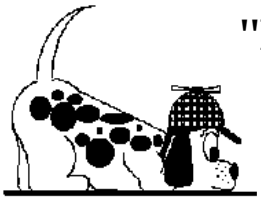
Resource 8.



"Become a Rock Detective"

A-Z Catalogue

May 2007

Sample Descriptions, Earth Science Concepts,

And Target Grades for all Mysteries

MYSTERY SAMPLE DESCRIPTION	MYSTERY CONCEPTS and TARGET GRADES ES = Elementary School MS = Middle School HS = High School/College	MYSTERY
ACTINOLITE	IN PREPARATION	228
AGATE — Plain, banded, or moss varieties	--- Demonstrates that window glass and agate are in the same family --- Mineral varieties (quartz) --- Mineral identification ES, MS	141
AGATE	See ONYX, banded	53
ALABASTER — A piece of massive alabaster suitable for carving	---- To introduce alabaster, a popular mineral for making statues ---To open a discussion about hardness and why alabaster is such a good mineral for sculptures ---To introduce the concept of alabaster as a variety of gypsum --- To introduce a simple chemical formula --- To open a discussion about elements within minerals ES, MS	150
ALIGATOR BONES, FOSSIL	IN PREPARATION	265
AMAZONITE — Feldspar, Microcline	--- Geography, Amazon River --- Mineral varieties (feldspar) --- Mineral Identification ES, MS	35
AMBER	IN PREPARATION	292
AMETHYST — Cluster of crystals	--- Electron movement in solids (between elements within the crystal lattice) --- Absence of electrons causes, 'hole color centers' and the characteristic amethyst color --- Development of a chemical formula --- Substitution of one cation for another in a common mineral --- Discussion about sources of natural radioactivity HS	135
AMMONITES __ A well-preserved specimen showing sutures	--- Introduce ammonites --- Jurassic Age paleogeography --- Life habits of an animal that is hundreds of million years old --- Central Europe was an ocean during the Jurassic MS, HS	139
AMMONITES __ An ammonite fossil shell.	___To practice the taxonomic system of classification ___To discuss index fossils and the grunt work of stratigraphy (the study of sedimentary rock strata, or layers) ___To apply the concept of specific gravity to solve a larger mystery, i.e. global distribution of a marine animal and species dispersion ___To discuss the extinction event at the end of the Cretaceous, and the effect a meteor impact may have had on ammonites HS	171

AMMONITES, ENGLAND, JURASSIC — A specimen of ammonite from the lower Jurassic age (Lias) in England. The shell must show growth lines (ribs)	-- To practice the taxonomic system of classification -- To discuss paleogeography and the concept of an ocean over England -- To discuss index fossils and the grunt work of stratigraphy (the study of sedimentary rock strata, or layers) -- To apply the concept of specific gravity to solve a larger mystery, i.e. global distribution of a marine animal and species dispersion -- To determine the age of a fossil individual -- To discuss the extinction event at the end of the Cretaceous, and the effect a meteor impact may have had on ammonites MS, HS	201
ANDESITE	IN PREPARATION	269
ANGEL WINGS SEA SHELL	IN PREPARATION	266
ANHYDRITE — A piece of anhydrite (CaSO4)	--- Evaporation as an earth science process (formation of the Dead Sea) --- Mineral identification, Anhydrite --- Conversion of degrees Fahrenheit to Celsius MS, HS	48
ANORTHOSITE WITH ANORTHITE	IN PREPARATION	287
ANTHRACITE COAL	See, Coal, Anthracite	65
APACHE TEARS -- An Apache Tear, or marekanite	-- To provide the opportunity to explore the historical basis for a Native American legend, i.e. the origin of "Apache Tears" -- To study the earth science behind a legendary rock sample -- To introduce the properties of glass -- To study a volcanic process, i.e. the formation of silicic glass MS, HS	168
APATITE — A sample of apatite	--- To introduce a mineral that is important to the human body --- To practice identifying elements in a mineral formula --- To discuss the effect of the element, fluorine on the hardness and acid resistance of human teeth --- To introduce the concept of replacement of components within a mineral to form another mineral with different properties MS, HS	153
APOPHYLLITE	IN PREPARATION	276
ARROWHEADS-MAKING TOOLS — Chert or flint with chipping stone	--- To show how arrowheads are made ES, MS, HS	144
ART, AND EARTH SCIENCE — Breccia, Leesburg Conglomerate (Triassic, VA) used for columns, US Senate, Washington, DC — Indian jewelry from copper ore, etc. — Jade, raw — Lithographic limestone for etchings — Opal, raw		17 131 34 102 37
ARTICULATED BIVALVE — An articulated bivalve fossil (any fossil mollusk or brachiopod in which both shells of one individual are together)	--- What is a fossil? --- Define study of Paleontology ES, MS	10
ASH FALL WITH PUMICE, TSHIREGE	IN PREPARATION	288
ASH FLOW TUFF (IGNIMBRITE)	See, Volcanic Tuff, Ignimbrite	126
ASPHALT — A piece of aggregate asphalt that clearly shows gravel	--- To help students understand the definition of a rock --- To encourage use of references --- To create a discussion about definitions --- To raise awareness about rocks created by organisms ES, MS, HS	28
AUGITE	IN PREPARATION	231

BANDED IRON FORMATION — A piece of Banded Iron Formation from the Upper Peninsula of Michigan	— To introduce Banded Iron Formation and the iron mining industry in Michigan — To study very old rocks and continents from the Proterozoic Geologic Era, two billion years ago — To present two models (biological and nonbiological) explaining the origin of Banded Iron Formation — To introduce the concept of photosynthesis, microorganisms containing chloroplasts that can produce organic matter from carbon dioxide and sunlight; and, give off oxygen as a waste product. — To introduce the biological model in which iron from ocean water is turned into rusty sheaths of iron oxide around the cells of photosynthetic microorganisms. The rusty sheaths grow from oxygen produced by the organisms; the sheaths are shed from the organisms and collect on the ocean floor. There is little or no oxygen in the atmosphere and the iron comes from weathering of rocks on the land surface. — To introduce the nonbiological model in which iron turns into rusty particles of iron oxide without the influence of microorganisms; the iron is supplied by the interaction of hot sea water with magma erupting onto the ancient sea floor. Oxygen is dissolved in the sea water from an atmosphere rich in oxygen produced by photosynthetic organisms. — To introduce the concept of water masses of different composition existing in the same ocean basin — And then to introduce the notion that iron-rich sedimentary rocks can form in an ancient ocean by the mixing of two water masses GRADES 9-12	176
BANDED IRON FORMATION — A piece of Banded Iron Formation from the Upper Peninsula of Michigan	— To introduce Banded Iron Formation and the iron mining industry in Michigan — To introduce the concept that the atmosphere of the early Earth contained no oxygen — To study very old rocks from the Precambrian Proterozoic Geologic Era, two billion years ago GRADES 5-8	179
BARITE — A sample of massive barite that feels heavy	— To introduce the concept that minerals vary in composition — To introduce the relationship between mass and composition, or the type of elements in the mineral — To begin learning about specific gravity as the method to measure mass ES, MS, HS	128
BARITE WITH SIDERITE	IN PREPARATION	239
BARNACLES, FOSSIL — A sample of large fossil barnacles	--- To introduce fossil barnacles --- To encourage intuitive problem solving (How do they grow?) ES, MS, HS	111
BASALT — A piece showing ropey structure and/or gas bubbles	--- To introduce students to volcanic basalt (ropey structure gas bubbles, etc.) --- To sharpen students ability to draw conclusions from their own observations ES, MS	41
BASALT AND RHYOLITE	IN PREPARATION	264
BASALT, ORDOVICIAN, MAINE	IN PREPARATION HS	261
BAUXITE — A piece of ore from Arkansas clearly showing rounded pisolites	--- To introduce bauxite, a rock name for the primary ore that contains aluminum --- To show that the state rock of Arkansas is a metal ore --- To dramatically contrast metal obtained from recycling and from raw ore --- To raise awareness of the need to recycle --- To provide an opportunity to practice geography of the US ES, MS	104
BEACH-IN-A-BOX — A box of sand containing various kinds of shells, shark's teeth, fossil bone, petrified wood, etc.	--- To introduce the concept of a fossil assemblage --- To show students, especially young ones what it is like to "find" a fossil --- To introduce the concept of classification ES, MS	112
BELEMNITES	IN PREPARATION	271
BERYL — An easily recognized sample of Beryl	IN PREPARATION MS, HS	155
BIOTITE	--- To introduce the mineral biotite --- To encourage the use of references to identify minerals --- To introduce the family of mica minerals and cleavage as a mineral property ES, MS	106
BIOTITE, A MINERAL IN THIN SHEETS — A sample of biotite that shows deep brown color and cleavage sheets	— To introduce the mineral biotite — To introduce the arrangement of atoms inside biotite and the notion that atoms are bonded together by negative and positive electrical charges.	259
BIOTITE, IN GRANITE	IN PREPARATION	262
BITUMINOUS COAL	See Coal, Bituminous	30
BLACK SHALE, LEAF FOSSILS, PENNSYLVANIAN AGE SWAMP	See, Fossil Leaves in Black Shale, Pennsylvanian Age	75
BLASTOID	IN PREPARATION	295
BLUE QUARTZ	IN PREPARATION	281
BLUE SAPPHIRE, SEE SAPPHIRE, BLUE		210

