FRIENDS OF MINERALOGY
Pennsylvania Chapter

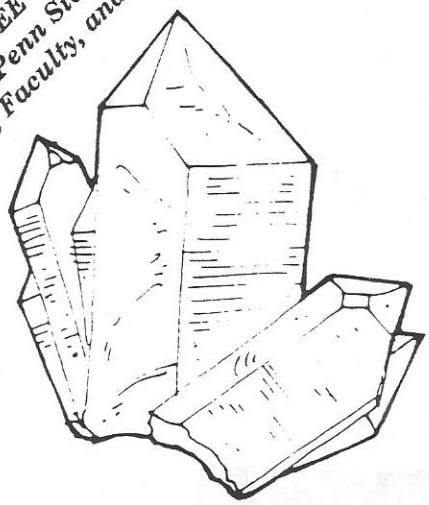
WORLD CLASS MINERAL DEPOSITS

Friends of Mineralogy 1993 Fall Symposium

Sponsored by the

Friends of Mineralogy
Pennsylvania Chapter
and
Pennsylvania State University
State College ,Pennsylvania

FREE to all Penn State Students, Faculty, and Staff



Friends of Mineralogy Symposium
"World-Class Mineral Deposits"

Pennsylvania State University
State College, Pennsylvania

October 8th-9th-10th, 1993

SCHEDULE OF EVENTS

Friday, October 8th

MUSEUM OPEN HOUSE and RECEPTION	*Room 112, Steidle (Art Gallery)*	*7:00 to 11:00 p.m.*

Saturday, October 9th

REGISTRATION and Coffee and Donuts	*Lobby, Deike Building*	*8:00 a.m.*
WELCOME	*Room 26, Mineral Sciences*	*9:05 a.m.*
WORLD CLASS MINERAL DEPOSITS: AN INTRODUCTION *Andrew A. Sicree*	*Room 26, Mineral Sciences*	*9:15 a.m.*
HABITAT OF DIAMONDS: EXPLORATION CONSTRAINTS *Dr. David P. Gold*	*Room 26, Mineral Sciences*	*9:30 a.m.*
MINERALOGY OF TANOMA KIMBERLITES INDIANA COUNTY, PENNA. *Chuma Mbalu-Keswa and Dr. David P. Gold*	*Room 26, Mineral Sciences*	*10:00 a.m.*
VIBURNUM TREND Pb-Zn ORE DISCOVERY: MISSOURI BECOMES LEADER IN Pb MINING *Mr. Heyward Wharton*	*Room 26, Mineral Sciences*	*10:45 a.m.*
LUNCH BREAK	*At Will*	*11:15 a.m.*
COLLECTIONS OF PENN STATE UNIV.: THE GENTH COLLECTION *Dr. Deane Smith*	*Room 26, Mineral Sciences*	*1:00 p.m.*
MINERALOGY OF MONT ST. HILAIRE *Marcell Weber*	*Room 26, Mineral Sciences*	*2:00 p.m.*
MINERAL SPECIMEN BENEFIT AUCTION *Friends of Mineralogy Grant Fund*	*Room 26, Mineral Sciences*	*2:45 p.m.*
TOURS	*Meet in Deike Building Lobby*	*3:45 p.m.*
THE FRANKLIN-STERLING HILL DISTRICT *Richard Bostwick*	*Atherton Hilton* *Banquet: Tickets $18*	*6:00 p.m.*

Sunday, October 10th

FIELD TRIP TO ROARING SPRING QUARRY	*Meet in Lobby, Deike Building*	*8:00 a.m. to 5:00 p.m.*

Sponsored by the Pennsylvania State University Earth & Mineral Sciences Museum and the Friends of Mineralogy, Pennsylvania Chapter

The Pennsylvania State University
Earth & Mineral Sciences
Museum and Art Gallery

112 Steidle Bldg., Pollock Rd., State College, PA

College of Earth and Mineral Sciences
The Pennsylvania State University,
University Park, Pennsylvania 16802
(814) 865-6427

ADMISSION: Free to all
HOURS: Monday through Friday, 9 a.m. to 5 p.m.
and by special appointment (call the curator, Andrew Sicree, at 814-865-6427). Closed weekends and main legal holidays, including the University's Christmas-through-New Year's Day recess.

