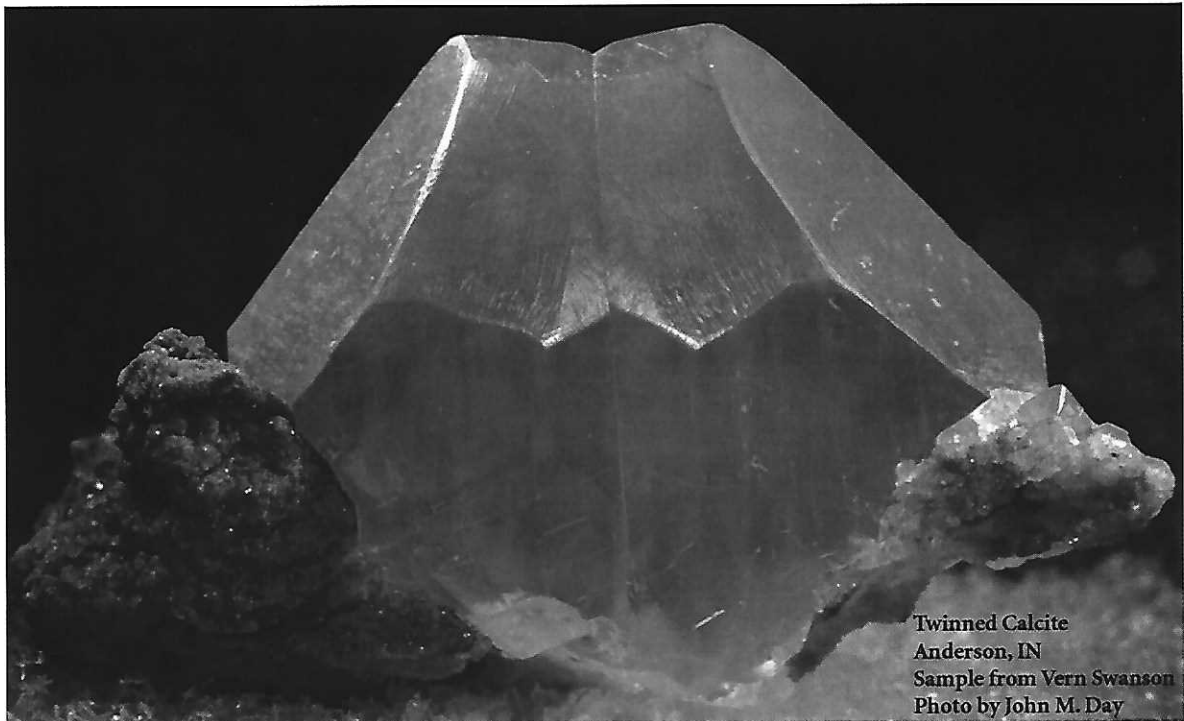


***FRIENDS OF MINERALOGY  
MIDWEST CHAPTER***



PRESENTS

**THE SIXTH ANNUAL MIDWEST MINERAL  
SYMPOSIUM  
INDIANA STATE MUSEUM  
INDIANAPOLIS, INDIANA**

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## CONCRETION, GEODES AND OTHER ROUND FORMS

Enrique Merino

Indiana University Geology Dept

The traditional view is that agates are quartz infillings of cavities in basalt, which implies open-system growth at low temperature from water. This view has good evidence in its favor: oxygen isotopes; association with clays and zeolites; close similarity with chert concretions and quartz geodes – all round and quartzose. But it has problems too: No evidence of silica transport through basalt around agates. Some agates occur in fresh basalt. How could precipitation from water yield the repetitive and sequential textures that agates are known for – concentric bands, chalcedonic texture, big crystals inward?

We found several years ago by modeling the quartz growth process that the only way for the repetitive banding and the chalcedonic fibrosity to be generated was for the quartz to grow from very silica-concentrated media – that is, from silica gels. But how to emplace a gel in a basalt?