BRACHIOPOD — A rock clearly showing brachiopods	--- To introduce brachiopods --- To encourage the use of reference books ES, MS	57
BRACHIOPODS, AND ARTICULATED MOLLUSK — Several brachiopods of various sizes that show both valves — One articulated simple modern mollusk like a clam	--- To introduce brachiopods --- To introduce the concept of symmetry --- To show the difference in symmetry between brachiopods and mollusks ES, MS, HS	9
BRECCIA (FROZEN LANDSLIDE) — A piece of breccia showing angular pieces or fragments of other rocks in a fine-grained matrix	--- To introduce the concept that some sedimentary rocks are deposited during “events” --- It follows that sedimentary rocks contain the record of how they were formed --- To introduce the concept that millions of years ago landslides happened when continents moved apart to form the Atlantic Ocean! ES, MS, HS	17
BRICK	See Shale for Brick	181
BRYOZOAN, *Schizoporella informata*, PLIOCENE, NORFOLK VA	--- To introduce Tertiary Bryozoans --- To discuss paleoecology--these bryozoans must have clean water, hence they are "evidence" for clear, not muddy conditions ES, MS	130
BRYOZOAN, STONY (ORDOVICIAN AGE, OHIO)	--- To introduce the Stoney Bryozoan --- To discuss geologic time, and the concept that, "the present is key to the past" --- To provide a segue into paleogeography (Ohio was an ocean 450 million years ago) ES, MS, HS	50
CALCITE, AND ACID --- Small pieces of rocks, all composed of calcite --- A bottle of dilute acid [2-3% Hydrochloric (Muriatic in the hardware store) will do well] --- A box of baking soda and a plastic dish to put some in --- Tissues to dry samples and hands --- A bowl of water to dip samples and fingers in	--- To show a mineral formula $CaCO_3$ --- To observe a chemical reaction (fizz) and then see an equation that describes the reaction --- To show that one mineral (calcite) can occur in many forms --- To show that fizz is a good test for calcite --- To show that some calcite is produced by animals for their shells, while other calcite is precipitated deep in the earth --- To introduce the relationship between acid rain and CO_2 --- To discuss the carbon geochemical cycle ES, MS, HS	11
CALCITE AND QUARTZ (Mineral Identification Tests)	--- To show differences between calcite and quartz --- To explore the concept that minerals are different because they are composed of different elements ES, MS, HS	77
CALCITE, BOTRYOIDAL — Botryoidal Calcite (from excavation of the Florida Barge Canal. Collected 1967 by the Marcus family).	--- To introduce botryoidal mineral shape --- To introduce the concept of water flowing in limestone aquifers --- To introduce the concept of mineral precipitation ES, MS, HS	94
CALCITE, SCALENOHEDRAL	IN PREPARATION	212
CALCITE, SPAR CRYSTAL AND GYPSUM — A piece of crystalline calcite — A piece of clear gypsum (or selenite)	--- To introduce the minerals calcite and gypsum --- To introduce the fingernail test for hardness --- To discuss the concept of hardness and use of the Mohs Hardness Scale to identify minerals ES, MS	12
CARBONATE CORE COMPARISON, Deike USGS PUB	IN PREPARATION HS	280
CAVE TRAVERTINE ---A sawed slice, or piece of travertine cut or broken across the banding	-- To introduce the rock type, travertine, and its mode of formation in water-filled cavities -- To introduce the concept of mineral precipitation as one process taking place as part of a vast and dynamic ground water system -- To discuss the relatively few major ways in which ground water composition can change, eg. dissolved elemental and gaseous constituents and temperature -- To discuss the global factors that control the composition of ground water -- To introduce the notion that the composition of minerals precipitated from ground water can reflect differences in global climate over periods of geologic time GRADES 5-8	180
CELESTITE	IN PREPARATION	215
CHABAZITE	IN PREPARATION	235
CHALK — A piece of Cretaceous age chalk (eg. from the southeast coast of England)	--- To introduce the carbonate rock called, CHALK --- To show that chalk is made of the mineral, calcite ($CaCO_3$) which reacts with acid (eg. vinegar) producing bubbles of the gas, carbon dioxide (CO_2) --- To show that rocks can be made of billions of tiny, tiny fossils --- To show that these fossils are from tiny sea plants, called coccolithophorids that live in the ocean. The fossils are called coccoliths, and are cast off, or shed from the tiny plant cells --- To introduce the concept that coccolithophores can store CO_2 in ocean sediments --- To open a discussion about the astounding notion that during the Late Cretaceous and Paleocene Periods of geologic time, some 60 to 100 million years ago, much of England and two-thirds of Europe were under water; and the United States was two land masses separated by a shallow sea that was also rich in coccolithophores MS, HS	161
CHERT	IN PREPARATION	246

CHESAPECTEN JEFFERSONIUS, PLIOCENE, VIRGINIA	IN PREPARATION	185
CHROMIUM GROSSULAR GARNET, SEE GARNET, CHROMIUM	IN PREPARATION	218

CHRYSOCOLLA	IN PREPARATION	277
CITRINE — A cluster of crystals	--- To introduce citrine --- To introduce the concept of varieties of the same basic mineral, i.e. kinds of quartz --- To introduce the concept of substitution of one element for another within the crystal lattice --- To introduce the concept of hole color centers in crystals --- To introduce the concept of radiation or heat changing the internal organization of a natural material --- To provide an opportunity to develop and use a chemical formula for a mineral --- To open a discussion about sources of natural radioactivity MS, HS	137
CLAY CONCRETION(S)	IN PREPARATION	233
CLAY, KAOLIN	IN PREPARATION	251
CLEAVLANDITE	IN PREPARATION	238
CLIFF SWALLOW NEST - Part of a Cliff Swallow nest clearly showing the nubbly outside texture and the thick construction of the muddy, silty nest material	- To help students understand the definition of a rock - To encourage use of references - To create a discussion about definitions - To raise awareness about rocks created by organisms ES, MS	200
COAL, ANTHRACITE	--- Introduce coal --- Metamorphism (coal to graphite to diamond) --- Paleogeography (Pennsylvania during the Pennsylvanian Period) ES, MS	65
COAL, BITUMINOUS	--- To introduce the shape and texture of coal --- To introduce the concept that energy can be stored in, and later released from a rock ES, MS	30
COBBLES, OCEANIC LAVA AND CORAL __ Two cobbles from Cobblestone Beach, Ram Head, St. John, US Virgin Islands __ One cobble composed of greenish-gray keratophyre (an extremely fine grained silica-rich igneous rock, generally extrusive, that contains more sodium than potassium) __ One cobble composed of white modern coral that has been rounded by the ocean surf	--- To provide the opportunity to examine the geography and geology of the Caribbean area of the Atlantic Ocean --- To introduce the concept of mixed provenance, that is, more than one source for sediments --- To introduce the concept of depositional energy; in this case the high energy of a hurricane --- To introduce the Caribbean tectonic plate --- To show that millions of years ago the tectonic plates were in very different positions than they are today, and that plates can travel long distances --- To show that fossils can be very important clues to the age and origin of rocks HS	160
COBBLES OF QUARTZITE CONTAINING *SCOLITHUS linearis*	--- To introduce *Scolithus linearis*, fossil worm tubes that are hundreds of millions of years old --- To introduce the concept of trace fossils --- To introduce the taxonomic system of classification --- To introduce the concept that rivers carry sediment long distances --- To introduce the concept that old sediment can be moved and redeposited --- To give young students the opportunity to hold several concepts in mind at the same time --- To study geography of Washington DC area, and paleogeography (what things were like in past geologic time) ES, MS, HS	29
COBBLES, ROUNDED IN A MAJOR RIVER — Several rounded stream cobbles	--- To introduce the concept of erosion and of sediment movement by rivers ES, MS	120
COBBLES, ROUNDED IN THE RAPAHANNOCK RIVER — Several rounded stream cobbles	--- To introduce the concept of erosion and of sediment movement by rivers --- To practice geography and using maps ES, MS	119
COCKYSVILLE MARBLE (PRECAMBRIAN TO ORDOVICIAN, MARYLAND) — Pieces of the Cockysville Marble clearly showing layers rich in mica flakes	--- To introduce a formation name. A formation is a layer, or body of rock that is recognizable over a large area (Cockeysville Marble is a well-known formation near Baltimore, MD) --- To show that metamorphism can cause layering that looks like a sedimentary rock --- To introduce the concept that metamorphism creates new minerals ES, MS, HS	54
COMMON OPAL, PEARLY LUSTER	IN PREPARATION	275
CONCRETE, A ROCK? — A piece of aggregate concrete clearly showing gravel or pebbles	--- To help students understand the definition of a rock --- To encourage use of references --- To create a discussion about definitions, and classifications --- To raise awareness about rocks created by organisms ES, MS, HS	62
CONCRETE BLOCKS — Samples of light and heavy aggregate concrete blocks	IN PREPARATION	166
CONGLOMERATE, PEBBLE — A sample of pebble conglomerate clearly showing pebbles in a muddy or sandy matrix	— To introduce the sedimentary rock, pebble conglomerate — To introduce the notion that sedimentary rocks were deposited by some agent (water, wind, gravity) and they contain clues about the place they formed — To provide the opportunity to learn the history of a sedimentary rock — To introduce the concept of the rock cycle--that is, water, etc. erodes preexisting rocks and carries them to a new location. Mountains are worn down and ocean basins become containers for muddy sediments. MS	157
CONGLOMERATE, PEBBLE, METAMORPHOSED — A metamorphosed pebble conglomerate— should show schist-like character from being metamorphosed.	-- To introduce very old sediments (one billion years old!) -- To introduce pebbles in a very old rocks and the concept of a pebble conglomerate -- To introduce the concept of weathering (harder things stand out in relief) ES, MS, HS	89

COPPER, NATIVE, SEE NATIVE COPPER — A piece of Native Copper Ore	Grades 5-8	207
COPPER, NATIVE, SEE NATIVE COPPER — A piece of Native Copper Ore	Grades 2-4	208
COPPER ORE — A piece of Copper Ore showing blobs of reddish-brown copper, if possible	--- To introduce copper ore --- To introduce the concept that very little metal is contained in ore --- To encourage intuitive problem solving --- To discuss the method of processing copper ore --- To introduce the concept of mining waste and the problems of disposal ES, MS, HS	92
COPROLITE, DINOSAUR, OR OTHER, FOSSILIZED DROPPINGS	--- To show a very exciting trace fossil (a preserved remain that shows the animal lived, but is not part of the animal) --- To sharpen student's (especially young ones) interest in paleontology ES, MS, HS	84
CORAL AND GEOLOGIC TIME SCALE — A typical Miocene coral	--- To introduce the concept of geologic time --- To introduce Miocene corals ES, MS	114
CORAL, BRAIN	--- To introduce the coral genus, *Meandrina* --- To show the shape of a coral community --- To reinforce the concept that rocks are often named for things that remind us of man ES, MS	87
CORAL, HORN — A well-preserved horn coral	--- To introduce horn corals --- To show the concept of geologic time ES, MS	56
CORAL IDENTIFICATION — A piece of a colonial coral that shows several well preserved corallites door to one coral "house")	--- To learn about two major groups of corals, scleractinian and rugose. They provide powerful tool for determining the age of rock layers --- To provide an opportunity to identify a coral MS, HS	146
CORAL, PETOSKY STONE	IN PREPARATION	227
CORAL, RUGOSE VS TABULATE	IN PREPARATION	272
COQUINA	IN PREPARATION	293
CRINOID — Well-preserved loose pieces of stem	--- To introduce the important Paleozoic fossil, crinoid --- To open a discussion about this animal that looks like a plant ES, MS	138
CRINOID-BEARING LIMESTONE, OR LIMEY MUDSTONE	--- To introduce the important Paleozoic fossil, crinoid --- To open a discussion about this animal that looks like a plant --- To segue into a discussion of paleogeography (where do modern equivalents of crinoid live?) ES, MS	127
CRYSTAL, QUARTZ, IN GRANITE	See, Rock and Crystal	204
CRYSTALS — Piece of rock showing obvious crystals	--- To introduce crystals to young children ES	148
CRYSTALS (DOUBLY TERMINATED)	IN PREPARATION	236
DENDRITE	--- To challenge students with the concept of chemical precipitation --- To demonstrate that not all things that look like fossils are --- To introduce the concept of bedding planes ES, MS, HS	78
DENTALIA (MOLLUSK) SHELLS — Several Dentalia shells	--- To introduce the mollusk called Dentalia --- To introduce the concept of burrowing mollusks and how they recirculate water --- To introduce the naming process: Phylum, Class, Order, Family, Genus, Species ES, MS, HS	103
DEVONIAN FOSSIL ASSEMBLAGE, NEW YORK — Separate (individual) Devonian fossils from New York State	--- To introduce the concept of a fossil assemblage (a group of different species common to an area and to a certain geologic time) --- To introduce and/or reinforce the concept of geologic time (millions of years) --- To open a discussion of paleogeography ES, MS, HS	5
DEVONIAN SHALE, TRACE FOSSILS IN — Devonian shale showing the tracks of animals (e.g.. from the Finger lakes Region of New York State).	--- To introduce the concept of trace fossils (footprints are a good example of a trace fossil!) --- To show students a Devonian shale --- To introduce shale as a rock type --- To dramatize the Devonian Period in the earth's history ES, MS, HS	26
DIABASE — A piece of Diabase that is obviously heavy	--- To introduce the rock type, diabase --- To reinforce the concept that rocks are made of minerals --- To show that heavy rocks are made of heavy, dense minerals --- To introduce the mineral pyroxene ES, MS, HS	86
DIATOMITE — A sample of very pure diatomite	--- To introduce diatomite, diatoms, and the concept of a rock made of diatom shells or tests --- To introduce the idea that a rock can be made of little hollow things ES, MS, HS	15
DIOPSIDE	IN PREPARATION	229
DOLOMITE	IN PREPARATION	232
DOUBLY TERMINATED CRYSTALS	IN PREPARATION	236
DRAG FOLD — A piece of rock showing drag folds in thin-bedded sediments	--- To introduce folding of rocks under compression --- For older students this sample can be used to open a discussion of drag folds as an indicator of large, regional folds ES, MS, HS	108

