BULLETIN

NUMBER SIX

of the

In this Issue:

WASHINGTON, D. C.

BULLETIN
OF THE
NATIONAL SPELEOLOGICAL SOCIETY

Issue Number Six | **July 1944** | **750 Copies. 68 Pages**

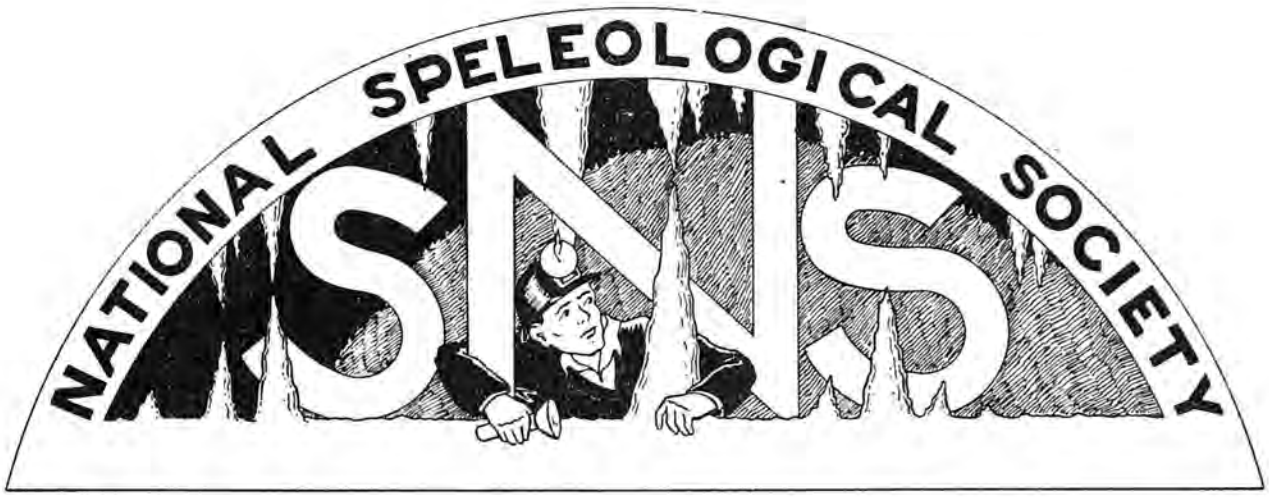
Published intermittently by The National Speleological Society, 510 Star Building, Washington, D. C., at $1.00 per copy.

CONTENTS LISTED ON OUTSIDE BACK COVER

IN THE NEXT ISSUE: From My Cave Notebooks, *by Alexander Wetmore;* Technique of Cavern Photography, *by George F. Jackson;* Composite Observations on Cave Life, *James H. Benn;* Cave of the River Styx, *by Capt. Jack Preble;* and Caves of the British Isles, *by Frank Solari.*

PRINTED BY WASHINGTON COLLEGE PRESS, TAKOMA PARK, MARYLAND

BULLETIN
of the
NATIONAL SPELEOLOGICAL SOCIETY



Number Six July 1944

A GLOSSARY OF SPELEOLOGY

COMPILED BY
DR. MARTIN H. MUMA AND KATHERINE E. MUMA*

Any science, in order to be exact, must possess a standardized terminology. This terminology should, in the strictest sense of the word, include only such terms as are generally used by those working in the field. However, when any science such as speleology includes two or more other sciences, more specialized terms are bound to creep into the language. Of the various branches of speleology those comprising geology, mineralogy, hydrology and biology have probably been the most thoroughly exploited and have therefore been the basis for the majority of terms included here. The other fields will, as their speleological studies progress, develop comparable terminologies. At the present time the language of speleology is restricted and often vague and ambiguous. Many new words are being coined by the various specialists. This cannot help but give rise to the condition of a large synonomy. It is the purpose of this glossary to make the primary step toward the standardization of the terminology by presenting a list of terms and by indicating loose, incorrect and ambiguous terms.

An endeavor has been made to include only terms dealing directly with speleology. Many of the terms listed are colloquial, local or confined in usage to the writings of a single worker. When the term was defined for us, or originated by a single worker that worker has been credited. If it is used colloquially or locally a statement to that effect has been made. In the several instances where specialists have disagreed as to exact definition of a term, the various definitions were listed and credited to the various specialists.

Words having ambiguous or multiple definitions have been indicated as such.

Acknowledgments are due the many fellow members of the National Speleological Society and the various specialists who have assisted us in compiling and defin-

**With previous knowledge that Mr. Mencken would appreciate any new etymological information available, the Editor secured permission of the authors of the Glossary to submit it in advance of publishing to the famous scholar. With his permission, the following is printed in the BULLETIN:*

November 4, 1943

Dear Mr. Bloch:

It seems to me that Mr. and Mrs. Muma have done a really first-rate job. The vocabulary is comprehensive, and the definitions are extremely clear. I'll certainly call attention to it in my projected supplement to "The American Language." Meanwhile, I hope you send me a copy of the printed bulletin when it is ready.

My very best thanks for your friendly aid.

Sincerely yours,
(Signed: H. L. Mencken)

ing terms. Particular appreciation is due Dr. J Harlen Bretz, Dr. R. J. Holden and Dr. Ralph W. Stone for their assistance with geologic and mineralogic terms, to Mr. Virgil Clymer and Dr. E. R. Pohl for their assistance with commercial and developed cave terms, and to Mr. W. J. Stephenson and Mr. J. S. Petrie for their encouragement and cooperation in the accomplishment of this work.

EXPLANATION OF TERMS

A

abrasion, mechanical wear.

acidulated water, water containing carbon dioxide or organic acids.

adit, subterranean passage open at one end only and generally level.

aeration, zone of, zone of rock above water table, not completely saturated. See vadose zone.

aggrade, filling caused by an overloaded carrying agency. See degrade.

aisle, an elongated, high, narrow, traversible passage. See passage, crawl, corridor, and lead.

alabaster, applied commercially to deposits of gypsum in caves. See gypsum.

alluvium, any detrital material deposited by running water.

alluvial fill, a fill composed of alluvium.

anastomosis, a complex of many irregular and repeatedly connected passages. Synonym—labyrinth.

anticline, an upfold or arch of rock strata, dipping in opposite directions from an axis. (Stone) An upward fold in sedimentary rock. (Price)

aquifer, pervious rock that is completely saturated and will yield water to a well. A porous rock strata that carries water.

aquifuge, impervious rock such as that which retains connate or artesian water in an aquifer.

aragonite, a form of calcium carbonate that occurs in orthorhombic crystals, usually formed under pressure. Sp. Gr. 2.99 to 2.93, infusible, soluble in HCl, chemical formula $CaCO_3$. See calcite.

areal map, a geologic map showing the distribution of bedrock formations at the surface and below the mantle rock.

arenaceous, sandy or containing considerable sand.

arenaceous rock, any sedimentary rock having a high percentage of sand.

argillaceous, containing or composed of clay.

argillaceous rock, any sedimentary rock having a high percentage of clay.

artesian circulation, movement of water through an aquifer below an impervious bed and well below a water table.