The way to do that is: a hot basalt flow traps a puddle on the ground, just after perhaps boiling off half of it or more. The water vaporizes, enters the flow from below, quickly forms a ball of gel by sticking to the silica polymers in a small volume of melt. The flow keeps moving, stops, starts to cool, and within a few years crystallizes. The silica gel lump inside crystallizes too, at roughly the same time, temperature, and rate as the host basalt. This means the agate must form at  $> 800\text{ }^{\circ}\text{C}$ , and in just a few months within a few years of eruption. This is the new model. If true, one could make agates in 3 months!

As the gel crystallizes inward the water and trace elements in it (such as iron) get swept to the center void. At the end, goethite, an iron oxyhydroxide typical in many soils, crystallizes together with the latest quartz in the agate. New isotopic data my colleagues have obtained for an amethyst and the goethite in it in one agate do yield minimal fractionation, which indeed confirms the huge temperature of crystallization the new model predicts. Thus, according to the new picture and evidence, agates are closed-system, syngenetic, and very-high-temperature precipitates of quartz.

Enrique Merino, Geology Dept (1005 E. Tenth Street)  
Indiana University, Bloomington, IN 47405

812-855-5088 (voice mail); fax 812-855-7899

<http://www.indiana.edu/~geosci/people/faculty/merino.html>

## **MINERALS OF THE FINDLAY ARCH DISTRICT, NW OHIO**

**Ernest H. Carlson**

**Department of Geology, Kent State University, Kent, OH**

Quarries in NW Ohio with Mississippi Valley-type minerals sit astride a large rock structure known as the Findlay Arch. Mineralization occurs in porous carbonate rocks that range in age from Middle Silurian to Middle Devonian. The most abundant minerals include: calcite, celestine, dolomite, fluorite, galena, marcasite, pyrite, sphalerite, and strontianite. Interest in the district dates back to 1819, when Professor Douglass, an instructor at West Point Military Academy, was on maneuvers in western Lake Erie and discovered large bladed crystals of celestine on Green Island. Although the district is mostly of interest to mineral collectors, celestine has been mined at two sites in Ottawa County, South Bass Island in the 1890's and a quarry near Genoa in 1940. Drilling was done in Wyandot County in the 1970's in the search for concealed lead/zinc deposits in Middle Ordovician rocks.

The district is best known for several world-class mineral occurrences. Old quarries on Kellys Island, Erie County, are acclaimed for colorless crystals of calcite exhibiting hexagonal dipyramids with basal pinacoids. Near Custar, Wood County, a quarry is famous for caves lined with large honey-colored scalenohedrons of calcite, and pockets filled with groups of sky blue prismatic crystals of celestine. Crystal Cave on South Bass Island, Ottawa County, is world renowned for a cave lined with tabular crystals of celestine that are 18 inches long and possibly the largest in the world. A quarry near Clay Center, Ottawa County, has yielded fine colorless bladed crystals of celestine and wine-colored cubes of fluorite over the years. A quarry at Lime City, Wood County, was especially noted in the 1970's for caves lined with prismatic to tabular crystal groups of celestine, and later for pockets containing large wine-colored cubes of fluorite. Unusually large bladed crystals of celestine have been recovered in recent years from small caves at a quarry near Portage, Wood County. Old quarries at Tiffin, Seneca County, and newer ones near Gibsonburg, Sandusky County, and Junction, Paulding County, are especially famous for cubes of iridescent brown fluorite. A quarry near Huntsville, Logan County, is renowned for lustrous diploidal crystals of pyrite. A quarry near Maple Grove, Seneca County, has yielded excellent groups of pale-brown radiating acicular crystals of strontianite.