DRILL CORE — A piece of rock drill core	--- To show a man-made rock shape, a drill core --- To show how we can study rocks deep in the earth --- To introduce the concept of labeling samples --- To segue into the, 'Law of Superposition' (younger rocks usually are above older ones) --- To encourage problem-solving skills ES, MS, HS	22
DRILL CORE — A piece of rock drill core	--- To show a man-made rock shape, a drill core --- To show how we can study rocks deep in the earth --- To encourage problem-solving skills ES	224
DRILL CORE SHOWING BURROWED STRUCTURE	IN PREPARATION	285
'DUGONG' (Pleistocene Sea Cow) rib bone	See Sea Cow Rib, Fossil 'dugong'	88
ECHINODERM — A fossil echinoderm showing the five-arm star on its shell	— To introduce five-sided symmetry — To introduce fossil echinoderms — To provide the opportunity to discuss animal groups that have been on earth for hundreds of millions of years ES, MS	66
ECHINODERM, MODERN - An echinoderm showing five-part symmetry on its shell	--- To introduce five-sided symmetry --- To introduce the Phylum Echinodermata --- To provide the opportunity to discuss an animal group that has been on earth for hundreds of millions of years ES, MS	260
ENCRUSTING RED FORAMINIFERA — A piece of coral, rock or shell encrusted with the red foraminifera, Homotrema rubrum	— To introduce foraminifera (forams), a group of single-celled organisms that are neither fungi, plants nor animals, and therefore require a separate Kingdom, Protoctista — To introduce Homotrema rubrum, the dramatically red, encrusting foraminifera — To show how the present-day distribution of a species can be used to infer past environments GRADES 9-12	113
EXOGYRA AND GRYPHAEA	IN PREPARATION	273
EXOGYRA, FOSSIL OYSTER	--- To introduce Exogyra, a well-known Cretaceous fossil oyster (Mollusca) --- To introduce the concept that animals evolve to fit their environment (in this case, the thick shell protects animal from the surf) --- To stimulate thought about why a species becomes extinct ES, MS, HS	46
FELDSPAR, AMAZONITE	--- To introduce the family of feldspar minerals --- To introduce amazonite --- To show that minerals belong to groups --- To encourage use of world maps --- To introduce the Amazon, the largest river (by volume of flow) in the world ES, MS	35
FELDSPAR CRYSTAL AND GRANITE — Single crystal of feldspar (either orthoclase or plagioclase) — A piece of granite containing the same variety of feldspar	--- To introduce the mineral feldspar and the rock granite --- To introduce the concept that rocks are made of minerals ES, MS	52
FELDSPAR, MAKES GLASS	IN PREPARATION	263
FELDSPAR, TEST FOR K-SPAR	IN PREPARATION HS	248
FISH VERTEBRA, FOSSIL -- Miocene fish vertebra from east coast, USA	-- To introduce fossil fish vertebra -- To introduce the notion of animals in an ocean 15 million years ago -- To open a discussion about the length of time human-like animals have been on the Earth ES, MS	226
FLINT	IN PREPARATION	234
FLUORITE — A piece of fluorite (CaF_2) — The Mohs Hardness Scale	--- To introduce the mineral Fluorite --- To encourage use of the Mohs" Hardness scale, and to show one of the Moh's Scale minerals --- To relate a fairly common mineral to a familiar object, like toothpaste --- To introduce the concept of minerals composed of elements --- For older students the concept of fluorine as a way to strengthen teeth can be considered with the chemical formula for calcium fluorophosphate ES, MS, HS	76
FORAMINIFERA, ENCRUSTING RED	In preparation	113
FORDHAM GNEISS, New York City Grades 3-6 — Piece(s) of the Fordham gneiss clearly showing layers and a surface rich in mica flakes	--- To introduce a formation name (Fordham gneiss is a well-known formation in New York City) --- To show that metamorphism can cause layering that looks like a sedimentary rock --- To introduce the concept that metamorphism creates new minerals	198
FOSSIL, SEE INDIVIDUAL NAMES (e.g.. Crinoid, Pecten, Graptolites, Bryozoan, etc.)		
FOSSIL ALLIGATOR BONES	IN PREPARATION	265
FOSSIL ASSEMBLAGES, KNOWN AGE + LOCATION (See List of Mysteries for more information)	See Individual Mysteries	Many
FOSSIL ASSEMBLAGE, MIOCENE AGE, HAMPTON, VIRGINIA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	73

FOSSIL ASSEMBLAGE, MIOCENE AGE, NAPLES FLORIDA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	74
FOSSIL ASSEMBLAGE, MIOCENE AGE, SARASOTA, FLORIDA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	72
FOSSIL ASSEMBLAGE, ORDOVICIAN AGE, BROOKVILLE, INDIANA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	69
FOSSIL ASSEMBLAGE, ORDOVICIAN AGE, CINCINNATI GROUP OH/IN —An assemblage of Ordovician age fossils from the Cincinnati Group, Ohio/Kentucky/Indiana, USA Grades 5-12	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types MS, HS	193
FOSSIL ASSEMBLAGE, CINCINNATI GROUP, ORDOVICIAN AGE, OHIO/INDIANA/KENTUCKY —An assemblage of Ordovician age fossils from the Cincinnati Group, Ohio/Kentucky/Indiana, USA Grades 3-8	— To introduce the notion of geologic time — To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) — To introduce the concept that millions of years ago an ocean covered a large area of the central United States ES, MS	189
FOSSIL ASSEMBLAGE, PLEISTOCENE AGE, NO KNOWN LOCATION	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	68
FOSSIL ASSEMBLAGE, PLIOCENE AGE, LAUREL, FLORIDA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	71
FOSSIL ASSEMBLAGE, PLIOCENE AGE, PORTSMOUTH, VIRGINIA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce the concept of geologic time, the fossils from Chuckatuck, for example, are from the Yorktown Formation of Pliocene age (about 4,000,000 years old) ES, MS, HS	186
FOSSIL ASSEMBLAGE, PLIOCENE AGE, SARASOTA, FLORIDA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	70
FOSSIL ASSEMBLAGE, SILURIAN AGE, NO KNOWN LOCATION	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	67
FOSSIL ASSEMBLAGE (no known location)	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types ES, MS, HS	125
FOSSIL BARNACLES	--- To introduce fossil barnacles --- To encourage intuitive problem solving --- For older students, a comparison between arthropods (barnacles and crabs) would be interesting ES, MS, HS	111
FOSSIL BONE + PETRIFIED WOOD	--- To introduce both petrified wood and dinosaur bone as fossils --- To demonstrate the difference in cell structure between wood and bone --- To demonstrate that petrification is a cell-by-cell process ES, MS, HS	32
FOSSIL, COPROLITES dinosaur (or other) 'poop', fossilized, of course	See Coprolites	84
FOSSIL FISH — A fossil fish in Eocene Age lake sediments of the Green River Formation, Wyoming, USA	--- To introduce well-preserved Eocene Age fossils --- To introduce the concept of environmental change --- To give students a chance to think about what caused fish to die in an ancient lake ES, MS, HS	140

FOSSIL FISH VERTEBRA -- Miocene fish vertebra from east coast, USA	-- To introduce fossil fish vertebra -- To introduce the notion of animals in an ocean 15 million years ago -- To open a discussion about the length of time human-like animals have been on the Earth ES, MS	226
FOSSIL GRAVEYARDS — A rock sample packed with familiar-looking fossils (clams, snails, brachiopods, etc.)	--- To demonstrate the concept, 'The present is key to the past' --- To start students thinking about depositional environment and how sedimentary rocks are formed ES, MS	38
FOSSIL IDENTIFIED TO SPECIES AND FROM KNOWN LOCATION — Detectives get to check up on the 'experts'	--- To introduce fossil families (taxonomy) i.e. genus and species --- To strengthen the concept of geologic time --- To encourage use and understanding of maps and references --- To raise awareness of the process of fossil identification --- To challenge energetic students MS, HS	123
FOSSIL IDENTIFIED TO SPECIES, AGE, AND FROM KNOWN LOCATION — A well-preserved fossil identified to species, with the locality described and the age determined. — Older detectives get to check up on the 'experts'	--- To provide the opportunity for a student to identify a well-preserved fossil using a variety of references including the internet. --- To introduce the concept of paleogeography--that is, the terrane and climate at the time the organism lived. The fossil can tell us a great deal about this. --- To show that millions of years ago the climate and location of large water bodies were very different than they are today. --- To show that even well-collected fossils are not always identified correctly. HS	164
FOSSIL LEAVES AND PIECES — A piece of mudstone that is not black, clearly showing the imprint of leaves and/or stems	--- To introduce fossil leaves and stems --- To provide an opportunity to write and think about large numbers (millions) --- To open a discussion about processes that happened during fossilization of trees. ES, MS	147
FOSSIL LEAVES IN BLACK SHALE, PENNSYLVANIAN AGE — A piece of black mudstone clearly showing the imprint of leaves	--- To introduce fossil leaves --- To demonstrate a swamp as a depositional environment (the fossils were once trees that grew in a swamp, and the black mud was rich in organic matter from the trees) --- To introduce and/or reinforce the concept of geologic time --- To provide an opportunity to practice geography of the US ES, MS	75
FOSSIL LEAVES, MIOCENE, CALIFORNIA	IN PREPARATION	173
FOSSIL LEAVES, MONONGAHELA GRP., PENNSYLVANIAN AGE	IN PREPARATION HS	249
FOSSIL OYSTER, EXOGYRA	See Exogyra	46
FOSSIL OYSTER, GRAPHAEA	See Graphaea	47
FOSSIL OYSTER, OSTREA	See, Ostrea	134
FOSSIL, PLANT, GREEN RIVER FM	IN PREPARATION	167
FOSSIL RIB BONE FROM MARINE MAMMAL — A large fossil rib bone from a marine animal — A diagram of the human skeleton clearly showing the ribs	--- To introduce the concept that extinct marine mammals have a skeleton somewhat similar to human one --- To introduce the texture and shape of fossil bone --- To introduce the concept of extinct marine animals ES, MS	23
FOSSIL SAND DOLLARS	See Sand Dollars	124
FOSSIL SEA URCHIN	See, Sea Urchin	206
FOSSIL, TRACE	See, COBBLES OF QUARTZITE CONTAINING *Scolithus linearis* See, COPROLITE See, DEVONIAN SHALE WITH TRACE FOSSILS See TRACE FOSSILS, SNAIL See TRACE FOSSILS IN LIMESTONE	29 84 26 79 244
FOSSIL, TRILOBITE	See, TRILOBITE, PIECES IN SHALE OR LIMESTONE See, TRILOBITE, WHOLE	121 55,
FOSSIL TURTLE SHELL	IN PREPARATION	243
FOSSILIFEROUS LIMESTONE OR SHALE — A piece of fossiliferous shale or limestone containing evidence for fossils such as crinoids, gastropods, brachiopods, etc.	--- To encourage students to look carefully for fossil pieces --- To demonstrate typical occurrences of crinoids and other fossil types ES, MS	42
GARNET — A rock with obvious garnet crystals; preferably dark red and showing crystal faces	--- To introduce garnet, an important metamorphic index mineral --- To introduce a mineral with many crystal faces ES, MS	151
GARNET, CHROMIUM GROSSULAR	IN PREPARATION	218
GARNET, MASSIVE	IN PREPARATION	284
GASTROPODS, LEFT AND RIGHT HANDED — Several gastropods that are both left and right handed	--- To demonstrate that gastropods can grow to the right (clockwise) or to the left (counterclockwise) --- To help with left and right consciousness --- To pose a real mystery--scientists don't know why some gastropods grow counterclockwise! ES, MS, HS	116
GEODE(S)	IN PREPARATION	213
GEOLOGIC SAMPLE WITH NUMBERS — Rock specimens with sample numbers on them	— To encourage students to learn where mountains occur on the Earth — To show that mountains are studied by collecting rocks from them — To show that geologists go into foreign countries and study mountain-building — To introduce the concept of numbering samples as they are collected in the field ES, MS	203
GEOLOGIC SAMPLES WITH SAWED FACES — A sample with one obviously sawed surface making a, 'flat face'	--- To introduce the concept of rock slices and thin sections to study the earth --- To sharpen reasoning skills ES, MS	20