B

back-flooding, a theory of cave excavation including enlargement of passage at or near the water table by gravity flow alternating in direction with periods of precipitation. (Pohl)

bacon, also known as bacon strip and bacon rind. Thin, elongate, translucent flowstone with parallel colored bands on or projecting from roof and walls of some caves. Resembles bacon strips or slices.

balcony, commercially, a grotto above the floor in the side wall of the cave, usually applied to grottoes large enough for people to walk or stand in. Also commonly used in reference to any projection from the wall of a cave large enough to support one or more persons with or without the aid of climbing equipment.

base level, the lowest level to which land can be eroded by water, and other eroding agencies.

bedding plane, the parting between two adjacent strata. (Bretz) The surface between two adjacent beds of sedimentary rock. (McGill)

bedrock, the solid rock that lies under all loose surface materials; it may be igneous, sedimentary or metamorphic.

blade, the remains of a partition. See bridge and partition.

blind valley, surface valley which is completely enclosed and has only subterranean drainage. See sink and hollow.

botryoid, a grape-like form of calcium carbonate, usually a wall formation. (Curry) See clusterite and grape formation.

box work, a reticulated pattern of thin plates of calcite etched out in relief on limestone walls and ceilings. Typical examples in Black Hills caves.

branch work, dentritic system of subterranean water courses with many incoming branches (tributaries) and no outgoing ones. The type of cave pattern which water table streams should produce. (Bretz)

break, a crack in rock; often lined with formation.

break-down, collapse of a cave roof or corridor, commonly where passages impinge on surface valleys. Position is characterized by presence of surface rubble in the cave.

bridge, an original rock span across a cave inclined less than 45° from the horizontal.

C

calcite, this is a term applied to the variety of forms of calcium carbonate that occur in rhombohedral crystals, Sp. Gr. 2.72 to 2.71, infusible, soluble in HCl, chemical formula $CaCO_3$. See aragonite.

calcareous, containing lime or calcium carbonate in considerable quantity.

carbonation, chemical change due to the action of carbon dioxide. Takes place at a low temperature contrasted to the higher temperature of silication.

capillary fringe, the lowest part of the vadose zone just above the water table. (Meinzer)

carbon dioxide, a gas (CO_2) which combined with rain water or soil water renders ground water an effective solutional agent of calcareous rock.

carbonic acid, See carbon dioxide.

cave, a natural cavity, recess, chamber, or series of chambers or galleries occurring beneath the surface of the earth and usually extending to total darkness and large enough to permit human entrance. Also loosely used as a verb meaning to collapse or fall in. Colloquially used as a verb; to enter and explore caves.

cave axis, the general direction taken by the major portion or main passage of the cave.

cave biota, total life found living in a cave at one time. (Dearolf) Any life occurring in caves in or at the entrance, in the zone of partial darkness or in total darkness irrespective of time. (Muma)

cave channel, the main passage. The course that the cave stream followed in forming the cave.

cave earth, any insoluble organic or inorganic material deposited during channel excavation, remaining from solution of limestone or drifting in through sink holes in underground channels.

cave coral, term applied to formation resembling coral with no reference to the origin of the formation. See knobstone. May also be applied to exposed fossil coral in caves.

cave fauna, total animal life found living in a cave at one time. (Dearolf) Any animal life occurring in caves at or in the entrance, in the zone of partial darkness or in total darkness irrespective of time. (Muma)

cave fill, any material such as mud, sand, gravel, etc. that partially or completely blocks a passageway or room of a cave, or covers the bedrock floor.

cave flora, total plant life found living in a cave at one time. (Dearolf) Any plant life occurring naturally or accidentally under the conditions given for cave fauna.

cave formation, secondary mineral deposits formed by the accumulation, dripping or flowing of water in a cave. Also used for crystal deposits found in certain caves.

cave ice, ice formed in a cave by natural processes. Also incorrect term often applied to dripstone and flowstone.

cave inlet, term used by Malott for a surface stream that goes underground on a gentle gradient.

cave man, a cave dweller; especially a man of the Stone Age.

cave mile, actual linear distance, same as that of mile on the surface (5280 feet). Underground term applied to exaggerated distance, usually any distance over five hundred feet.

cave onyx, a crypto-crystalline banded deposit of calcite or aragonite capable of retaining a high lustre or polish. (Commercial)

cave pearl, a smooth, rounded concretion of calcite or aragonite formed by concentric precipitation around a nucleus. (Stone) Synonym—pisolite.

cave spring, a spring arising within a cave.

cave system, the composite of all passages and rooms underground in a given area whether continuous or discontinuous from a single opening.

cave-in, the collapse of the ceiling or side walls of a cave, or of a land surface into a subterranean passage.

caver, one whose hobby is exploring caves. One who explores caves for recreation. "A nut, a bug, usually a mysogynist; often wears spectacles to correct hyperdeveloped negative stereotropism." (Pohl)

cavern, a large, pretentious, natural underground cavity or cave. A relative term contrasted with cave.

cavernicolous, of or pertaining to caves or caverns. In speleobiology, the term applied to true cave-inhabiting biota.

cavernophile, a cave-loving plant or animal. According to Casteret, any life found commonly in caves that is not true cave life. See troglophile.

cavernophilous, cave-loving. In speleobiology, term applied to cave-loving biota.

cavernophobe, one who shuns darkened or enclosed places. See claustrophobia.

cavernous, divided into small spaces or little caverns. Also applied to any opening large or small that appears deep and dark.

caving, a term applied to incomplete filling in or collapse of a cave. Also the present participle of the loosely used verb, to cave.

cavity, a solutional concavity in limestone caves, the location and outline of which is determined by a joint. Generally larger than a pocket which lacks the determining factor of a joint. (Bretz) Also applies to some basalts as well as limestone; its outlines are not necessarily determined by joints. (Holden) Applied loosely to any hollow or hole in a cave.

ceiling cavity, solutional concavity facing down in a cave ceiling, its length determined by a joint. (Bretz) See domepit.

ceiling meander, winding upside-down channel eroded in the limestone of a cave ceiling. (Bretz)

ceiling pocket, a down-facing solutional concavity in a cave ceiling unrelated to joints in the limestone. (Bretz)

ceiling tube, commonly a half tube occurring in a cave ceiling and elongated along a joint. According to Malott the remains of a primitive cave.

cenotes, vertical, roofless solution shafts in limestone in Yucatan and Mexico. According to Pearse they appear to be a particular type of sink hole. According to Cole they are collapsed shafts.

chamber, a large space in a cave. Perhaps differing from a room in having only one connection with other parts of a cave. See room.

channel, water course made by a free-surface stream.

chasm, a deep wide gap; a cleft; a fissure; a deep recess extending below the floor of a cave. See cleft, fissure and crevice.

chert, a very hard, dull, siliceous substance resembling flint that occus in limestone. (McGill) Also occurs as thick sedimentary deposits. (Pohl)

chimney, a steep ascending passage or vertical shaft smaller by comparison in the same cave than a well or hole. Not necessarily open at both ends. Commercially, an opening in the ceiling where water has entered; a vertical passage or round, cone-shaped room; a rotunda. (G. A. Smith)

chimneying, method of climbing between two vertical or nearly vertical walls by the application of body pressure against the opposing surfaces.

choke, a cave fill completely blocking passage. See cave fill.

chute, an inclined channel or trough.

clastic, in geology, made up of fragments of pre-existing rocks.

claustrophobe, an individual affected by claustrophobia.

claustrophobia, a morbid dread of being in closed rooms or narrow spaces.

clay fill, a fill composed of dry or wet clay.