# Minerals in Kentucky

Warren H. Anderson  
Kentucky Geological Survey

Kentucky has a rich assortment of minerals in various parts of the State. Many of the sedimentary rocks contain nodules, vugs, geodes and veins of minerals. Geodes containing quartz, sulfides and sulfates occur in parts of Kentucky. One of the most famous localities for Millerite is located in Halls Gap, Ky where the Millerite occurs in small geodes. Vein type mineral deposits contain sulfides, fluorides and sulfates, while the agate field of eastern Kentucky has become famous for red and black silicious agates. Meteorites also occur in Kentucky, but they are very rare. Kentucky also has some rare igneous rocks such as kimberlites and peridotites in eastern and western Kentucky that contain garnets, serpentine, olivene, ilmenite, magnetite, chromite and mica. The Kentucky Geological Survey has a museum and educational display of minerals from Kentucky in the Mining and Minerals Resources Building on the University of Kentucky campus.

## Vein Deposits

Both the central Kentucky Mineral District and the western Kentucky Fluorspar District contain a suite of minerals consisting of fluorite, barite, sphalerite, galena, calcite, gypsum, dolomite and secondary minerals such as smithsonite, cerussite, anglesite, and numerous secondary sulfates. Fluorite is one of the most common minerals collected; purple, blue, yellow and clear crystals form in veins in central and western Kentucky. Calcite has been found in numerous habits including optical rhombic, scalenohedrens, nailhead and travertine. Gypsum has been found as transparent selenite crystals, satin spar, and gypsum flowers in these veins.

## Agates

Kentucky agate occurs in east-central Kentucky and can occur as multi-colored banded silicious agates or nodules in Mississippian rocks. Blue, yellow, red, brown and black are the most common colors and the red and black seem to be most favored by collectors.

## Geodes

Geodes occur in various parts of the state, usually containing various habits of quartz, and some sulfides. Millerite occurs in Lincoln County and is a world class locality for Millerite specimens.

## Meteorites

Twenty-seven meteorites have been documented as fallen in Kentucky and they consist of iron meteorites and stoney meteorites. The most famous meteorite would probably be the Murray carbonaceous chondrite, a meteorite very high in pri-mordial gases and organic matter, suggestive of an early solar system origin.

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# Minerals in Indiana

## By Nelson Shaffer

### Midwest Chapter Friends of Mineralogy

Indiana abounds with collectable well-crystallized minerals. Many are mundane but others are world-class. More than 100 mineral species have been reported from Indiana including one species, smythite, that was first found in Indiana. The now discredited clay species Indianite was first noted in Indiana, but later was found to be a mixture of minerals.

Good crystals of calcite are the best and most common well-crystallized specimens. Calcite crystals occur in most of Indiana but are especially common in Devonian rocks of the Muscatatuck Group, Silurian carbonates of Wabash, Salamonie and Louisville Formations, and Mississippian rocks of the Sanders and Blue River Groups. Sanders Group rocks host geodes that contain small but excellent and diverse crystals throughout south central Indiana. Dolomite is common near Corydon especially as large, pink crystals. Gypsum deposits occur in carbonate rocks of southwestern and northern Indiana but gypsum occurs in other situations. Aragonite occurs sometimes in beautiful, white large specimens as speleothems and geode fillings. Siderite forms concretions in several widespread shale units; some of these concretions are nucleated around fossils and many host sulfides, barite and clays in syneresis cracks. Sulfides occur throughout the state with outstanding iron sulfide (pyrite and marcasite), sphalerite, and galena concentrations at Pleasant Ridge. Excellent pyrite concretions developed in black shales and selected carbonate units. Sphalerite is widespread and can form masses of many pounds. Galena is much more rare. Sulfate minerals, developed from sulfide oxidation, are common as are efflorescences formed from evaporation of ground waters in caves or an outcrop. Rare sulfates such as barite and celestite are more localized in the south central part of the state. Fluorites in large, excellent crystals have been collected near Fort Wayne and many examples of smaller crystals are known. Chert is a common quartz form, but quartz also grows in many varieties especially in geodes. Clay minerals are easy to overlook, but special clays including halloysite and very well crystallized kaolinites are notable. Various oxides grow in Indiana and many others, often in the form of heavy minerals, were moved here by glacial actions which also brought gold, garnets, zircons, and other exotic minerals. Phosphate, mostly as carbonate fluorapatite and vivianite, are present as are other rare phosphates.