GNEISS — A piece of gneiss clearly showing grains and layering	--- To introduce the rock type, gneiss --- To introduce the idea that sedimentary metamorphic rocks were once soft sediment ES, MS, HS	95
GNEISS, FORDHAM, New York City Grades 3-6	See, FORDHAM GNEISS	198
GNEISS, GRANITE	See, Granite Gneiss	145
GNEISS OR SCHIST? -- A piece of schist, clearly showing thin layers of mica flakes -- A piece of gneiss that shows banding with alternate layers of light and dark grains	--- To introduce two common metamorphic rocks, schist and gneiss --- To introduce the mineral, mica; and the notion of mineral grains --- To introduce the process of metamorphism	183
GOETHITE, WEATHERED — Some red, yellow, or brown, fine-grained goethite (derived from weathering hematite, magnetite, etc.)	--- To introduce goethite as a mineral --- To introduce the concept of weathering ES, MS	63
GOLD ORE — Several pieces of gold ore that show very little or no gold (for example, from Republic, Washington)	--- To introduce gold ore --- To introduce the concept that very little metal is contained in ore --- To encourage intuitive problem solving --- To introduce the method of processing gold ore --- To discuss the problems of disposal of mining waste ES, MS, HS	96
GRANITE — A piece (or pieces) of coarse-grained granite clearly showing the colors of the three major minerals — RECOMMENDED FOR YOUNGER STUDENTS: A picture of Granite, with the name in large letters near-by.	--- To show that rocks are made of minerals --- To introduce granite as a rock type --- To show that granite is made of the three minerals, feldspar, quartz and 'dark' minerals that may include hornblend, biotite, etc. ES, MS	44
GRANITE + FELDSPAR	See, Feldspar Crystal and Granite	52
GRANITE FROM MAINE, HISTORY -- A piece of granite of the type shipped south in the 1800's	--- To provide an opportunity to discuss the granite industry in Maine and with it the history of the US --- To use maps to locate granite mines --- To introduce the concept of several varieties of granite --- To study the geography of Maine and Washington, DC --- To introduce the concept of subduction and the origin of granite ES, MS, HS	177
GRANITE & GABBRO -- A piece of granite clearly showing coarse crystal grains -- A piece of dark-colored gabbro Grade 3-6	--- To introduce two major igneous rock types, granite and gabbro --- To recognize mineral differences between granite and gabbro based upon color and weight --- To introduce the layers of the Earth (Core, Mantle, Ocean Crust and Continents) --- To introduce the notions that, 1) igneous rocks form miles beneath the ground, 2) rocks melt to form magma inside the Earth, 3) granite forms from melted continental rocks, and gabbro forms from melted mantle rocks, and, 4) the different color, weight and mineral composition between gabbro and granite can be explained by their different origins inside the Earth	191
GRANITE & GABBRO -- A piece of granite clearly showing coarse crystal grains -- A piece of dark-colored gabbro Grade 7-9	--- To introduce two major igneous rock types, granite and gabbro and to understand the differences in felsic (granite) rocks and mafic (gabbro) rocks --- To recognize mineral differences between granite and gabbro based upon color and weight --- To define density and perform an experiment to discover the densities of granite and gabbro --- To formulate and test a hypothesis regarding density differences between granite and gabbro --- To relate the density differences between granite and gabbro to density distribution within the Earth and to the formation of the Earth's layers (Core, Mantle, Ocean Crust and Continents) --- To introduce the notions that, 1) igneous rocks form hundreds of meters beneath the ground surface, 2) rocks melt and form magma inside the Earth, 3) granite forms from melted continental rocks, and gabbro forms from melted mantle rocks, and, 4) the different color, weight and mineral composition between gabbro and granite can be explained by their different origins inside the Earth	192
GRANITE & GABBRO, NEW PARADIGM -- A piece of granite (for example, from eastern Maine) containing angular pieces (clasts) of dark-colored gabbro Grade 7-12 (Must do #192 first)	--- To build on ideas from Mystery #192 --- To reinforce the idea that this igneous rock formed hundreds of meters beneath the ground, where rocks melt to form magma which rises, cools and hardens, then is ultimately exposed by erosion --- To show that two major igneous rock types, granite and gabbro can occur together even though the magmas have very different origins --- To introduce the notions that, 1) the broken clasts of gabbro indicate that the gabbro must have been cooled and hardened before it was broken into pieces that were incorporated in the soft, molten granite; and 2) that since these breccias are found next to "pillows" known to indicate the intrusion of mafic magma, then the clasts must have been ductile, and rather easily broken, and 3) given that mafic magma intrudes into granite when both are still molten, then we must accept that the two magma types do interact.	194
GRANITE GNEISS __ A piece of granite that is coarse-grained enough to show feldspar, quartz and dark minerals such as mica or amphibole __ A piece of granite gneiss clearly showing banding of dark minerals such as mica or amphibole	--- To introduce metamorphic rocks, specifically granite gneiss --- To show the parallel alignment of dark minerals and provide an opportunity to discuss mineralization under pressure --- To open a discussion about processes that happened during the geologic history of an area including: 1) the origin of granite; 2) what could cause subsequent metamorphism; 3) how the resulting rock gets up to the surface where it can be observed MS, HS	145

GRANITE, GRAPHIC	IN PREPARATION	223

GRANITE, RADIOMETRIC AGE DATING — Coarsely crystalline granite or pegmatite showing large, pink orthoclase crystals (A) in picture below, and one or more of: black hornblende, light gray muscovite flakes, and/or dark brown biotite flakes (B) in picture below. See picture to help identify the minerals in your sample	-- To introduce the radioactivity of elements contained within minerals and how it is used to determine the age of rocks containing those minerals -- To introduce the notion of half-life of a radioactive element -- To provide the opportunity to discuss the age of the earth determined by radioactive decay ES, MS, HS	202
GRANITE, THE ROCK	See, Rock and Crystal	204
GRANITE? WITH OPALESCENT CRYSTALS	IN PREPARATION	286
GRAPHAEA, MOLLUSK, OYSTER, CRETACEOUS AGE — A nearly complete specimen of Graphaea showing thick shell	--- To introduce Graphaea, a well-known Cretaceous fossil oyster (Mollusca) --- To introduce the concept that animals evolve to fit their environment (in this case, the thick shell protects animal from the surf) --- To stimulate thought about why a species becomes extinct ES, MS, HS	47
GRAPHIC GRANITE	IN PREPARATION	223
GRAPHITE	IN PREPARATION	222
GRAPTOLITES Grades 1-6 — A piece of slate clearly showing undeformed Graptolites in white against the black background.	--- To introduce Graptolites, an important Paleozoic marker fossil --- To challenge students to seek answers from the literature --- To dramatize differences between fossil plants and animals --- To provide an opportunity to discuss life in a Paleozoic ocean (graptolites were 'world travelers') ES, MS	117
GRAPTOLITES — A piece of shale clearly showing one or more Graptolites	- To introduce Graptolites (important Paleozoic marker fossils) - To challenge the students to seek the answer from the literature Grades 7-9	195
GYPSUM	See, Alabaster See, Calcite Spar Crystal and Gypsum	
HALITE, SALT ROCK — A sample of Halite rock	--- To show students that salt occurs as a rock --- To introduce the concept that salt rock is from evaporation of sea water --- To demonstrate that mountains of salt can form very quickly --- To introduce the concept that quick in geologic time means 10,000 years --- To demonstrate a formula for a mineral, NaCl --- To discuss Mt. Sedom in Israel and the story of Lott's wife --- To practice using maps --- To discuss halite mining in the US and world ES, MS, HS	16
HEMATITE — A rock mostly composed of reddish hematite Grades 1-4	--- To introduce the mineral Hematite, and to associate it with rust --- To show that some minerals can be identified using simple tests, such as the streak plate test --- To introduce the concept that rocks are made of minerals --- To introduce the notion that minerals are made of elements ES	197
HEMATITE, HISTORIC ORE — Hematite from very old pit mines near Leesburg, VA.	--- To introduce the history of iron mining in early America --- To introduce the mineral hematite --- To show that heavy minerals are made from heavy elements and these elements are called metals --- To show chemical symbols for the elements iron (Fe) and Oxygen (O) ES, MS	101
HERKIMER DIAMONDS	IN PREPARATION	245
HIGH SCHOOL MYSTERIES	See, HS for High School	
HISTORY, AND EARTH SCIENCE — Botryoidal Calcite (from excavation of the Florida Barge Canal. Collected 1967 by the Marcus family). — Civil War, Hematite for cannon balls from very old pit mines near Leesburg, VA. — Granite from Maine Shipped by sail.	See Individual Mysteries	94 101
IGNEOUS ROCKS (see also individual rocks, e.g.. lava, granite) — Pegmatite — Volcanic (Tuff Ignimbrite)	See Individual Mysteries	107 126
IGNIMBRITE	See, Volcanic Tuff	126
ILMENITE SAND, COVE POINT, MD	IN PREPARATION	252
INDIAN "THINGS" FROM THE EARTH — Includes several of the following: Face Paint (Weathered Goethite); Chert for arrow heads; Colored minerals for jewelry; snail-drilled bivalve shells for wampum; pot shards of clay	--- To demonstrate that early people had to use rocks from Nature's Hardware Store --- To encourage students to trust their own observations --- To introduce boring snails --- To introduce flint, conchoidal fracture, and the making of arrowheads --- To introduce the use of minerals as face paint and dye ES, MS	131
JADE, UNCUT, RAW — Raw jade (green, black, or other like mixed green and pink, etc.). Be sure to scrub your sample under water and possibly varnish it to bring out the color.	--- To demonstrate a raw gem mineral --- To open a discussion about the origin of Jade ES, MS	34
KAOLIN, CLAY FOR PORCELAIN Grades 5-8 -- Powdered Kaolin clay Note: Kaolinite is the name associated with the pure crystalline form of the mineral. Kaolin is the name for the industrial clay, which is mostly composed of Kaolinite, but also has other minerals in it.	--- To practice world geography --- To introduce the idea that physical properties affect what a mineral can be used for economically. --- To introduce grain size. --- Introduction of kaolin's molecular structure (the arrangement of atoms in a mineral), and how it changes when heated. --- To introduce the idea that minerals change when exposed to rainy weather, a process called mineral alteration. ES, MS	251