clay filling, epoch of, the interval occurring between Davis' epochs of phreatic solutional development and of dripstone replenishment. (Bretz)

cleavage, the property of a mineral or metamorphic rock whereby it splits readily parallel to one or more planes.

cleft, See fissure, crevice and chasm.

clusterite, round or semi-round smooth knobs usually occurring in clusters. Common in some caves. See botryoid.

column, a dripstone formation nearly circular in cross section, usually longer than wide, formed by the union of a stalactite and a stalagmite. Contrast with pillar.

collapse sink, a sink hole formed by the falling in of part of a cave roof, generally steep-sided. (Bretz) See ponor.

commercial cave, any cave to which admission is charged.

compaction, the settling of a fill or sediment.

compound stalactite, See stalactite sheet.

concretion, an aggregate of mineral matter formed by precipitation and growth around a nucleus. A cave pearl is one type of concretion.

condensation room, a room in some caves in which there is condensation of water on the walls and ceiling and which is of a different temperature than the outside air or the cave air beyond such a point. Example: Blowhole Cave, Teterton, West Virginia. (Muma)

conduit, a subterranean stream course generally considered to function under hydrostatic pressure, hence it is completely filled with water at all times.

conglomerate, sedimentary rock composed mainly of cemented gravel. (McGill)

conical wall niche, a crescentic wall niche that has been deepened and its curvatuer enlarged by down-cutting contemporaneous with the under-cutting. According to Bretz they record a clay-filled cavern of phreatic origin later washed out by a meandering vadose stream forming the half-cone wall niches; the half cone of limestone carries a slip-off slope on the inside of the curve. (Bretz)

connate water, sea water trapped in the pores of limestone, basalts or other sedimentary rock. Term used by Gardner in his theory on cave formation.

corrasion, the abrasional removal of rock by running water or wind; mechanical wear by streams. See erosion and corrosion.

coral formation, a formation often developed on cave walls where the solute does not accumulate sufficiently to be affected by gravity. See cave coral, botryoid and grape formation.

corridor, a narrow, level, underground passageway that is comparatively straight and connecting two or more rooms. See aisle, passage, lead, crawl.

corrosion, the chemical or solutional removal of rock by running water. See erosion and corrasion.

crater, the funnel-shaped opening of a volcano, geyser or sink hole.

crawl, a passageway low enough to permit passage only by crawling. See aisle, corridor, lead and passage.

crescentic wall niche, a more or less semicircular wall niche eroded in a cave wall by under cutting of a meandering free-surface cave stream. (Bretz)

crevice, a synonym of fissure except possibly of smaller size. See fissure, cleft and chasm.

cross-bedding, lamination in sedimentary rock, confined to single beds and inclined to the general stratification. Found most often in sandstone and some limestones.

crust stone, a fragile formation covering portions of cave walls and having the appearance of a flaky crust. Found locally in Hell Hole and some Kentucky caves. (Stephenson)

crustation, a thin deposit of calcite or gypsum overlying a base.

crystal cave, a cave in which the rock surfaces carry conspicuous crystal faces. See geode.

crystalline rock, an igneous or metamorphic rock composed of minerals crystallized from a parent material. (McGill)

cuesta, an escarpment due to erosion where a moderately tilted stratum resists degradation. Often parallels regional strike of strata. (Pohl)

cul-de-sac, a subterranean passage having but one entrance, also spelled culdesac and cul de sac.

D

dead cave, a cave wherein the formations are dry or dead; one in which excavation and deposition have ceased. Contrast with live cave.

dead end, a corridor or passageway blocked at one end. See cul-de-sac.

deep cave, a cave occurring in two or more levels usually complex or of great length.

degrade, the effort of a stream to reduce its gradient by corrasion.

dendritic, a term often applied to helictites that are shaped like small trees and bushes, many-branched. Also used to describe a cave stream which has many tributaries. Likewise descriptive of a branch work topographic pattern.

developed cave, synonymous with commercial cave except that it may be artificially improved and admission may or may not be charged.

dip, maximum inclination of beds of rock or fault planes to the horizontal measured in degrees.

displacement, amount of movement or displacement along a fault.

doline, the term used by Cvijic for a wide sink hole with gently sloping and usually soil covered sides. Also called doline sink.

dolomite, a rhombohedral magnesium carbonate of lime. Sp. Gr. 2.9 to 2.8, infusible, slightly soluble in HCl, chemical formula $(CaMg)CO_3$. The term is also loosely applied to sedimentary rock carrying 40% of $MgCO_3$.

dolomite cave, cave formed by the solution of dolomite, comparatively rare as compared with limestone caves.

domepit, a shaft or vertically elongated cave room made by vadose water initially descending along a joint plane; when elongated horizontally it does not necessarily follow a joint. (Bretz) See vertical shaft.

drapery, streamer or curtain-like forms of travertine

deposits, usually formed through the union of a row of stalactites or deposited by trickling waters on an inclined cave wall. See bacon.

drift, detrital material that has been washed into a cave from a sink hole or vertical entrance. Often contains remnants of surface biota.

driftstone, stone or strata within a cave which has shifted, that is, shifted in relation to the ceiling and walls.

driphole, any point in a cave where the water drips fast enough to make a hole or niche in the rock or clay. Also point where slow precipitation of lime builds up a rim forming a basin; formations usually form around and over the rock or clay, leaving a central hollow space filled with water. This waterfilled hollow space or pool is known as a drip pool.

drip pool, a small basin of water maintained by dripping water. See driphole.

dripstone, any secondary calcareous cave deposit formed by dripping water.

drop ways, openings between two parallel passages that lie at different levels.

druse, a crystal-covered surface; the term is generally applied where crystals are small and crowded.

duck under, condition in a cave wherein the passage is filled or nearly filled with a stream or pool making it necessary to crawl or swim beneath the surface of the water in order to progress farther.

E

emergence, term applied to the point at which an underground stream comes to the surface. See resurgence.

erode, to wear away, as land by the action of water, wind or any gradational agents.

erosion, the act of eroding or state of being eroded. See corrosion and corrasion.

erosion, cycle of, the sequence of changes in land form resulting from erosion. The cycle includes youth, maturity and old age; the end product is called a peneplain.

ex-commercial, any commercial cave temporarily or permanently closed to the public.

F

facet, term used by Malott and others for flutes. See flutes.

fault, a break in the continuity of a body of rock along which displacement has occurred.

fault block, a body of rock bounded by faults. (Stone) The breaking of the earth's strata by a tilting movement into inclined blocks exhibiting a similar succession is known as block-faulting. (Pohl)

fault cave, a cave developed along a fault or fault system.

feather, See oulopholite.

ferruginous, containing iron, usually in oxide form.

fill, any material fallen from the ceiling or side walls of a cave or washed in and deposited by rains, floods or underground streams.

fissile, capable of being split; cleavable.

fissure, an extensive crack, break or fracture in the rocks. Also applied to a deep, narrow excavation in a cave floor. See crevice, cliff and chasm.

fissure cave, a cave developed on a fissure.

flowstone, any calcareous formation deposited on the walls or floor of a cave by flowing water.

flue, an air inlet or outlet.

flutes, asymmetrical scalloped rock surfaces either abrasional or solutional. See facet. Also known as solution ripples. Applied commercially to individual drapes of drip or flowstone.

fold, an anticline, syncline or monocline in rock caused by lateral pressure.

formation, in geology, a body of sedimentary strata having common lithologic and ecologic characteristics. Also a mapping unit. In speleology, either the country rock in which a cave is developed or the deposits of calcium carbonate in a cave.

formation room, any room in one cave where there is an unusual amount of cave formation, or a room having dripstone in a cave that is otherwise barren of it, or a room in an otherwise dead cave wherein some dripstone is forming.

fossil, the remains, traces or impressions of organisms of previous geologic ages or eras embedded in sedimentary rock.

fossiliferous, containing fossils.

free-surface stream, a gravity cave stream with air in the upper part of the passage it occupies. (Bretz)

fresco, a half section of a stalactite on a cave wall. (Stephenson)

friable, the ability or characteristic to crumble; loosely cemented.