Unrecognized species doubtlessly remain to be collected and identified. The ability to collect at new sites decreases yearly so mineral collectors need to savor existing samples and search their holdings for previously unreported minerals.

## **From Outcrop to a Kilometer Below the Deep Sea Floor: Sediment Chemistry and Mineralogy on the Bengal Fan**

**Anne Argast, Dept. of Geosciences,  
Indiana University -Purdue University Fort Wayne,  
2101 E. Coliseum Blvd., Fort Wayne, IN 46805-1499**

Clastic sedimentary rocks are the product of a complex set of processes that includes weathering on an exposed outcrop, transportation of the eroded debris, deposition and burial. In each of these regimes, characteristic processes act on the rocks and minerals. Understanding the physical and chemical changes caused by these processes is of fundamental importance when trying to understand clastic sedimentary rocks.

Potassium is an element of special interest. Weathering reactions tend to remove potassium as a dissolved ion in ground water. Potassium can be rapidly exchanged on the surfaces of some clay minerals during transport. Sorting and reworking tend to redistribute potassium according to grain size. During deep burial, potassium can be redistributed into different clay mineral phases, and claims have been made that potassium fluxes during deep burial result in massive transfers of  $K_2O$  over large vertical and horizontal distances.

The Bengal Fan is the world's largest deep-sea fan having a volume of  $12.5 \times 10^6 \text{ km}^3$ . It is mostly composed of sediment eroded from the Himalayan Mountains and carried to the Bay of Bengal through the Ganges-Brahmaputra system. (Biogenic debris from pelagic sources and minor admixtures from other crustal sources also contribute to the volume of the Bengal Fan.) A core at Deep Sea Drilling Project site 218 penetrates the Bengal Fan to a subbottom depth of 773 m. This core records four separate turbidite pulses distributed from near the sediment/water interface to the bottom of the core. A detailed study of the chemistry and mineralogy of these four pulses reveals remarkably little change in grain morphology and microchemistry from top to bottom in the core. Bulk sediment chemical trends, especially those involving potassium, are also remarkably similar throughout the core, are identical to the types of trends observed in once deeply buried (and even metamorphosed) sedimentary rocks and are explainable within the context of transport-related sorting processes. The results strongly suggest that massive fluxes of  $K_2O$  are not required to explain observed inhomogeneities in the distribution of potassium in this clastic sedimentary sequence, and call into question the general applicability of massive-flux K-metasomatism as part of deep diagenesis. Further investigations in more deeply buried deltaic sediments are pending.



**Mexican Microcrystals from Acanthite to Zinkenite**  
**Dan Behnke**  
**Northbrook, IL**

Mining for gold and silver in Mexico dates back to prehistoric times while “modern” mining history can be tracked for about the last 500 years. Silver was the primary objective, and even today Mexico is still a world leader in the production of silver: other important mineral resources are gold, copper, lead and zinc. The variety of colorful species available to collectors is due not only to the availability of silver and the silver bearing minerals but also due to the large number of secondary minerals found in the oxide zones of the hydrothermal deposits.

There are eleven geological provinces in Mexico most of which were the sources of the micros included in the program. Two of the mountainous regions in the country run north to south: on the west there is the Sierra Madre Occidental while on the east there is the Sierra Madre Oriental. The Mesa Central is the plateau that lies in between them. The third range, Sierra del Sur is smaller and runs east to west in the southern portion of the country. The names of some of the mining districts are very familiar to collectors of Mexican minerals: Santa Eulalia, Naica, Mapimi, Taxco and Zacatecas.

Comprehensive documentation of the minerals of Mexico is rare. An excellent reference is *Minerals of Mexico* by William D. Panczner published by Van Nostrand Reinhold in 1987 and now out-of-print. Over the course of four years in the late 1980s, the Boletín de Mineralogía published a list in Spanish of the species found in Mexico and the number came to over 475. The real challenge is finding many of them in micromineral size. There are over 80 species represented in this program, the majority of which are in the oxide, arsenate, carbonate, and silicate chemical classes.