KAOLIN, CLAY FOR PORCELAIN Grades 5-12 -- Powdered Kaolin clay Note: Kaolinite is the name associated with the pure crystalline form of the mineral. Kaolin is the name for the industrial clay, which is mostly composed of Kaolinite, but also has other minerals in it.	--- To introduce the process of mineral alteration. --- To define elements, atoms, and molecules. --- To introduce the concept of paleoenvironment; that climate and sealevel have been very different in the geologic past --- To introduce the concept of flocculation as a process of sediment accumulation. --- To differentiate between igneous, metamorphic, and sedimentary rocks --- To establish the idea that geology and geography are related. ES, MS, HS	255
KAOLIN, CLAY FOR PORCELAIN Grades 5-8 -- Powdered Kaolin clay Note: Kaolinite is the name associated with the pure crystalline form of the mineral. Kaolin is the name for the industrial clay, which is mostly composed of Kaolinite, but also has other minerals in it.	--- To introduce the mineral kaolin and its use for making porcelain. --- To Introduce atomic structure (the way atoms are put together to make minerals). --- To introduce thermal metamorphism (minerals change their structure depending on their surroundings.) ES, MS	256
KAOLIN, CLAY FOR PORCELAIN Grades 9-12 -- Powdered Kaolin clay Note: Kaolinite is the name associated with the pure crystalline form of the mineral. Kaolin is the name for the industrial clay, which is mostly composed of Kaolinite, but also has other minerals in it.	--- To introduce the origin of the mineral Kaolinite by the chemical alteration of feldspar --- To explore the relationship between the arrangement of atoms (molecular structure) within kaolinite and the physical characteristics that make it so well suited for ceramics, particularly for porcelain --- To explore the concept of thermal metamorphism; within minerals the arrangement of atoms changes to maintain equilibrium (stay in balance) with the changing temperature of their environment --- To introduce X-ray diffraction as a method of identifying the atomic structure of minerals MS, HS	257
KAOLIN, CLAY FOR PORCELAIN Grades 9-12 -- Powdered Kaolin clay Note: Kaolinite is the name associated with the pure crystalline form of the mineral. Kaolin is the name for the industrial clay, which is mostly composed of Kaolinite, but also has other minerals in it.	--- To introduce the mineral kaolinite and the notion of a secondary mineral formed by the process of mineral alteration --- To illustrate the difference between residual and sedimentary kaolin deposits --- To introduce the idea that mode of deposition can effect the purity of a mineral deposit and therefore its economic value --- To introduce the idea that climate effects the kind of clay minerals in soils --- To introduce the notion that the kind of clay in ocean sediments varies in different parts of the ocean MS, HS	258
KINDERGARTEN & FIRST GRADE MYSTERIES — Beach-in-a-box, a box of sand with an assortment of fossils and minerals to 'sort'.	See Individual Mysteries	112
K-SPAR (POTASSIUM FELDSPAR), SAMPLES STAINED FOR	IN PREPARATION	248
KYANITE — A piece of Kyanite showing blue color and cleavage grooves	--- To introduce the mineral, kyanite --- To introduce the concept of metamorphic index minerals --- To demonstrate mineral cleavage ES, MS	248
KYANITE, MASSIVE -- Massive kyanite in quartzite from the Ordovician age Arvonia formation that underlies Willis Mountain near Farmville, Virginia, USA	--- To introduce the origin of a large deposit of kyanite, an important industrial mineral --- To provide an opportunity for students to use the Geologic Time Scale --- To introduce and encourage discussion of the Taconic orogenic period of continental collision along what is now the eastern border of the North American continent --- To introduce the chemical formula for kyanite --- To introduce the important geological processes of erosion, denudation and isostacy --- To open a discussion about the use of kyanite for industrial ceramics, particularly for spark plugs in gasoline engines --- To present an example of the transfer of energy from chemical to mechanical	242
LAPILLI TUFF	IN PREPARATION	270
LEPIDOLITE — A sample of lepidolite from Maine. It must show clearly a lilac color	--- To introduce the mica mineral lepidolite --- To provide some practice with naming colors --- To practice locating states of the USA and using compass directions, north and east --- To talk about elements --- To introduce the element lithium, and its use for the treatment of depression --- To introduce the flat shape of the mica minerals MS, HS	152
LIMESTONE AND MARBLE — A piece of limestone showing fossils — A piece of marble showing sugary texture	--- To demonstrate the difference between a sedimentary and a metamorphic rock --- To open a discussion about metamorphism (change in texture and sometimes mineralogy but not overall composition) ES, MS, HS	80
LIMESTONE, LITHOGRAPHIC — A piece of lithographic limestone, preferably cut so that its extremely fine-grained homogeneous texture can be seen, and so a smooth surface is visible.	--- To introduce lithographic limestone and to describe the rock etching process of printing --- To encourage problem solving ES, MS, HS	102
LOESS, ALASKA	IN PREPARATION ---HS	184

LOESS, FAIRBANKS, ALASKA --- A sample of loess from Fairbanks, Alaska	– To introduce the windblown sedimentary deposit called loess – To introduce the notion that tons of sediment accumulated in Alaskan River valleys, 10,000 years ago as glaciers melted – To study the geography of Alaska, and practice locating places with latitude and longitude. – To discuss the origin of loess in Fairbanks (it was blown out of nearby river valleys and deposited on the surrounding area) – To discuss the probems loess has caused for the city of Fairbanks – To introduce the notion that loess contains no clay-sized grains and therefore doesn't stick together well--and, to discuss the way this can effect foundation design of houses – To consider how the grain size, texture and mineral composition of loess can effect soil for growing food --- MS; HS	162
LOESS, MANTANUSKA VALLEY, ALASKA --- A sample of loess from Mantanuska Valley, Alaska	– To introduce the windblown sedimentary deposit called loess – To introduce the notion that tons of sediment accumulated in Alaskan River valleys, 10,000 years ago as glaciers melted – To study the geography of Alaska, and practice locating places with latitude and longitude. – To discuss the origin of loess in Mantanuska Valley – To discuss the probems loess has caused for the city of Fairbanks – To introduce the notion that loess contains no clay-sized grains and therefore doesn't stick together well--and, to discuss the way this can effect foundation design of houses – To consider how the grain size, texture and mineral composition of loess can effect soil for growing food --- MS; HS	250
LYONS SANDSTONE -- a sample of Lyons Sandstone quarried in Colorado	IN PREPARATION	172
MAGNETITE SAND — A bag of sand containing a large percentage of magnetite sand	--- To provide the opportunity to identify a mineral by a characteristic property --- To introduce the concept that rivers can sort minerals by their properties --- To introduce the concept of placer deposits and gold mining ES, MS	143
MAGNETITE, WITH SEVERAL KINDS OF METAL ORES — Several types of metal ores one of which is magnetite — A magnet — A streak plate (unglazed tile)	--- To show that heavy minerals are made of heavy elements (iron= Fe, lead= Pb, copper= Cu etc.) --- To introduce the use of the streak plate --- To show how magnetite got its name ES, MS, HS	13
MANGANESE OXIDE AND MICROBIAL POWER CELL	IN PREPARATION	274
MANITOBA, NORTHWEST TERRITORY, ROCKS FROM	IN PREPARATION	237
MARBLE AND LIMESTONE	See, Limestone and marble	80
MARBLE, COCKEYSVILLE (CAMBRIAN, MD)	See, Cockeysville Marble	54
MARBLE, UNION, GR 8-12	IN PREPARATION	240
MARINE VERTEBRATE FOSSIL BONE — jaw bone, whale — rib bone — vertebra porpoise — vertebra whale	See Individual Mysteries	49 45 23 24 25
METAMORPHOSED SEDIMENTARY ROCKS — Pebble conglomerate	See, Conglomerate, Pebble, Metamorphosed	89
METATUFF, METAMORPHOSED VOLCANIC ASH	IN PREPARATION	282
MINERALS, (See also, individual mineral names, e.g.. hematite, calcite, quartz) -- Amazonite -- Barite -- Biotite -- Fluorite -- Halite -- Kyanite -- Prehnite -- Stilbite -- Talc		 35 128 106 16 76 1 36 98 64,91
MINERAL TO IDENTIFY — A mineral sample with clearly recognizable feature(s) so students can practice. Requires a good guide to mineral identification like, The Audubon Society Field Guide Alfred A Knopf, New York, 1990	--- To show that mineral identification requires references --- To encourage students to question labels --- To provide an opportunity to discuss ways of identifying minerals MS, HS	51
MIOCENE FOSSIL ASSEMBLAGE, HAMPTON, VIRGINIA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss paleogeography of Virginia ES, MS, HS	73

MIOCENE FOSSIL ASSEMBLAGE, NAPLES, FLORIDA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss paleogeography of Florida ES, MS, HS	74
MIOCENE FOSSIL ASSEMBLAGE, SARASOTA, FLORIDA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss paleogeography of Florida ES, MS, HS	72
MOHS' HARDNESS SCALE -- USED WITH VARIOUS MYSTERIES -- Calcite and gypsum -- Quartz -- Talc -- Fluorite -- Quartz and calcite -- Talc -- Talc		 12 31 64 76 77 91 100
MOLLUSKS AND GASTROPODS, TERTIARY, SARASOTA, FLORIDA — Tertiary mollusk and gastropod fossils from Sarasota, Florida that show wide variety of species and some with spikes on their shells.	--- To show that animals develop many different species (diversity) where conditions are good --- To show that lack of erosion of vulnerable parts (spikes) of shells tells us that the energy (wave action on a beach) was low where the animal shells accumulated ES, MS, HS	113
MOLLUSKS, LARGE — A large fossil mollusk with both shells, or valves intact	--- To introduce the concept that mollusks don't all look like modern clams --- To provide the opportunity for students to study the symmetry of an extinct mollusk ES, MS	142
MOLLUSK, OYSTER, EXOGYRA — A nearly complete specimen of Exogyra (Cretaceous) showing thick shell	See, Exogyra	46
MOLLUSK, OYSTER, GRAPHAEA — A nearly complete specimen of Graphaea (Cretaceous) showing thick shell	See, Graphaea	47
MUDSTONE — A piece of mudstone, homogeneous and showing obvious conchoidal fracture	--- To introduce the concept of conchoidal fracture, common to rocks and minerals that are homogeneous and very fine-grained --- To introduce the rock type, mudstone ES, MS	115
MUSCOVITE — A large piece of muscovite	--- To introduce the mica mineral, muscovite --- To demonstrate that mica minerals form in thin sheets --- To open a discussion about how elements bond with each other to form minerals--weak bonds produce sheets ES, MS, HS	14
NATIVE COPPER, SEE ALSO COPPER		207 208
NATIVE COPPER — A handspeciman of natuve copper	-- To help students understand that minerals are composed of elements -- To introduce the chemical symbols for elements -- To introduce the notion that copper is a common metal -- To introduce specific gravity and provide the opportunity to compare the weight of copper to that of water -- To introduce the use of copper for electric wire MS	207
NATIVE COPPER — A handspeciman of natuve copper	-- To help young students understand that some minerals are found in their pure form -- To introduce the notion that native copper was used by ancient humankind ES	208
NATIVE SULPHUR	IN PREPARATION	221
OBSIDIAN Grades 3-6	--- To introduce the volcanic glass, Obsidian --- To portray the idea that glassy lava can be caused by the rapid cooling of stiff, viscous (thick and sticky) volcanic flows. --- To introduce the concept of tool usage by early civilizations	182
OBSIDIAN Grades 7-9	IN PREPARATION	196
OIL SAND — A piece of oil sand that clearly smells like petroleum; is obviously black, sticky, and grains of oil-coated sand rub off.	--- To introduce oil sand --- To show that oil comes from pores in a rock composed of sand grains --- To show that the grains in porous sandstone sometimes are so loosely held together they can come off when you rub the rock --- To introduce the concept of porosity --- To open a discussion about where oil sand is found in ancient rocks, and how geologists look for it ES, MS, HS	90