G

gallery, an underground channel or level; a part of an abandoned channel or level above the main passage.

geode, a hollow nodule of stone having its cavity lined with crystals. See crystal cave.

geologist, one versed in the science of geology.

geology, the science of the earth. The science of the minerals or aggregates which compose the earth, the relations which the several constituents bear to each other, their formation, structure, position and history.

geosyncline, a large downfold or sinking trough in the earth's crust. Often includes numerous anticlines and synclines.

graded stream, a stream in whose regimen erosion and deposition are essentially balanced.

granite, granular, crystalline or igneous rock composed mainly of quartz, feldspar and mica.

grape formation, a wall decoration due to deposition from a sparse solute. See botryoid.

grotto, a hole eroded in the side wall of a cave by seepage or by a lateral stream. A small cave, especially one having some attractive feature. An authorized local branch or group of the National Speleological Society.

gravity stream, a continuous downhill flow.

gravity spring, surface discharge of ground water at the water table.

ground water, underground water occupying cavities or intergranular spaces in rock in the zone of saturation. According to Meinzer, this does not include vadose water in the zone of aeration.

ground water divide, the line on a water table surface from which the water table slopes downward and

away on each side. Also called a water table divide. Usually, but not always, underlies a surface water divide.

group, in speleology, two or more closely related formations occurring together.

guano, speleologically, the term applied to the excrement of bats. Usually materially altered physically and chemically with the formation of new minerals. (Holden)

gulf, a term used by Malott to describe a steep-walled sink hole with a flat alluviated floor on which an underground stream either sinks or rises.

guide line, line fastened at the cave entrance and unwound by the explorer to mark his return path; often incorrectly used synonymously with guide rope.

guide rope, rope used in descents to prevent spinning; also used to help climber past obstacles.

gypsum, a hydrous sulphate of lime containing 21 per cent water. Sp. Gr. 2.3, fusibility 2.5 to 3, soluble in HCl, chemical formula $CaSO_4 \cdot 2H_2O$.

gypsum cave, a cave formed by the solution of gypsum, or a cave containing incrustations of gypsum.

gypsum flowers, See oulopholite.

H

hall, See gallery.

helictite, a contorted twig-like lateral projection of calcium carbonate found in caves. Occurs in a wide variety of forms. Also applied to needle-shaped, frost-like crystalline formations.

hollow, a geological term applied to a large sink.

horst, in speleology, a pendant with the connecting portion smaller than the main body. Also a solutional form found in limestone areas beneath the soil mantle.

hydraulic circulation, a flow of water controlled in direction and velocity by hydrostatic pressure.

hydrographer, one who is versed in hydrography.

hydrography, the description and study of seas, lakes, rivers and other waters especially with reference to utilization of their waters.

hydrologist, one who is versed in hydrology.

hydrology, the science that relates to the surface and underground water of the earth, its properties, phenomena and laws.

hydrophilous, water-loving. Term used to describe water-loving plants or animals. Also used in connection with water-attracting chemicals.

hydrotropism, the negative or positive reaction of a plant or an animal to water.

hydrostatic pressure, pressure due to weight of water at higher levels in the zone of saturation.

hypogaeic, of, pertaining to, or occurring beneath the surface of the ground; subterranean.

hypogeous, occurring, living or growing beneath the surface of the ground.

I

ice cave, a cave in which ice forms and persists throughout the majority of the year. Also a cave formed in ice.

ice piton, spikes long enough so that when driven into ice they support climber or aid him in retaining balance.

igneous rock, rock formed by the cooling and hardening of molten rock materials.

impervious rock, rock resistant to water penetration and percolation.

intermediate channels, angular or almost horizontal channels between well-defined levels.

intersecting channel, an opening or passage between two major channels or levels.

intraformational solution, the theory that solution of limestone may remove a fraction of a calcareous formation, the overlying rock settling with the solution, thus leaving no cavity. (Stockdale)

invasion theory, the theory that phreatic caves are small and that the surface streams using them under vadose conditions are responsible for most of the solutional enlargement. (Malott)

inverted siphon, a passage forming a U, contrasted with siphon.

J

joint, a deep crack in rock usually vertical or steeply inclined, often occurring in systems of two sets intersecting at right angles.

junction, point where two or more passages meet or intersect horizontally or vertically.

juvenile water, See magmatic water.

K

karabiner, term applied to snap rings, oval or pear-shaped, used to attach rope to a piton or to secure safety rope to climbing rope, line, rung of ladder, etc.

karst, the topography of a limestone region characterized by sink holes.

karst cave, a cave in which the water enters directly through sink holes.

karst fenster, See karst window.

karst topography, a land surface full of limestone ridges, sinks and solution cavities of various sizes. Used synonymously with karst.

karst window, the term applied to a place where an underground stream flows out of an open cavern across an open space and into an open cavern. (Malott) Synonym—karst fenster.

keyhole, a small passage that in cross section is rounded at the top, constricted near the middle, and is roughly rectangular or flares below.

knobstone, a term used primarily by Stephenson for the formation generally called cave coral. Generally larger, more pronounced and more widely separated than cave coral. Commercial synonym—"potatoes in the year of drought."

L

lake, a term commonly applied to a body of standing subterranean water, often only a few feet in diameter. Vaguely differing from a pond or pool in size.

laminar flow, the movement of a medium in horizontal sheets or layers in which the lowest part moves slowest and there is no mixing of upper and lower layers. Contrast turbulent flow.

lapiaz, areas torn by erosion forming chasms, trap holes, fissures and tunnels.

lapies, fluting, grooving, faceting and scalloping of limestone by solution.

lava cave, usually a long hollow tube formed by the evacuation of the interior of a lava flow whose surface has solidified. Occasionally chambers and rooms are formed in this manner.

lava tunnel, a lava cave having an opening at both ends.

leach, the solutional action of atmospheric, vadose, or ground water on calcareous deposits.

lead, the term applied to any small passage, usually narrow and following a general direction. See passage, crawl and aisle.

level, the altitudinal relation of a cave floor with an outside surface. Also, one of a series of more or less horizontal passages occurring at more than one depth in the ground.

lily pool, a terraced rimstone pool. See rice paddy.

limb, one side or arm of a fold, syncline or anticline.

limestone, sedimentary rock composed largely of calcium carbonate.

limestone cave, a cave formed in limestone.
stone.

live cave, a cave with a flowing stream and/or dripping water in which calcium carbonate is being deposited.

loop ladder, a rope with a loop tied every two feet; used as ladder in climbing.

lost river, a surface stream that enters an underground course.