The Pennsylvania State University
Earth & Mineral Science Museum

The Earth & Mineral Science Museum at the Pennsylvania State University in State College, PA, is a unique mineral museum. The main gallery display includes displays of fine minerals such as azurite and "velvet" malachite from Bisbee, Arizona, and microcline crystals from Pikes' Peak, Colorado. In addition to collections of rocks, minerals, and fossils totaling more than 22,000 specimens, the Museum maintains collections of glasses, ceramics, metals, plastics, synthetic materials, old mining and scientific equipment, and archaeological artifacts. Many of these specimens are on display while the others are available for research and educational purposes.

The country's most extensive collection of paintings and sculpture depicting mining and related industries is on display in the Museum. Also, the Museum houses the world's most extensive collection of "push-button" electro-mechanical exhibits demonstrating dozens of the electrical, optical, and physical properties of minerals and materials such as fluorescence, radioactivity, magnetism, conductivity, flexibility, triboluminescence, piezoelectricity, double refraction, resistivity, and much more. Other displays include a collection of more than 100 mine safety lamps and scientific instruments and specimens belonging to Frederick Augustus Genth, the famous mineralogist.

The Museum serves both as a teaching tool for University courses and as an educational institution, bringing the general public an appreciation for minerals, mining, and the materials sciences.

Donation Policy: *The Penn State Earth & Mineral Sciences Museum gratefully accepts financial contributions and applies these donations to furthering the Museum's educational and scientific purposes. Donations of minerals, rocks, and fossils, as well as old mining equipment, antique scientific instruments, and unique glasses, ceramics, metals, and materials similar to those presently on display, are also gratefully accepted. Penn State alumni and all others interested in becoming a "Friend of the Museum" are urged to write to the Museum at the above address. Please contact the curator, Andrew Sicree, at (814) 865-6427, to send a donation or for more information.*

MINERALOGY OF THE TANOMA KIMBERLITES, INDIANA COUNTY, PENNSYLVANIA

by

Chuma Mbalu-Keswa and David. P. Gold, Department of Geosciences, The Pennsylvania State University,University Park, Pa. 16802, and Joseph R. Tedeski, Department of Environmental Resources, Bureau of Topographic and Geologic Survey, 500 Waterfront Drive, Pittsburgh Pa. 15222-4740

A number of "kimberlite" dikes, 20 cm to 1 m thick are exposed in the underground workings of the Tanoma Coal Mine, Indiana County, Pennsylvania. The dikes, which strike almost due east-west as an *en echelon* swarm, have been encountered in the longwall stopes and entry panels over a distance of more than 2 km. These dikes undoubtedly are part of the dike swarm that was exposed in the now closed Barr Slope Mine, near Dixonville only 2 km to the east.

These dikes are typically gray, pophyritic, micaceous kimberlite containing variable amounts of both angular (mainly shale and sandstone) inclusions, 1 to 10 cms across, and rounded xenoliths. Phenocrysts of phlogopite (1-2 cm), clino-pyroxene (1 - 10 cm), garnet, serpentinized olivine, ilmenite and spinel are set in fine-grained matrix of carbonate, serpentine, spinel, mica and perovskite. These rocks are of interest for the relative paucity of country rock inclusions, the presence of exotic deep-seated xenoliths such as the carbonate xenoliths with unusually high concentration of ^{13}C (heavy carbon), the consistency of their approximately 1 cm thick chilled margins with the country rocks, their bulbous extensions of 2 to 3 m into the coal seams, and the number of euhedral to subhedral megacrysts, up to 10 cm across, of chrome diopside. Inclusions in the latter minerals record an earlier trapped magmatic phase of phlogopite, dolomite and opaque oxides that differ in texture and composition from the kimberlite matrix. It is apparent from the coking of the coal and the incursions of the kimberlite into the coal seams that the kimberlite magma interacted with the coal more readily than with the other clastic sedimentary rocks.

Five samples of the bulk rock were analysed by XRF techniques at the Franklin and Marshall College, Lancaster, Pa. They show a surprising homogeneity between the samples, and characterize the Tanoma kimberlite as unusually high in calcium (average of 20.9% CaO). The rest of the major element, (SiO_2 = 29.3%; TiO_2 = 2.1%; Al_2O_3 = 2.95%; FeO = 10.43%; MgO = 34%) expressed as oxides, are typical of kimberlites.The following minerals have been studied on an electron microprobe analyser (CAMECA-SX 50) in the Mineral Constitution Laboratories of the Pennsylvania State University:

Clino-pyroxenes: The chrome diopsides occur mainly as euhedral green phenocrysts, with low Cr_2O_3 (0.75 to 1.00%), TiO_2 (,< 1%), Al_2O_3 (< 3%), and Na_2O (<2%): Ca/Ca+Mg = 0.55, and very little deviation in magnesium number (Mg/Mg+Fe = 0.79). They are similar in composition to those from other kimberlites (Mitchell, 1986).