ONYX — Pieces of onyx showing fine banding	--- To introduce onyx, a popular rock for collectors --- To show that onyx and agate are often names used for the same rock --- To illustrate that window glass and onyx are in the same family of minerals (composed of silica and oxygen) loosely called quartz, and that they don't fizz in acid ES, MS	53
ONYX MARBLE, BANDED _ -A sample of onyx marble that is compact, banded, translucent, and will fizz in acid. This mystery requires calcium (or other) carbonate composition, hence travertine from limestone caves is appropriate.	-- To introduce onyx marble, a popular rock for collectors, because it is dense and takes a good polish. It is used as a decorative or architectural material or for small ornamental objects. -- To introduce the concept of two names (onyx marble and travertine) for the same rock -- To introduce the term, transluscent -- To introduce the concept of caves -- And for older students, to introduce the concept of water dissolving rock (specifically limestone) to form an opening called a cave	163
ONYX MARBLE, NOT FINELY BANDED	IN PREPARATION	267
OPAL, OR OTHER RAW GEM MINERAL — A hand-specimen of raw gem mineral	--- To show what gems look like before they are cut for jewelry --- To provide the opportunity to discuss the origin of various minerals ES, MS, HS	37
OPAL, COMMON, WITH PEARLY LUSTER	IN PREPARATION	275
ORE, VARIOUS METALS -- Aluminum -- Copper -- Gold -- Iron -- Lead -- Silver -- Titanium -- Zinc	See Individual Mysteries	13 104 92 96 101,13 13 132 13 13
OSTREA, FOSSIL OYSTER — A large valve (shell) from one of the common species of Ostrea . Valve must show hinge with growth lines	--- To introduce Ostrea, a well-known Cretaceous fossil oyster (Mollusca) --- To introduce the concept that animals evolve to fit their environment (in this case, the thick shell protects animal from the surf) --- To stimulate thought about why a species becomes extinct --- To use the growth lines to determine age of the specimen ES, MS, HS	134
OSTREA sp., FOSSIL OYSTER — A large valve (shell) from one of the common species of Ostrea . Valve must show hinge with growth lines	--- To introduce Ostrea, a well-known Cretaceous fossil oyster (Mollusca) --- To introduce the concept that animals evolve to fit their environment (in this case, the thick shell protects animal from the surf) --- To stimulate thought about why a species becomes extinct --- To use the growth lines to determine age of the specimen ES, MS, HS	187
PALEOCENE FOSSIL ASSEMBLAGE, VIRGINIA — Separate (individual) Paleocene fossils from Virginia	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Paleocene paleogeography of Virginia ES, MS, HS	4
PALEOZOIC FOSSIL ASSEMBLAGE, BROOKEVILLE, IND.	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Paleozoic paleogeography of Indiana (it was an ocean) ES, MS, HS	69
PEBBLE CONGLOMERATE	See, Conglomerate, Pebble	157
PEBBLE CONGLOMERATE, METAMORPHIC	See, Conglomerate, Pebble, Metamorphosed	89
PEBBLES, TOPAZ (gouttes d'eau) — Pebbles of Topaz from Minas Novas, Brazil	See, Topaz	149
PECTEN, SHELL DIFFERENCES VS SPECIES — Well-preserved top and bottom valves of the mollusk fossil pecten, Chesapecten (if possible). — An articulated (both valves fastened together) pecten showing both valves attached to each other as they were before the animal died — An envelope large enough for the articulated one	--- To introduce the concept that some clam-like animals have dis-similar top and bottom shells --- To introduce Pecten as a common fossil of the Miocene on the East Coast, USA, and especially in the Chesapeake Bay (Chesapecten was the first fossil described in the US!) --- To show the importance of articulated fossils ES, MS, HS	105
PECTOLITE — Pectolite showing radial structure	-- To introduce the concept of radiating mineral growth and the mineral structure called, radial -- To introduce the mineral pectolite ES, MS	211
PEGMATITE — A piece of pegmatite showing clearly three major granite minerals, Quartz, Feldspar and Mica.	--- To introduce the rock type, pegmatite --- To introduce the concept that rocks are made of minerals --- To provide an opportunity to discuss the origin of pegmatite, and the many minerals that are found in it ES, MS, HS	107
PETOSKY STONE, MICHIGAN	IN PREPARATION	227

PETRIFIED WOOD — Two pieces of petrified wood that show bark or other structure easily identified as wood	--- To show that petrified wood has been turned to stone (petros=Greek for stone) --- To introduce the concept of plant cells --- To show that petrification is a cell by cell replacement process in which the detailed structure of the wood is preserved ES, MS, HS	2
PETRIFIED WOOD AND FOSSIL BONE — A piece of petrified wood that shows bark or other structure easily identified as wood — A piece of fossil bone that shows the cell structure clearly — A magnifying glass	See, Fossil Bone and Petrified Wood	32
PHYLLITE, A METAMORPHIC ROCK	IN PREPARATION	268
PLANT FOSSILS, EOCENE, GREEN RIVER FM.	See Fossils; Plants	167
PLATE TECTONICS — Drag fold in very munched rock — Schist with bent layers	See, Drag Fold See, Schist	108 109
PLEISTOCENE FOSSIL ASSEMBLAGE, KNOWN AGE + LOCATION	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Pleistocene paleogeography ES, MS, HS	68
PLIOCENE FOSSIL ASSEMBLAGE, LAUREL, FLA.	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Pliocene paleogeography of Florida ES, MS, HS	71
PLIOCENE FOSSIL ASSEMBLAGE, NORFOLK, VA	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Pliocene paleogeography of Virginia ES, MS, HS	129
PLIOCENE FOSSIL ASSEMBLAGE, PUNTA GORDA, FLORIDA, USA — An assemblage of fossils of Pliocene Age from Punta Gorda, Florida, USA	---To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) ---To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types and ages (especially powerful if several assemblage-type mysteries (eg. #67 to #74) are used together) MS, HS	178
PLIOCENE FOSSIL ASSEMBLAGE, SARASOTA, FLA.	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Pliocene paleogeography of Florida ES, MS, HS	70
PORCELAIN, KAOLIN CLAY FOR	IN PREPARATION	251
PREHNITE	--- To introduce the concept that certain minerals can be used to indicate geologic processes --- To introduce the mineral prehnite --- To encourage speculation about deep earth processes (What causes heat?) ES, MS, HS	36
PUMICE, VOLCANIC — A piece of pumice — preferably one that will float — A cup or bowl of water to float the pumice in — Optional: A picture of a volcano	--- To introduce pumice --- To show that pumice is full of sealed hollow spaces that were gas bubbles and hence volcanic lava is often frothy ES, MS, HS	40
QUARTZ, CITRINE	See, Citrine	137
QUARTZ, DIFFERENT TYPES INCLUDING LARGE EUHEDRAL SPAR — Several pieces of quartz — A heavy glass plate, or clear glass ashtray	--- To introduce the concept of hardness as a characteristic of minerals --- To introduce the mineral quartz and how to identify it --- To demonstrate a mineral formula, SiO_2 ES, MS, HS	31
QUARTZ, IN GRANITE	See, Rock and Crystal	204
QUARTZ, SMOKY	See, Smoky Quartz	136
QUARTZ, TINY GLITTERING CRYSTALS — Rock with Botryoidal (bah-tree-oy-dal) hollow cavities covered with tiny quartz crystals that glitter OR — Rock having an obvious layer or patch of small quartz crystals	--- To introduce the concept of mineral precipitation, and the mineral quartz lining pores --- To open a discussion about why minerals have faces ES, MS, HS	60
QUARTZ VS CALCITE (Mineral identification tests)	See, Calcite and Quartz	77
QUARTZITE	--- To introduce the metamorphic rock, quartzite --- To show that the rock quartzite is different than the mineral quartz --- To introduce 'ite', Greek for, 'made from' ES, MS, HS	97

QUARTZITE AND SANDSTONE — A piece of quartzite clearly showing fracture across grains — A piece of sandstone	--- To introduce the concept of metamorphism as a process of 'welding' the components (grains) that make up sedimentary rocks --- To dramatize the difference between sandstone and quartzite --- To introduce the rock types, sandstone and quartzite ES, MS, HS	122
RADIAL STRUCTURE, MINERALS	See, Pectolite Stilbite Wavellite	 211 98 199
RADIOMETRIC AGE DATING	SEE, GRANITE, RADIOMETRIC AGE DATING	202
RHYOLITE, KINEO, DEVONIAN, MAINE GR 9-12	IN PREPARATION	241
RHYOLITE AND BASALT	IN PREPARATION	264
RIB BONE FOSSIL, TERTIARY, MARINE MAMMAL — A large fossil rib bone from a marine animal — A diagram of the human skeleton clearly showing the ribs	--- To introduce the concept that extinct marine mammals have a skeleton somewhat similar to human one --- To introduce the texture and shape of fossil bone --- To introduce the concept of extinct marine animals ES, MS	23
ROCK AND CRYSTAL -- A handspeciman of granite that clearly shows grains of quartz -- A quartz crystal	-- To help students define crystals, minerals, and rocks -- To introduce granite as a rock-type -- To introduce the mineral quartz in its crystal form and as mineral grains in granite -- To provide the opportunity to identify quartz grains in granite and to understand two different ways the mineral quartz can form ES	204
ROCK, IS IT A?	See, Cliff Swallow Nest	200
ROCK SAMPLES, MANITOBA, NWT, GR 9-12	IN PREPARATION	237
ROCK SAMPLES, SAWED AND NUMBERED — Rock specimens with sample numbers on them, and with sawed faces	--- To introduce the concept of numbering samples as they are collected in the field --- To show that rocks are studied by sawing off a piece for a, 'thin section' --- To show that geologists go into foreign countries and study mountain-building --- To encourage students to use maps of the world ES, MS	43
ROSE QUARTZ CRYSTALS	IN PREPARATION	219
RUTILE CRYSTALS IN QUARTZ	IN PREPARATION	290
SAMPLE, GEOLOGIC, WITH NUMBERS	SEE GEOLOGIC SAMPLE WITH NUMBERS	203
SAND DOLLARS, ECHINODERMS, PLIOCENE, FLORIDA	--- To introduce sand dollars --- To introduce the concept that, 'The Present is Key to the Past' --- To demonstrate paleoecology ES, MS	124
SAND DOLLARS, MODERN — One or two modern sand dollar shells	— To introduce the concept of fossil preservation ES, MS, HS	175
SAND, OIL	See, Oil Sand	90
SAND, THREE KINDS — A bag of black volcanic sand from Hawaii — A bag of white gypsum sand from White Sands, New Mexico — A bag of shelly sand from Florida	--- To introduce the concept that sand is produced in nature by a variety of "tools", such as ocean surf and wind --- To show that sand can vary in composition depending upon the type of nearby rock --- To give young children a global feel for earth processes (the sands come from areas that are widely different and very far apart) ES, MS	81
SANDSTONE AND QUARTZITE	See Quartzite and Sandstone	122
SAPPHIRE, BLUE	IN PREPARATION	210
SCHIST — A piece of schist (sh-ist) clearly showing the effects of squeezing	--- To introduce metamorphic rocks and the concept that great pressure is exerted on rocks deep in the earth --- To demonstrate how scientific words are made from root languages: (meta=change; morphic=shape) ES, MS, HS	109
SCHIST OR GNEISS	See, GNEISS OR SCHIST	183
SCHIST, OR OTHER ROCK TYPE CONTAINING MICA FLAKES — A piece of rock (often schist) containing mica flakes that reflect light.	--- To introduce the mineral mica --- To show that rocks are made of minerals --- To show that mica occurs in flakes ES, MS	83
Scolithus linearis, COBBLES OF QUARTZITE CONTAINING	See, Cobbles of Quartzite containing *Scolithus linearis*	29
SCORIA	IN PREPARATION	230
SEA COW RIB, FOSSIL 'DUGONG' — Piece of fossil rib from the, 'dugong', a pre-Pleistocene sea cow, similar to today's manatee	-- To introduce the 'dugong' and pieces of its rib which are common fossils found on Florida beaches -- To reinforce the concept of extinction	88
SEA URCHIN, FOSSIL -- A fossil sea urchin showing some shell design	-- To introduce the preserved remains (a fossil) of the sea urchin, an animal that is also common in the world today -- To show students the differences and similarities between fossils and their modern counterparts -- To introduce and provide an opportunity to discuss the process of fossilization -- To examine the echinoderms, an important group of animals whose fossilized shells provide information about conditions on the Earth millions of years ago ES	206
SEDIMENTARY ROCKS (See also individual rock names, e.g.. shale, sandstone, etc.)	See Individual Mysteries	
SEDIMENTS, UNCONSOLIDATED — Cobbles — Sand	See Individual Mysteries	119,120 81
SERPENTINE	IN PREPARATION	289