M

magmatic water, water that has escaped from cooling liquid rock.

meander niche, See crescentic and conical wall niche. (Bretz)

marine cave, a cave at sea level, containing sea water which is affected by tides. Also applied to any cave formed by wave action on rock or occurring below sea level. Loosely applied to caves containing an abundance of fossils.

meteoric water, water from rainfall contrasted with magmatic and connate ground water.

metamorphic rock, igneous or sedimentary rock greatly altered by heat or pressure.

monocline, beds of rock dipping in one direction.

mud fill, a condition wherein a passage is plugged or partly plugged with mud; mud choke.

mud stalagmite, a stalagmite formed of mud, usually squat and caused by extremely muddy dripping water.

mud piton, same as an ice piton except flat-bladed.

N

network, an anastomosing angular ground plan of cave passages located along intersecting joints.

nodule, a small, irregular, roundish lump of substance, commonly chert, formed in a rock. Also applied to nodular cave formations.

O

oolite, a variety of limestone consisting of round grains like the roe of a fish. Often incorrectly applied to cave pearls. See cave pearl.

one-cycle cave, a cave developed by the circulation of vadose water above and at the water table during the present cycle of erosion. (Davis)

one-cycle theory, the theory that caves are made by the circulation of vadose water above and at the water table, during the present cycle of erosion. (Davis)

opening, a hole in the surface of the earth that may or may not lead into a cave.

oulophlite, term applied to the occurrence of gypsum in crystals or crystalline masses that are curved and twisted. Gypsum ($CaSO_4 \cdot 2H_2O$ selenite) occurring in more or less curved, twisted forms. Synonyms —cave flowers, gypsum flowers, alabaster lilies, gypsum rosettes.

P

pahoehoe lava, lava having a smooth, ropy, fluted or lobate surface resulting from cooling, quiet lava streams.

partial darkness, zone of, term originally used by Archer for that part of an underground channel wherein light can be detected from at least one point in the channel. (Muma)

partition, an original rock span across a cave inclined from the horizontal more than 45°. (Bretz)

passage, an underground opening having greater length than height or width, large enough for human entrance and larger by comparison than a lead. See aisle, lead, crawl and corridor.

pendant, a hanging projection of native rock from ceilings or overhanging walls, not dripstone. (Bretz) The term is also applied to stalactites.

perched water table, a lens-shaped body of ground water held within the vadose zone over a limited area by impervious rock.

permeable, having a texture that permits the penetration or movement of water.

peter out, applied, in speleology, to the condition wherein a lead tapers too small for human passage.

phototropism, the positive or negative reaction of a plant or animal to light.

phreatic water, underground water at or below the water table, specifically underground water reached by wells. See ground water.

physiographer, one versed in the science of physiography.

physiography, in general, the description of nature or natural penomena; specifically, the description and interpretation of the surface features of the earth.

pillar, a column of rock remaining after the solution of soluble rock. Contrast with column. Also commercially applied to a column or stalactostalagmite.

piracy, the diversion of a water course, surface or subterranean, from an upper level to a more favorably situated lower level. The upper water course is pirated, robbed, beheaded or segmented. (Bretz) Piracy may occur horizontally or vertically; underground, chiefly vertically. (Holden)

pisolite, See cave pearl.

pit, a deep well in a cave; also one of the small holes or pits made by true cave beetles in cave clay or sand.

pit colony, a group of small pits such as is made by true cave beetles in cave clay or sand. Also the occurrence of certain faunal forms in pits.

pocket, a solutional concavity in a cave ceiling, wall or floor whose location is not determined by a joint but by localized attack of a current. They rarely occur singly. (Bretz)

ponor, term used by Cvijic for a steep-sided sink hole, caused by the collapse of a portion of a cave roof.

pool, a loose term used for any small body of standing water within a cave. Often confused with lake or pond.

port hole, a nearly circular natural opening, usually about two feet in diameter, penetrating a thin rock wall, often connecting two parallel passages.

pothole, an abrasional or solutional circular concavity usually on cave floors or gently sloping walls, caused by swirling in free-surface streams. Sand, gravel and stones are the abrasional agents.

primitive cave, the term used by Malott for the initial passage developed by phreatic circulation.

Q

quartz, a mineral composed of silica, SiO_2.

quartzite, a metamorphosed sandstone; quartz sand cemented by silica.

quartzose, containing quartz.

R

rappelling, the art of lowering oneself by a rope, using the friction of the rope around the body as a brake.

replenishment, epoch of, term used by Davis in his two-cycle theory for the later period in a cave's history when the presence of air allows deposition of dripstone, flowstone and rimstone.

resistant rock, rock that disintegrates slowly under the action of erosive agents.

resurgence, return to the surface of a lost river. See emergence.

rice paddy, terraced rimstone pool.

rift, a relatively long, narrow opening above or between underground channels.

rill, a small channel made in the ceiling, wall or floor of a cave channel by circulating water.

rimstone, term used by Davis for calcareous deposits formed around the edges of overflowing basins. See travertine dam.

rise, Malott's term for a resurgence.

rock fissure, See fissure.

rock house, in speleology, a cave in a cliff with openings through face of cliff.

rock piton, same as ice piton but shorter.

rock shelter, See rock house; may be a simple room in a rock cleft.

rope ladder, a ladder made entirely of rope, or of rope with wooden rungs, often used in caves because it can be easily folded and carried.

room, an expanded portion of a passage whose dimensions are expressed in feet or yards, differing from a chamber in having more than one connection with the rest of the cave. See chamber.

rosette, a flower-like form usually of calcium sulfate (gypsum). See oulopholite.

S

safety rope, a second rope usually fastened to the climber by a bowline to prevent accident by falling or the breakage of the climbing rope. Often confused with guide rope.

saltpeter, potassium nitrate, niter, rock salt, (KNO_3). all interstices are always full of water under hydro-

saltpeter cave, a cave from which soluble nitrates such as calcium nitrate, formerly used in the preparation of saltpeter, may be obtained. (Holden)

saltpeter earth, cave deposits from which soluble nitrates may be obtained. Often erroneously believed to contain saltpeter.

saltpeter rock, synonym of saltpeter earth.

sand fill, cave fill composed of sand.

sandstone cave, a cave developed in sandstone; often caused by wind erosion.

sandstone, a sedimentary rock composed of cemented grains of sand, commonly particles of quartz.

saturation, zone of, rock below a water table in which static pressure. Synonym—phreatic zone.

schist, foliated crystalline metamorphic rock exhibiting cleavage.

sea cave, a cavity produced by wave action in a rock ledge at sea level. See marine cave.

secondary, material derived from solution of other rocks and redeposited by streams, ground water or vadose water. (McGill)

sedimentary rock, rock composed of particles of other rock, organic remains, or other materials deposited from air or from solution in water. It is always a secondary rock and is characterized by layered structure known as bedding or stratification.

segmentation, See piracy.

selenite, hydrous calcium sulfate often occurring in clear bladed crystals.

shaft, in caves, a chimney, a vertical passage.

shaft cave, a cave or portion of a cave having the dimensions and position of a shaft.

shale, sedimentary rock composed of indurated clay and mud. It is characterized by rather fragile and uneven laminae.

shallow cave, a cave close under the surface. Also a passage extending only a few feet underground.

sheet, a thin coating of calcium carbonate formed on walls, shelves, benches and terraces by trickling water.