Mica: Phlogopite occurs mainly as phenocrysts up to 2 cm across, and they appear to be compositionally similar to those from other kimberlites. The main variations are in TiO_2 (1.32 - 1.95%) and Cr_2O_3 (0.2 - 0.5%). content. The phlogopites within the clino-

THE HABITAT OF DIAMONDS: EXPLORATION CONSTRAINTS

David P. Gold, Department of Geosciences,
The Pennsylvania State University, University Park, Pa. 16802

Perhaps the most significant developments in diamond exploration during the past decade has been the recognition that (a) diamonds may occur as a primary constituent in certain lamproites, alkali basalts and some ultra-high pressure metamorphic rocks from subduction zone regimes, (b) inclusions in diamond reveal an association with both a peridotitic (sulfides, enstatite, chromite, forsterite, garnet and diopside) and a eclogitic (sulfides, clino-pyroxene, rutile, corundum, kyanite, coesite and garnet) rock suites, (c) diamonds are far more abundant in both eclogitic and peridotitic mantle inclusions (xenoliths) suites than the host "kimberlite", (d) the few diamonds with dateable inclusions have ages billions of years older than the emplacement age of the host medium, (e) a correlation of diamonds with G-9 and G-10 type garnets, and (f) the poor preservation of diamonds if there has been an oxidation trend of the host medium during emplacement, (f) diamonds have been around for billions of years and are accidental inclusions (xenocrysts) rather than primary crystallization products of the transporting magmas.

Modern exploration strategy usually incorporates the following facts: (a) that diamonds are very dilute even in the richest of deposits - grades typically run at 1 to 120 carats/100 tons, (b) that stream sediment sampling for the minerals that co-travel with diamonds (chrome diopside picroilmenite and pyrope garnets) is still the most efficient and cost effective exploration method, (c) that the old cratons with a low thermal gradient and/or a deep cold lithosphere at the time of emplacement are the preferred habitat for diamond preservation, (d) that it is the distribution and quality of the larger size stones that governs the economic viability of a deposit.

Significant new finds have been made on the Archangel Platform and in the Kola Peninsula of western Russia; in the Kirkland Lake area, Ontario; Fort a la Corne, Saskatchewan; and around Lac de Gras, 300 km northeast of Yellowknife in the Northwest Territories of Canada. Recent evaluation of 50 tons of kimberlite form the # 4 pipe in the Lac de Gras cluster yielded 62.1 carats of diamonds or a grade of $141/ton. This compares favorably with the best of the big producers, (Jwaneng in Botswana at $154/ton), and it could well be the first diamond mine to go into production in North America since World War 11.

pyroxene inclusions blebs appear to be richer in TiO_2 than those in the matrix. The average Mg/Mg+Fe ratio is 0.79, well below the range for yellow-brown phlogopites (0.93 to 0.87) from other kimberlites (Mitchell, 1986).

Ilmenite: is a widespread but minor component of the matrix, where it occurs as discrete grains up to 3 mm in size. They are typical of the "glassy" picroilmenite of kimberlites with 8.9 to 10.00 weight % MgO. Ilmenite is more abundant in the inclusion blebs within the clino-pyroxenes (Cr_2O_3 = 0.38 - 0.87%; TiO_2 = 49.2 - 51.0%; FeO = 33.99 - 35.99%), where they appear to be depleted in chrome, relative to those in the kimberlite matrix (Cr_2O_3 = 1.9 - 3.4%; TiO_2 = 50.6 - 51.1%; FeO = 34.23 - 34.98%). Some of the former appear to be overgrown with perovskite.

Garnet: occurs a rounded megacrysts up to 5 cms in diameter. Most of the garnets are either a reddish brown or a deep red color. Microprobe analyses on the former show them to be titanian pyropes, or Group 1 garnets in the Dawson and Stephens (1975) classification. The critical components are: TiO_2 (0.43 - 0.57%), Al_2O_3 (20.8 - 21.3%), Cr_2O_3 (1.2 - 1.5%), FeO (8.8 - 9.2%), MgO (19.4 - 20.0%).