SERPENTINITE — Serpentinite from Huntinghill Quarry, Rockville, Maryland, clearly showing the three minerals, garnet, diopside and talc	--- To introduce the rock type, serpentinite --- To encourage use of maps and to show where certain rock types occur (i.e. serpentinite in Rockville, MD) --- To provide the opportunity to talk about plate tectonics and serpentine as an ocean bottom rock --- To show the three minerals, garnet, talc and diopside --- To provide the opportunity for older students to practice mineral formulas --- To introduce the idea of one mineral (talc), 'growing' at the expense of another (diopside) -- the concept of mineral replacement ES, MS, HS	99
SERPENTINITE (GROSSULAR GARNET + DIOPSIDE) — Serpentinite from Vermont, clearly showing the three minerals, garnet, diopside and talc	— To introduce the rock type serpentinite — To encourage use of maps and to show where certain rock types occur (i.e. serpentinite in Vermont) — To show the three minerals, garnet, talc and diopside — To introduce the idea of one mineral (talc), 'growing' at the expense of another (diopside) -- which is the concept of serpentinization. MS, HS	217
SERPENTINITE, THETFORD, CANADA — Serpentinite from Thetford Quarry, southern Quebec	--- To introduce the rock type serpentinite --- To introduce the Plate Tectonic concept of Mid-ocean Ridges and the eruption of mantle material to form ocean floor --- To open a discussion about Geologic Time and the notion that continents were in very different locations in the past --- To encourage use of maps --- To discuss the concept of movement and collision of Continental and Oceanic tectonic plates MS, HS	174
SHALE, FISSILE — Very fissile shale showing many, many planar surfaces.	--- To introduce the concept of bedding planes --- To introduce shale as a sedimentary rock type --- To teach a new word, fissile ES, MS	61
SHALE, FOSSILIFEROUS -- A sample of shale containing pieces of fossil leaves and stems	--- To introduce fossil pieces (that is all grown-up Rock Detectives often have to work with!) --- To encourage use of the magnifying glass and imagination ES, MS	82
SHALE, BLACK WITH LEAF FOSSILS, Pennsylvanian Age	See, Fossil Leaves in Black Shale, Pennsylvanian Age	75
SHALE FOR BRICK; VIRGINIA; USA	IN PREPARATION	181
SHALE, POKER CHIP — Pieces of poker chip shale (breaks into flat, round pieces, like poker chips) from drill core. The shale should clearly show laminations visible on the side of the core.	--- To introduce and/or reinforce the concept of bedding planes --- With older students this Mystery can open a discussion of the depositional environment of a huge river delta (like the Mississippi River) --- To introduce shale as a rock type --- To demonstrate that shale breaks along bedding planes ES, MS, HS	118
SHALE VS SLATE -- A piece of slate that “clanks” -- A piece of shale that “clunks” -- Teacher supplied: A metal object, eg. a spoon or table knife	--- To learn to identify the difference between slate, a useful metamorphic rock and shale a common sedimentary rock --- To introduce two easily recognizable characteristics of slate, it is always evenly layered and it “clanks” --- To introduce some of the differences between metamorphic and sedimentary rocks ES, MS	225
SHALE, WITH AND WITHOUT MOLLUSK OR GASTROPOD FOSSILS — One piece of shale containing clam-like (brachiopod) or snail-like (gastropod) fossils — A piece of shale containing no fossils	--- To pose the question, "Why are there no fossils in some rocks?", (fossil preservation vs an environment in which no animals lived) --- To develop powers of observation ES, MS	39
SHALE WITH OR WITHOUT FOSSILS (OF ANY KIND) — One piece of shale containing fossils (for example, stems or leaves) — A piece of shale or slate containing no fossils	— To develop powers of observation — To open a discussion about why fossils are found in some places and not in others — [If one of your samples is SLATE] -- To explore the process of metamorphism that results in the destruction of fossils ES, MS	247
SHARKS' TEETH — Several sharks' teeth	— To introduce fossil sharks' teeth — To get the students thinking about how sharks' teeth become fossils. — To show that there was once an ocean over what is now upraised land — To introduce the concept of sea level change ES, MS	3
SHATTERCONES, CAUSED BY METEOR IMPACT	IN PREPARATION	278
SHELL HASH -- Pieces of broken shell, etc. from an ocean beach or near shore environment	-- To introduce the loose sediment called shell hash -- To introduce the notion that ocean margins (beach and near-shore areas) are very high energy environments where shells get broken into pieces -- To provide the opportunity to look closely at loose material that someday may become cemented together into rock ES, MS	188
SHELLS, MODERN AND FOSSIL SHELLS — Modern shells from a sandy tropical beach — One or two groups of shells from much older sandy beaches, preferably in the same area	--- To pose the question, "What is a fossil?" ES, MS	18
SIDERITE, WITH BARITE	IN PREPARATION	239
SILTSTONE, GRAINSIZE/DEPOSITIONAL ENVIRONMENT	IN PREPARATION ES, MS	279

SILURIAN FOSSIL ASSEMBLAGE, NEW CUMBERLAND, MD	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Silurian paleogeography of Maryland ES, MS, HS	67
SILVER ORE — A sample of silver ore	--- To introduce silver ore --- To introduce the concept that very little metal is contained in ore --- To encourage intuitive problem solving --- To introduce the method of processing silver ore --- To discuss the problems of disposal of mining waste ES, MS, HS	132
SKELETON, DIAGRAM OF HUMAN	See Individual Mysteries	24,25,88
SLAG __ A piece of blast furnace iron ore slag, or steel slag, may be fresh or weathered GRADES 5-8	--- To introduce slag, the blast furnace, and the iron smelting process --- To introduce the differences between iron ore slag and steel slag --- To compare slag with volcanic lava --- To introduce the use of steel slag for pavement where skid resistance is important --- To provide the opportunity to talk about how the mining industry is preventing environmental damage by utilizing by-products --- To discuss other uses for a material like slag MS, HS	158
SLAG __ Blast-furnace slag from iron ore smelting GRADES 9-12	--- To introduce the slag and discuss the blast furnace smelting process --- To work with a simple oxidation/reduction reaction, i.e. the reducing of iron ore to elemental iron while oxidizing carbon --- To compare the composition of slag with that of the earth's crust MS, HS	159
SLAG (MAN-MADE ROCK) — A piece of slag (ideally it should show a bubbly texture)	--- To show students one waste produce of the metal refining process --- To show that not all rocks are natural --- To sharpen observational and problem-solving skills ES, MS	33
SLATE, METAMORPHIC ROCK -- A piece of slate that “clanks” -- Teacher supplied: A metal object, eg. a spoon or table knife	-- To learn to identify slate, a familiar rock -- To introduce two easily recognizable characteristics of slate, it is always layered and it “clanks” -- To introduce the concept of metamorphism ES, MS	214
SLATE VS SHALE -- A piece of slate that “clanks” -- A piece of shale that “clunks” -- Teacher supplied: A metal object, eg. a spoon or table knife	-- To learn to identify the difference between slate, a useful metamorphic rock and shale a common sedimentary rock -- To introduce two easily recognizable characteristics of slate, it is always evenly layered and it “clanks” -- To introduce some of the differences between metamorphic and sedimentary rocks GRADES 3-8	225
SLICKENSIDES -- A sample showing slickensides with grooves that are both visible and can be felt with the fingertips	--- To introduce slickensides --- To show evidence for rocks sliding past each other during faulting and/or earthquakes ES, MS	85
SMOKY QUARTZ __ A sample of smoky quartz	--- To introduce smoky quartz --- To introduce the concept of varieties of the same basic mineral, i.e. kinds of quartz --- To introduce the concept of substitution of one element for another within the crystal lattice --- To introduce the concept of hole color centers in crystals --- To show that radiation or heat changes the internal organization of a natural material --- To provide an opportunity to develop and use a chemical formula for a mineral --- To open a discussion about sources of natural radioactivity MS, HS	136
SODALITE __ A sample of sodalite	--- To introduce the mineral sodalite --- To provide some practice with using maps and geography --- To provide the opportunity to discuss the important difference between beliefs and facts	154
SPECIFIC GRAVITY, DEFINITION OF, BARITE AS EXAMPLE	See, Barite	128
SPODUMENE — A sample of spodumene clearly showing pearly luster and crystal cleavage faces with measurable angles of 87° and/or 93°	--- To provide the opportunity for a student to measure cleavage angles and begin to understand the pyroxene family of minerals --- To introduce the concept of fractional crystallization, and differentiation of a molten magma into mineral components that crystallize in order of their properties --- To provide the opportunity to work with elemental symbols and mineral formulas --- To show that the lithium atom has properties that discourage it from being incorporated into solid feldspar mineral structures that are the first ones to solidify when a magma cools MS, HS	165
STAUROLITE, TWINNED	IN PREPARATION	220
STILBITE, RADIATING — Stilbite showing radiating structure.	--- To introduce the concept of mineral shape called radiating --- To introduce the mineral, stilbite --- To show a vein-filling mineral, and discuss veins in rock bodies ES, MS, HS	98
TACTITE (SKARN) It Fizzes!	IN PREPARATION	253
TALC FOR BABY POWDER — A piece of talc (soapstone) — A box of baby powder	--- To introduce the mineral, talc --- To show that minerals are used for everyday products --- To encourage reading ingredients --- To introduce the Mohs"" Scale of Mineral Hardness and the fingernail test ES, MS	91