shield, a disc-shaped formation standing edgewise at a high angle in a cave, origin obscure.

silication, the formation of a silicate by chemical union of silica with a base. See carbonation and silicification.

siliceous, containing silica (SiO_2).

silicification, replacement of other materials by silica or direct deposition of silica. Contrast silication.

silt, insoluble fine sediment often occurring in cave streams, lakes and pools. It also occurs over rock and clay on cave floors.

simple solution cave, a cave in which the water seeps through the rock to enter and develop it.

sink, one of the hollows in limestone regions caused by the collapse of a cave roof and often communicating with a cavern or subterranean passage. This term is contrasted with sink hole. Definitions of the two terms are debatable even among authorities. See sink hole.

sink hole, a depression in the earth's surface caused by solution. See sink.

sinking creek, a small stream which disappears into a subterranean course. Usually characteristic near the

head of erosion in karst areas. Synonyms—sinking stream, sinking spring.

siphon, a comparatively small, upright or inverted U-shaped channel filled with water in hydrostatic balance. See inverted siphon and duck under.

slip-off slope, See conical wall niche.

slump pit, a dip in the clay fill of a cave caused by a vadose stream eroding away the clay beneath the fill.

solution cavity, a cavity formed by solution of differentially soluble rock.

solution, epoch of, the first epoch in a cave's history occurring, according to Davis, in the zone of saturation.

solution ripples, Malott's term for flutes.

speleobiologist, a student of cave biota.

speleobiology, the study of cave biota.

speleological, of or pertaining to speleology.

speleologist, one versed in the study of speleology.

speleology, the scientific study, exploration and description of caves and all matters pertaining to caves.

spelunker, one who explores caves as a hobby or recreation.

spelunking, caving with recreation as the primary motive.

spring, any natural discharge of underground hot or cold, pure or mineralized water. Commonly, the point where underground water emerges.

spongework, an irregular pattern of very small interconnected solution cavities. (Bretz)

spur, an outjutting of rock sufficiently insoluble to have resisted solution; usually extends horizontally from a sidewall.

squeeze, a passageway so narrow that forward progress can be made only with difficulty.

stalactite, depending columnar or icicle-like deposit, generally of calcium carbonate, formed on the roof of a cavern by the drip of mineral solutions. See dripstone.

stalactite sheet, compound stalactitic deposit forming a sheet.

stalactostalagmite, a column formed by the union of a stalactite and stalagmite. See column.

stalagmite, an uprising columnar deposit, generally of calcium carbonate, formed on the floor of a cavern by the drip of mineral solutions from the roof. It may also be formed on a shelf or ledge. See dripstone.

static water zone, the deepest portion of the water-saturated rock, where circulation is very slow.

static water zone theory, the theory that the draining of connate water from porous zones in limestone permits solutional enlargement of these zones by vadose water. (Gardner)

stratification, See bedding and sedimentary rock.

stratified, in beds or layers.

stratigraphy, the description and interpretation of the succession and relation of rock.

stratum, a bed or layer of rock or earth. Plural, strata.

stream capture, See piracy.

strike, the trend of a fold. The course or bearing of the outcrop of an inclined bed or structure on a level surface.

structure, arrangement of rocks in the earth's crust. (McGill)

structure section, a graph showing the relationship of rocks of the earth's crust as they would appear in a vertical section.

stylolite, a small, short, columnar structure, transverse to the bedding, common in some limestones and calcareous shales, and supposed to have been formed by differential, vertical movement under solution or pressure.

subterranean, being or occurring under the surface of the earth; hypogaeic.

subwater table stream, the term used by Davis for strong arterial ground water under hydrostatic pressure. According to Bretz this would include all strong flows giving rise to large magnitude springs.

subwater table stream theory, the theory that most large elongated caves of phreatic origin are records of former subwater table streams.

suspended water table, a local water table in the vadose zone. See perched water table.

swallow hole, any nearly vertical route by which a surface stream may wholly or in part disappear under ground. (Bretz) A small, usually steep-sided vent, dry except during rains, found in the base of most sinks. (Pohl)

syncline, a downward fold in stratified rock. (McGill and Price) A trough-shaped fold in rocks in which the strata dip inward from both sides towards the axis; opposite of anticline. (Stone)

system, all the rocks formed during a geologic period. Also applied to a genetically related series of cave passages, even though at present distinct from each other.

T

talus, on the surface, a heap of coarse rock waste at the foot of a cliff, or a sheet of rock waste covering a slope below a cliff. In a cave, loose rock fallen from side wall or ceiling and resting at a critical angle.

total darkness, zone of, term used for that part of a cave to which no light penetrates.

trail, the cave passageway marked out by previous explorers. Also walkways in developed caves.

traverse, in speleology, to make a traverse survey; a line surveyed across a given area. Also to progress horizontally along a rock wall above floor level.

travertine, a concretionary calcareous rock, usually light colored, either calcite or aragonite, usually hard and semi-crystalline, deposited from the water of springs. Cave floor flowstone is also called travertine. According to Holden a general term for calcium carbonate deposits, either of calcite or dolomite, formed from solution on the surface or in large cavities in the vadose zone; it includes onyx marble and some forms of marl.

travertine dam, a deposit of rimstone caused when lime in solution overflows an obstruction. See rimstone, rice paddy and lily pool. Sometimes such a deposit dams a free surface cave stream.

troglobies, plants and animals that are wholly troglodyte.

troglodyte, a cave dweller; cave man; an animal that spends its entire life in darkness. Used locally in some places as a synonym of spelunker.

troglodyting, caving; exploring caves as a hobby or recreation.
troglophiles, plants and animals that live more or less continually underground, but have relations with the epigean world.
troglozenes, facultative inhabitants of caves that have some adaptations which fit them for cave life. (Racovitza)
tufa, a deposit similar to travertine except that it is more porous. A porous travertine.
tufaceous, having the texture of tufa.
tunnel, a natural or artificial subterranean passage open at both ends and generally level.
tunnel cave, a simple cave composed of one passageway into which a surface stream enters and later emerges as a spring or resurgence.
turbulent flow, the ordinary mixing flow of air and water, strands or streams of swifter current crossing main flow. Contrasted with laminar flow.
two-cycle cave, a cave apparently developed according to the two cycle theory.
two cycle theory, the Davis theory that caves are made by phreatic circulation and that only after lowering of the water table do they become partially drained and contain air.

U

underground rocking, rock climbing inside of a cave contrasted with rock climbing on the surface.
upside-down channel, See ceiling meander.
uvala, the term used by Cvijic for a large, elongated sink hole formed by the coalescence of a row of doline sinks.