Spinels: An understanding of the composition and oxidation history of the spinels is crucial for diamond exploration. Microprobe analyses to date show most of the spinels to be titano-magnetites, zoned with an enrichment of TiO_2 outward from 11.6 to 16.3%, and a sympathetic decrease in Cr_2O_3 from 10.4 to 1.9%..

Other minerals: yet to analysesd include *olivine, perovskite and the carbonates.*

THE VIBURNUM TREND LEAD-ZINC ORE DISCOVERIES MISSOURI BECOMES WORLD LEADER IN LEAD MINING

by Heyward M. Wharton, Missouri Geological Survey, Retired

ABSTRACT

The first record of lead mining in what was to become the Southeast Missouri Lead District was by a French prospecting party at Mine La Motte in 1720. But mining was small scale and sporadic until the discoveries and development of the large, deeply-buried lead & zinc deposits in the "Lead Belt" around Bonne Terre and Flat River in St. Francois County. The St. Joseph Lead Company made the initial discoveries at Bonne Terre in 1865, and eventually took over control of the district. Production of lead and zinc in the Southeast Missouri, the Upper Mississippi Valley and the Tri-State (MO, OK, KS) Districts was so important that deposits of this kind are now designated Mississippi Valley -type worldwide.

By the end of World War II, ore reserves in the Missouri Lead Belt were seriously depleted, so St. Joe Lead embarked on a regional prospecting program in hopes of finding a new district. The company's aggressive, 10-year campaign finally achieved success in 1955.The initial discovery was near the small village of Viburnum, about 40 miles west of the "Old" Lead Belt. Mining began in 1960, and by 1969, St. Joe and 4 other companies had developed 5 new mine-mill complexes and built 2 new lead smelters along the Viburnum Trend. By then, mine production exceeded 300,000 tons per year of contained lead metal and Missouri became the world leader in lead mining.

COLLECTIONS OF PENN STATE UNIVERSITY - THE GENTH COLLECTION

Deane K. Smith, Department of Geosciences
The Pennsylvania State University, University Park, Pa. 16802

Frederick Augustus Wilhelm Genth was a 19th Century chemist/mineralogist who resided in Philadelphia and worked at the University of Pennsylvania during his later years. He is responsible for characterizing nearly 20 new mineral species and collecting chemical and physical data on many more. During his career, he collected and catalogued over 8000 mineral and meteorite specimens. This collection now resides at Penn State University. Although most of the specimens in the collection are valued primarily for their research value, some are currently on display in the Earth and Mineral Sciences Museum. The talk will include information on Genth's career and illustrate his equipment and research.

WORLD CLASS MINERAL DEPOSITS - AN INTRODUCTION

Andrew A. Sicree, Earth and Mineral Sciences Museum
The Pennsylvania State University, University Park, Pa. 16802

The concept of a "world-class mineral deposit" has a different meaning for the mineral collector than for, for instance, the economic geologist. The economic geologist considers factors such as a deposit's total mineral reserves and the magnitude of metals production derived from the deposit to be factors determining whether or not a particular deposit is called "world-class". The mineral collector, on the other hand, is concerned primarily with the quality of the specimens a deposit produces - quantity is only a minor consideration. Thus, a relatively small mine in a pegmatite may produce only small amounts of lithium and beryllium and be insignificant from the commercial stand-point, yet still be a "world-class" mineral deposit in the eyes of the mineral collector. Such deposits often have world-wide fame among mineral collectors. Some deposits, of course, are "world-class" to both economic geologists and mineral collectors. The Tsumeb Mine in Namibia, and the lead-zinc mines of the Viburnum Trend are examples of these.

FRIENDS OF MINERALOGY
Pennsylvania Chapter

This is a note to all those who helped with this symposium and field trip for the 1993 Fall symposium. Thanks to you for your efforts to make this years symposium a real sucess . Thanks to the Staff here at Penn State for their support and assistance .They not only helped to provide the field trip and guide ,but also helped to provide the space and displays you are all using and enjoying today.

Thanks to those of you attending .I hope you find the information educational and the knowledge benefical to you personally .Thanks for your support and for spending the weekend with us here on the campus of Penn State.

I want to express my heart felt thanks to Dr. Gold for his support; to Andrew Sicree for his help and enthusiam on this project; to Joe Dague for his help with the Field Trip and for his interaction with the staff here at Penn-State on my behalf.

Arnold R. Mogel
President
Friends Of Mineralogy
Pennsylvania Chapter ,Inc.