TALC, SOAPSTONE — A piece of soapstone (talc)	--- To introduce the mineral, talc --- To show that minerals can have more than one name --- To introduce the Mohs Scale of Mineral Hardness and the fingernail test ES, MS	64
TEKTITE — One tectite (a tear-shaped piece of melted rock)	--- To introduce tektites --- To discuss meteorites and what happens when they strike the Earth ES, MS	19
TERTIARY FOSSIL ASSEMBLAGE, FLORIDA — Separate (individual) Tertiary fossils from Florida	--- To introduce the concept of fossil assemblage (a group of species that lived in one place at a specific time in the geologic past) --- To sharpen observational skills (the students must remember differences between species) --- To introduce fossils of various types --- To practice use of maps --- To discuss Tertiary paleogeography of Florida ES, MS	6
TOPAZ — Pebbles of topaz from Brazil	--- To introduce raw topaz, a variety of quartz, and the November birthstone --- To provide the opportunity to talk about how well quartz survives a journey in a river (it is broken and rounded, but not dissolved like sugar) --- To introduce the Portugese language ES, MS	149
TOPAZ — A sample of topaz	- To introduce raw topaz and the November birthstone - To introduce the names of several chemical elements found in topaz - To introduce the Mohs Scale of Mineral Hardness - To note that topaz is a very hard mineral and that hard minerals can survive erosion in a long river journey - To introduce the notion that topaz can be found in many parts of the earth and to provide the opportunity to locate these countries and learn what languages are spoken there ES, MS	209
TOURMALINE — A piece of crystalline tourmaline	--- To introduce the mineral tourmaline and its easy identification --- To open a discussion about piezoelectricity and pyroelectricity MS, HS	156
TOURMALINE — A sample showing crystals with characteristic curved triangular cross-section	--- To show that mineral identification requires references --- To encourage students to question labels MS, HS	51
TRACE FOSSILS IN DEVONIAN SHALE — Devonian shale showing the tracks of animals (e.g.. from the Finger Lakes Region of New York State).	--- To introduce the concept of trace fossils (footprints are a good example of a trace fossil!) --- To show students a Devonian shale --- To introduce shale as a rock type --- To dramatize the Devonian Period in the earth's history ES, MS, HS	26
TRACE FOSSILS IN LIMESTONE -- A slab of limestone showing the tracks of animals imprinted on bedding plane surface .	-- To introduce the concept of TRACE FOSSILS (footprints are a good example of a trace fossil!) -- To show students a bedding plane -- To introduce limestone as a rock type -- To dramatize the concept of “the present is key to the past” ES, MS, HS	244
TRACE FOSSILS, SNAIL — Sandy mudstone showing clear trace of an animal, like a snail making a track across the muddy bottom of a shallow water body	--- To introduce the concept of trace fossils (footprints are a good example of a trace fossil!) --- To demonstrate that 'The Present is Key to the Past' ES, MS	79
TRACE FOSSIL, WORM TRACKS	See, Worm Tracks, sedimentary rock	170
TRILOBITE, PIECES IN SHALE OR LIMESTONE — Several slabs of shale showing clearly pieces of Trilobites. — A good illustration of a Trilobite to put in the envelope	--- To introduce the well-known fossil arthropod, Trilobite (three-lobed body, tri=three) --- To show that fossils don't always come in whole specimens --- To challenge students' powers of observation ES, MS	121
TRILOBITE, PIECES IN SHALE OR LIMESTONE — Several slabs of shale pieces of trilobites.	IN PREPARATION	254
TRILOBITE, WHOLE — A well-preserved trilobite, preferably one still in the rock matrix.	--- To introduce the well-known fossil arthropod, Trilobite (three-lobed body, tri=three) --- To provide students an opportunity to identify species --- To discuss Trilobites ES, MS	55
TUFF, VOLCANIC (IGNIMBRITE)	See, VOLCANIC TUFF, (IGNIMBRITE)	126
TURRITELLA — Several Turritella (Tertiary Age) fossil gastropods	--- To show that fossil snails (Turritella) grow in a whorl that turns clockwise --- To help with the concept of clockwise (to the right) --- To show that Turritella grow the same way even if they live in different areas and at different geologic times ES, MS	110
TURTLESHELL	IN PREPARATION	243
TURTLE SHELL OR BONE FOSSIL — Piece(s) of fossil turtle bone or shell	IN PREPARATION	169
TUSCARORA QUARTZITE, HOLDS UP MOUNTAINS, EG FOLDED APPALACHIANS	IN PREPARATION	283
UMBER, WEATHERED COPPER ORE	--- To introduce the mineral, umber --- To introduce the concept of weathering and the chemical process of some elements being carried away by water leaving other elements behind ES, MS, HS	133
UNAKITE	IN PREPARATION	205

UNION MARBLE, MAINE -- Piece(s) of the Union Marble clearly showing layers rich in mica flakes	--- To introduce a formation name (Union Marble is a well-known formation near Union, ME in the USA) --- To show that metamorphism can cause layering that looks like a sedimentary rock --- To introduce the concept that metamorphism creates new minerals ES, MS	190
URCHIN, SEA, FOSSIL	See, Sea Urchin, Fossil	206
VERTEBRA, FISH	See, Fossil, Fish Vertebra	226
VERTEBRA, FOSSIL, PORPOISE — A large fossil vertebra from a Tertiary age porpoise — A diagram of the human skeleton clearly showing the backbone	--- To introduce a large fossil vertebra from an extinct marine mammal --- To introduce the concept of scale (the fossil bone compared to the size of a human vertebra) ES, MS	24
VERTEBRA, FOSSIL, WHALE — A large fossil vertebra from a Tertiary age whale — A diagram of the human skeleton clearly showing the backbone	--- To introduce a large fossil vertebra from an extinct marine mammal --- To introduce the concept of scale (the fossil bone compared to the size of a human vertebra) ES, MS	25
VESUVIANITE	IN PREPARATION	216
VOLCANIC ASH, MT SPURR, ALASKA — A small bag of ash	--- To introduce the Ring of Fire (volcanoes and earthquakes around the Pacific Ocean) --- To dramatically introduce the concept that the Earth is a living planet --- To show that volcanic ash presents a hazard to living animals, especially, man --- For older students: To introduce the concept of subduction and its relationship to volcanism ES, MS, HS	7
VOLCANIC ASH, MT ST HELEN'S	IN PREPARATION	291
VOLCANIC ASH, REDOUBT, ALASKA — A small bag of ash	--- To introduce the Ring of Fire (volcanoes and earthquakes around the Pacific Ocean) --- To dramatically introduce the concept that the Earth is a living planet --- To show that volcanic ash presents a hazard to living animals, especially, man --- For older students: To introduce the concept of subduction and its relationship to volcanism ES, MS, HS	8
VOLCANIC BASALT — A piece of volcanic basalt (must show ropey structure, and gas bubbles, or crust)	--- To introduce volcanic basalt --- To discuss the composition of volcanic lava --- To sharpen student's ability to draw conclusions from their observations ES, MS	41
VOLCANIC TUFF, IGNIMBRITE — A sample of volcanic tuff that clearly shows angular bits of lava, country rock, pumice etc. cemented with welded ash — Ignimbrite results from deposition of hot ash from the feared lahar, or rapidly traveling ash flow that has buried villages and claimed many lives	--- To introduce an ash flow, called a lahar, that travels dangerously fast down the side of volcanoes --- To open a discussion about how hot volcanic ash is deposited as thick beds which as they cool, become welded rock called, tuff --- To practice converting kilometers per hour to miles per hour ES, MS, HS	126
WASHINGS FROM RESEARCH WELL, LIMESTONE (TERTIARY AGE, FLORIDA) — A bag of "washings" that contains both bone and shell material from an exploration well drilled into fossiliferous limestone.	— To introduce the concept of well drilling as an activity that geologists do to learn more about what rock layers are composed of — To stimulate students to think about how well drilling is done — To show that some marine sedimentary rocks can contain bone from animals as well as shells ES, MS, HS	21
WASP NEST(S), A ROCK? — A mud wasp nest(s) clearly showing the wasp burrows.	--- To discuss the definition of the term, rock --- To encourage use of references --- To raise awareness about rocks created by organisms ES, MS, HS	27
WAVELLITE, RADIAL STRUCTURE — Wavellite showing radial structure	-- To introduce the concept of radiating mineral growth and the mineral structure called, radial -- To introduce the mineral wavellite ES, MS	199
WEATHERED COPPER ORE, UMBER FOR INDIAN FACE PAINT	See, Umber, Weathered Copper Ore	133
WEATHERED IRON ORE, GOETHITE FOR INDIAN FACE PAINT	See, Goethite, Weathered Iron Ore	63
WEATHERED ROCK — A piece of weathered rock, one that is crumbly, light-weight, rusty- looking, but that shows 'ghosts' of minerals that have been dissolved and weathered. Saprolite is perfect for this mystery.	--- To introduce the concept of weathering as a process of dissolving and carrying away reactive elements from the minerals in rocks --- To dramatize the idea that 'dirt' (and soil) is formed from rock that has reacted with rain ES, MS, HS	93
WELL, DRILL CORE FROM	See, Drill Core	22
WHALE EARBONE — A baleen whale earbone fossil	-- To introduce anatomical characteristics of baleen whale ears that are specialized to receive low frequency sound. The ear bones are large and dense enough to resonate at the low frequency vibrations produced by other whales. Also, the loose connections between the ear bones allow the bone room to vibrate a lot. -- To introduce the idea that sound is a pressure wave that travels by pushing molecules into each other, and that in water, low frequency sounds travel longer distances than high frequency sounds because they require less energy to keep moving -- To understand that low frequency hearing allows baleen whales to communicate across large distances in the ocean -- To introduce the idea that baleen whales seem to be solitary creatures, but the ability to communicate log distances allows indivuals in a single group, or pod to spread out over a large area.	49A

WHALE EARBONE — A baleen whale earbone fossil	-- To introduce the two major groups of whales, toothed and baleen, and to note that baleen whales eat small marine organisms which they strain thru baleen, a comb-like material in their mouth -- To introduce the following concepts about humpback baleen whales: - They communicate with each other by "singing" at low frequencies *See discussion about sound frequency in the Teaching Techniques. - Whales in the same pod learn songs from each other. - Different pods of humpback whales sing similar songs even tho they are located in widely distant parts of the ocean. -- To introduce communication sounds and migration patterns of other types of baleen whales. -- To introduce the large area occupied by a single pod of baleen whales and how low frequency sound transmission is essential for their communication	49B
WHALE EARBONE — A baleen whale earbone fossil	IN PREPARATION	49C
WHALE JAWBONE, FOSSIL, BALEEN — A piece of Baleen whale jawbone clearly showing curve	--- To introduce Baleen whale jawbone fossils which are relatively common in late Tertiary formations --- To teach the concept that fossils are often pieces of the whole --- To dramatize the existence of huge marine animals in the geologic past ES, MS	45
WORM BURROWS, SEDIMENTARY ROCK — A piece of drill core, or other rock that clearly shows burrows	--- To dramatize the idea that sedimentary rocks like shale or mudstone were once soft, and often had animals living in them --- To introduce the concept of a trace fossil ES, MS, HS	59
WORM TRACKS, SEDIMENTARY ROCK -- Silty or sandy shale showing the tracks of worm-like animals imprinted on bedding plane surface	-- To introduce the concept of TRACE FOSSILS (footprints are a good example of a trace fossil!) -- To show students a bedding plane -- To introduce silty or sandy shale as a rock type -- To dramatize the concept of "the present is key to the past" ES, MS, HS	170
WORM TUBE, TOREDO WORM, FOSSIL	--- To introduce the concept of boring Mollusks --- To show a trace fossil (evidence left by an animal, but not a part of the living creature, for example, a footprint) ES, MS, HS	58