V

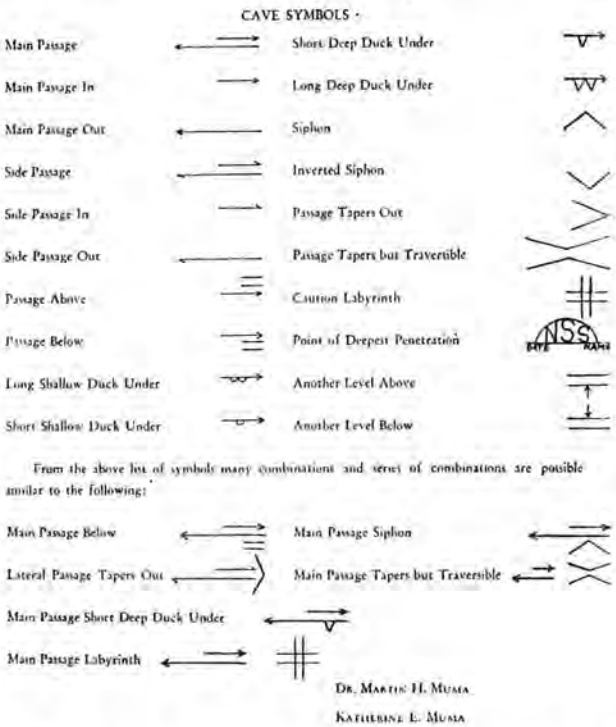
vadose, See vadose water.
vadose water, shallow ground water; water passing through the zone of aeration on its way to join and become ground water.
vadose zone, that portion of the earth between the water table and the surface.
vein, a deposit of mineral matter in a joint or crevice.
vent, a narrow intersecting channel, too small for human passage. Also the outlet of a sink hole.
vertical shaft, a vertically elongated subterranean chamber formed by a concentrated vadose flow. See dome-pit.
vertical well, a vertical shaft opening to the surface.
vug, a small unfilled cavity in a rock or vein. A vug in limestone lined with crystals may become a geode. See geode.

W

wash, any loose deposit of sand, gravel, boulders, etc.
water table, upper surface of the zone saturated with ground water.
water table stream, a gravity cave stream flow along the gradient of the water table.
water table stream theory, the theory that the major solution work in the origin of a cave is done at the level of the water table. (Swinnerton)
water level, the level at which, by natural or artificial drainage, water is removed from a cave.
weak rock, rock which offers slight resistance to erosion or solution.
well, same as chimney except that it occurs in the floor.
window, a natural opening above the floor of a passage or room, usually a few square feet in area, giving access or a view into an adjoining cavity or to the outdoors. Less symmetrical than a porthole. See porthole.
wire ladder, same as rope ladder except rope is replaced by wire.

SYMBOLS FOR USE IN CAVES

As the National Speleological Society grows in membership and becomes more widespread and more caves are discovered and explored it will become increasingly necessary to standardize symbols used in cave exploration. The demand for this standardization is not as



evident now as it will be when the majority of the caves of the country have been discovered and explored. As yet most of the caving done by the Society is into relatively new territory. Many members of the Society now and an increasing number in the future will be interested in caves solely for exploration and adventure. At the same time the number of biologists and other cave scientists will increase. The principal purpose of these scientists is to collect data and identify and record material of scientific interest in the caves. The job of the scientist would be greatly simplified if, on entering a cave, he found it well marked as to possible passages, length of passages, danger points, duck unders and extent of exploration. The scientist would have

only to, follow the symbols, collect his data and material, and waste no time in exploration or in following passages that soon taper out.

We are proposing the following list and request anyone interested or anyone who may have corrections, additions or suggestions to contact us.

THE NETHERLAND OF NIGHT

By Jo Chamberlin

Most of our American streams have been traced to their sources, our mountain peaks climbed, and our valleys surveyed. But there is an America underneath the earth which has never been explored and possibly never will be, a netherworld of night where man has yet to go. The United States is perhaps the richest of any country in the number, size, and variety of its underground caverns, and yet the exploration of them has barely begun . . . one of the most exciting, dangerous, macabre adventures left to man.

Mammoth Cave in Kentucky was discovered as long ago as 1799 by a hunter chasing a b'ar into a hole. Since that time 200 miles of its passages have been walked, crawled, hauled, and wiggled through by experienced men, but the end of Mammoth has yet to be found. There are five distinct levels with passages going in all directions for untold scores of miles. And Mammoth is one of possibly five hundred caves in the area, many of which have not been explored at all.

One recent autumn a party of scientists and trained guides started out to find the end of Roaring River, the underground stream in the lowest of Mammoth's levels, 360 feet underground. Two years ago an exploring group, using rubber boats, managed to get several miles up and down this stream, and were forced back because of low ceilings—just a few inches above the gunwales. All of the men admitted frankly that they were afraid of rising water which has been known to rise 22 feet in eight hours. Twenty-two inches would have drowned the men like rats. Nobody knows what is at the end of Roaring River because nobody has been there.

In the Guadalupe Mountains of New Mexico and Texas are at least a hundred of the grandest caverns in the world. In Carlsbad Cavern there is one room long enough to lay four ocean liners end to end, wide enough for two football fields, and high enough to accommodate a 30-story building. Visitors take a trip lasting about six hours and covering about seven miles. Some 33 miles of Carlsbad Cavern have been explored, but several levels below these shown to visitors are known to exist. An expedition of the National Geographic Society spent five months in Carlsbad Cave and reported that they had barely begun to see what was there.

The late Amelia Earhart, on seeing the black chasm in Carlsbad known as the "bottomless pit," inquired if she might join a party which would explore some of Carlsbad's dark, untrodden rooms just as soon as her flying projects would permit. The unknown appealed to her. Although attending to the many visitors does not permit much exploration, Supt. Thomas Boles felt that she was an outstanding woman of the times and that an exception could be made. Miss Earhart was to enter the unexplored regions when she returned. Had she not disappeared mysteriously over the Pacific, she undoubtedly would have penetrated some of the mysteries of Carlsbad Cavern.

Mammoth and Carlsbad have been explored *more* than most caves. There are hundreds of caves, in almost every state, that are not so extensive as those in the Shenandoah Valley, Kentucky, Missouri, or the Guadalupe Mountains, but which offer interest and excitement for the person with the strength, skill and nerve to go into them. "Caving" is not an adventure which appeals to men who must have a grandstand, wear fancy clothes, and talk on the radio afterward. Old clothes are best and the temperature remains constant in caves the year round—from 44° to about 54° Fahrenheit. "Caving" is unlike mountain climbing, where you can die with your head in the clouds if you make a mistake. It is not a pleasant thing to die in darkness, and it speaks well for the men who explore caves that, while they may get hurt occasionally, they are rarely killed.

They do not consider their work unusually hazardous, and believe that caving is only as dangerous as one wants to make it. It can be perfectly safe—or one can shake hands with death in the dark chasms.

There are two kinds of caves, developed and undeveloped. The former, privately owned and those administered by the government in our various parks, you can walk through in perfect comfort and safety. Their glistening stalactites and stalagmites are skillfully illuminated, the guide's language informative and sometimes amusing. But for people interested in adventure, the undeveloped, unexplored, or comparatively unexplored cave which may be only a few hundred feet in extent offers great thrills. It is these alone we are talking about. Men of sterner stuff would like to see what no one else has seen before—what nature as an artist can do with a little calcium carbonate, plain water, and ten million years.

In England, France, Germany, and Italy there are over two hundred clubs of men and women whose major interest is speleology—the study of caves and their

contents. The distinguished scientist, Sir Arthur Keith, is head of the British Speleological Society, which has a magazine devoted to "caving." Every weekend enthusiastic groups set out with lights, rope, food, and old clothes to explore the netherworld of night. So many amateurs have become adherents of the sport that a professional rescue organization has been formed in England to avoid deaths. In America there are "cavers" scattered across the country; scientists, guides in commercial caves who explore in slack seasons, and many others who "cave" as a hobby. This latter group, in one instance, embraces such diverse folk as a book dealer, a waterworks engineer, a blacksmith, a minister, a grocer, several newspaper reporters, a violinist, and, appropriately enough, an undertaker.