A Classic Locality in our Time--Mt. St-Hilaire, Quebec

Mont Saint-Hilaire, Quebec, offers one of the world's classic mineral localities. It is located about 20 miles east of Montreal and is one of the ten Monteregian Hills trending E-W for 125 miles from the Oka complex on the west to Mount Royal, St-Bruno, St-Hilaire, Johnson, Rougemont, Yamaska, Shefford, Brome and Megantic to the east. The mountain rises from the Saint Lawrence lowlands to a summit elevation of 1400'. The quarries are located on the NNE slope.

Mt. St-Hilaire has undergone two main intrusions: essexite forms the western half; nepheline-syenite/nepheline-sodalite syenite, the eastern half. First mention of unusual minerals here was in 1914. Poudrette Quarry was opened in 1959; Uni-Mix, operating in 1961, became known as DeMix Desourdy Quarry and later DeMix and Desourdy joined as DeMix.

Most important, collecting was allowed. Frank R. Melanson, one of these early collectors, found a pink mineral in 1963, which was later identified as serandite. Considering the size of the quarries, Mt. St-Hilaire may be the most prolific mineral locality known. "Monteregian Treasures" describes 221 species. The number of identified species is now hovering around 300. The unknown specimen numbers have reached 105. The species are mostly silicates and carbonates. Although most of the collectible species are in micro crystals, hand and cabinet specimens have been available.

There are 26 minerals having Mt. St-Hilaire their type locality. These are:

Abenakiite-(Ce)
Carletonite
Donnayite-(Y)
Doyleite
Gaidonnayite
Griceite
Hilairite
Lemoynite
Monteregianite-(Y)
Nalipoite
Normandite
Paranatrolite
Perraultite
Petarasite
Poudretteite
Rouvilleite
Silinaite
Steacyite
Thornasite
Yofortierite

and six species which have been approved by the IMA but are not yet published.

THE FRANKLIN-STERLING HILL DISTRICT

by

RICHARD BOSTWICK

The Franklin-Sterling Hill District is one of the World's great zinc mining areas and among its most extraordinary and complex mineral localities. The District comprises two zinc orebodies with a combined production of over 33,000,000 tons of ore which averaged about 20% zinc; the adjacent part of their host formation, the Franklin Marble; and several small magnetite deposits in or near the Marble. The origins of the zinc ores are not well understood but may be connected with ore deposition at ocean-floor spreading centers; the age and exact nature of the protores are not known, but the orebodies reached their metamorphic peak about 1.1 billion years ago and their subsequent history is anything but simple. The major Franklin-Sterling Hill zinc ores are not sulfides but oxides and silicates: franklinite, a spinel-group zinc iron manganese oxide; willemite, zinc orthosilicate; and zincite, zinc oxide. Local concentrations of lead, boron, arsenic, nickel, and other elements have also lead to the formation of many unusual minerals; the current mineral species total for the district exceeds 340 and includes record numbers of unique species and species first described from the area. There are distinctive mineral suites from the zinc ores, skarns, altered skarns, veins, pegmatites, weathering zones, iron ores, marble, etc.

Archibald Bruce and other pioneers of mineralogy began describing Franklin-Sterling Hill mineral species shortly after 1800; the effort has involved many of the major figures in American mineralogy and continues today with the likes of Pete Dunn, Paul Moore, and many others. The current bibliography of Franklin-Sterling Hill mineralogical and geological literature exceeds 1200 titles. Species new to science or new to the area are still being described.

The Franklin Mine closed in 1954 and the Sterling Mine in 1986. Their heritage is kept alive by the Franklin Mineral Museum, which was founded in 1960 and has extensive exhibits of local and world-wide minerals, and by the Sterling Hill Mining Museum. The latter institution, open since 1990, preserves many of the surface structures and mine workings at Sterling Hill; and includes a museum of mining equipment and memorabilia. Tours and field collecting are available at both insitutions. The interests of local mineral collectors and many outside the area are also served by the Franklin-Ogdensburg Mineralogical Society, Inc. (FOMS), a locality-specific organization which publishes the respected periodical The Picking Table.

Mineral collectors may be drawn to Franklin-Sterling Hill for its crystal classics, such as franklinite and rhodonite, or for its exotic species or unusual micromounts. The locality is perhaps best known for the extraordinary responses of many of its minerals to ultraviolet light. These have earned Franklin the title "The Fluorescent Mineral Capital of the World." Whether large and flashy or small and strange, the minerals of Franklin and Sterling Hill remain an enigma and a source of fascination for knowledgeable mineral collectors everywhere.