clay minerals for which a nominal fee is charged. The common physical and chemical properties of each of these clays have been studied and the results of these studies make up the remainder of this publication.

SOURCE CLAYS

The collection is presently housed in the Source Clays Repository at the University of Missouri, under

the curatorship of William D. Johns, Department of Geological Sciences. The Source Clay Repository contains both Source Clays and Special Clays. Although of interest, the Special Clays are relatively rare and are available only in small quantities and thus are not included in this handbook.

The Source Clays are collected from large, commercial, reasonably homogeneous deposits that have been carefully selected to be both representative of the clay mineral and to minimize variation. Techniques that are routinely used by industry to process the freshly mined clay can significantly change the properties of the clay. Therefore, the companies that provide the Source Clays have agreed to use only low-temperature, steam-fired tray drying, and imp or Raymond mill pulverization. One metric ton of each clay was made available initially to the repository. The Source Clays presently available for purchase in 500 g units include: KGa-1b kaolinite, low-defect, Washington County Georgia, USA. (Note: KGa-1b replaces KGa-1); KGa-2 kaolinite, high-defect, Warren County, Georgia, USA; PFI-1 palygorskite ('attapulgitite'), Gadsden County, Florida, USA; SAz-1 Ca-montmorillonite ('Cheto'), Apache County, Arizona, USA; SHCa-1 hectorite, San Bernardino County, California, USA (contains appreciable calcite as an impurity); STx-1 Ca-montmorillonite, Gonzales County, Texas, USA; SWy-2 Na-montmorillonite, Crook County, Wyoming, USA (Note: SWy-2 replaces SWy-1), and Syn-1 Barasym SSM-100, synthetic mica-montmorillonite (NL Industries). This synthetic clay is no longer being produced.

Ordering information and a list of both the Source Clays and the Special Clays can be found on the internet at the web site of The Clay Minerals Society at <http://cms.lanl.gov>. This information is also available at the web site of the Source Clays Repository, <http://web.missouri.edu/~geoscjy/SourceClay/>. The latter also offers chemical and physical data for the clays and a biography relating to the Source and Special Clays.

This information can also be obtained by contacting W. D. Johns at: Source Clays Repository, Department of Geological Sciences, 101 Geological Sciences Building, University of Missouri, Columbia, MO 65211 USA. Tel. (573)882-3785 or (573)884-1453, Fax (573)882-5458, E-mail: johnsw@missouri.edu

SAMPLE PREPARATION

Except for X-ray diffraction analysis, which was performed on a fine size-fraction of the samples and of the samples as supplied by the Repository, the fine-size fraction of each of the Source Clay Mineral samples was used. The fine-sized particles ($<2 \mu\text{m}$) were separated by centrifugation. To ensure homogeneous sample preparation throughout the study, each of the samples was prepared at the State University of New York at Buffalo using the procedure given in Moore and Reynolds (1997, pp. 211–212).

In each case, 25 g of the clay sample were placed in a 600 mL polyethylene centrifuge bottle along with 500 mL of distilled water and allowed to hydrate for 24 h to form stable dispersions. Except for the two kaolinites, KGa-1b and KGa-2, no dispersing agent was added. For KGa-1b and KGa-2, Na hexameta-phosphate was added to the suspensions. The suspensions were shaken thoroughly and then centrifuged for

6 min at 600 rpm in an IEC Centra-8 centrifuge. The supernatant liquid was then poured into 200 mL polypropylene cups, frozen, and then placed in a freeze drier until the ice was sublimated. The samples were placed in sealed containers and sent to the various laboratories for analyses.

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REFERENCES

Moore, D.E. and Reynolds, R.C., Jr. (1997) *X-ray Diffraction and the Identification and Analysis of Clay Minerals*, 2nd edition. Oxford University Press, New York, 378 pp.

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