Scientific interest in caves has been greatly stimulated in recent years by a new theory of their origins expounded by the late Professor W. M. Davis in 1930. Formerly, caves were considered as the simple result of running water dissolving and cutting passages through limestone fissures. The new theory is that they were formed for the most part under water millions of years ago, and that recent streams in them have done little to change them. Which brings us to another mystery—no one really knows how the caves themselves were formed. Some of the oldtime cave guides have theories ranging from the credible to the utterly fantastic, and they love to expound them. One geology student, wearying of such discussion, said *he* had a new theory. The rock, he suggested, simply formed around a hole that had been there in the first place.

Finding a cave no one has been in before is often an accidental matter, but a good grade of detective work, based on scientific knowledge, is a great help. Winding valleys and rugged ravines often make it difficult even for natives to locate known openings. But caves occur in limestone regions and where there is one cave, there are likely to be others.

One of the Shenandoah Valley caves (Endless) was discovered by boys chasing rabbits, another (Luray) by two men seeking another entrance to a known cave on the other side of a hill, and a Kentucky cave (Crystal) by a young woman blackberrying. She and her two small brothers saw the opening in the rocks, got a fallen cedar tree, and slid down into the unknown to see what was there. Sometimes quarry-workers blast into caves, or a farmer's livestock go down through the crust when a cave roof is near the surface.

Carlsbad Cavern was first explored by a cowpuncher, Jim White, riding range in the lonely Guadalupe Mountains, who was attracted by what appeared to be smoke issuing from a mountainside. It turned out to be three million bats that live in the cave, going out to forage at dusk. The Oregon Caves in the Siskiyou Mountains were first entered by a hunter trailing a wounded bear. Howe Caverns in New York were found, traditionally, by a farmer who couldn't understand why his cow Millicent seemed so comfortable chewing her cud under a blazing midsummer sun in the middle of a field. He discovered what Millicent had long since discovered, that a refreshing current of cool air blew steadily out of a small opening in the rocks. Millicent was air-conditioned before her time.

It is not difficult to understand the fascination caves have for people today. The evil gods and beasts of folklore dwelt in them. With no chilly adherance to dull fact, heart-stirring legends of Indians, smugglers, lovers, highwaymen, hermits, and murderers have grown up about them.

In prehistoric days they were man's earliest home—in them he found refuge from the cold winds and rain, safety from his enemies. At night when wild beasts prowled the forests, he could carve and paint upon their walls, and in death he could find a burial place among the debris and bones of animals he himself had eaten. The Peking Man, the Rhodesian Man, and some Neanderthalers were all found in caves. The ancient Jews escaped from the Philistines by hiding in caverns. In the caves of India the faithful still worship in impressive Buddhist Temples built centuries ago. And in present day China, Turkey, and Africa, people still live in caves, die in them, and are buried in their earthen floors.

Mankind's fear of darkness may be a carryover from the days of cave existence, and it is a familiar thing to see boys dig caves or make underground passages that resemble them—possibly in fulfillment of some lost instinct. And when you are in a wild, untrodden cave, winding through stygian passages, listening to the drip, drip, drip of water which has been going on for *millions* of years—you must be experiencing some of the feelings of the cave dweller who lived before civilization was born. You are face to face with the unknown, and time means nothing.

Most cave explorers will frankly admit that they have been panic-stricken, that they have been lost and despaired of ever finding their way out again. Actually, cave exploration is no more dangerous than anyone wants to make it. Few lives have been lost, and then only because the victims knew nothing about caves. Most of the fatalities reported each year in the newspapers occur in sinkholes, sandstone pits, sand banks, and overhanging rocks which are referred to loosely as caves.

Not long ago a Kentucky farmer burned some brush in a small opening in a hillside in order to crack the limestone and widen the entrance so he could get through. The burnt embers dropped down into the pit and smouldered there, using up the oxygen. Believing the fire out, the farmer let himself down onto a ledge about 30 feet from the bottom of the pit, was overcome by fumes, and fell to his death below. The air in most caves is very pure. Furthermore, the man erred in entering the pit alone. He should have been let down by companions, with the rope tied under his shoulders, so he could be pulled out in case of trouble.

Most cave explorers do not depend on flashlights. They carry a carbide light or small kerosene lamp, which can be pushed ahead of them in narrow places, plenty of tallow candles, and matches in a waterproof bottle.

Clothes should be easy to get into and get out of. Practically every explorer will testify that he has had to slip out of his clothes to get through a tight place. Often the passages are just wide enough for you to worm through, if you breathe regularly and go slow. *Worm* is the word. Swearing is considered good form where you have to crawl through a lot of mud. Also, you may go forward on your belly for as much as a quarter of a mile, then find that you can't turn around, and have to back out. Your clothes draw up, so it may be necessary to stop, crawl forward and out of them, pull them past you and then drag them behind you as you crawl out. The glistening white crystals which intrigued your eye on the way in will give you many a cut and jab in the stomach on the way out—but you will see daylight again.

At one time or another everyone gets lost, and there is danger in becoming panicky. In a narrow place your body swells and the more you struggle, the tighter you wedge yourself in. The experienced guide usually finds that reassuring talk and the casual touch of his hand will drive your panic away. Passages often look entirely different when retracing one's steps, for the shadows fall differently, and distances are confusing. You may *think* you have made a mistake—and that is enough. If you shout, the distant echoes will sound like answers from your friends. If you listen, you will sometimes swear you hear footsteps. Most sounds are greatly amplified—a drop of water in a small place will sound PLOOMP, and a small waterfall roar like a torrent.

The best procedure is to sit down and think it over. Experienced cave explorers never go alone. Like Tom Sawyer, a few use a ball of string but it may break and is not always practical when you are going straight up or straight down. Experienced "cavers" often make arrows of stones in confusing places to show the way back.

It is usually the unexpected that causes trouble. Schuyler Hunt, able Kentucky guide, tells of a time he let himself down a rope into one of the pits with which Mammoth Cave abounds. These are usually 12 to 25 feet in diameter, from 75 to 150 feet deep, the walls vertical. Hunt let himself down to a two-inch ledge about 50 feet from the bottom of the pit and, while resting, noticed a small opening leading off on the opposite side. He swung across on his rope, and proceeded to worm his way into the passage, after securing his rope around a rough stone. The passage had a dead end a little further on so he crawled back to the pit.

There was his rope dangling idly on the other side of the pit—it had swung loose from the stone. Hunt's first impulse was to make a leap for it, but he was in a cramped position and he knew that his chances of catching the rope in the dim, flickering light were nil. It seemed this or nothing, but he lay there thinking . . . mainly about what a fool he was ever to let himself get into this predicament. Nobody knew where he was or could help him. He thought how wonderful it would be if he just had the bamboo fishpole and line he had used as a boy to catch catfish in Green River—he could just cast over there and retrieve his rope. Then he realized that he didn't have to have a pole—all he needed was a line. He tore his shirt into strips, tied them together, fastened a small stone at the end, cast it across the pit. After three or four efforts he snarled it around the rope and pulled it back to his side of the pit.

"I was so scared," recalls Hunt with amusement, "that it took me an hour to figure out this schoolboy trick."

One must be careful not to dislodge small stones which may fall on someone below or which may loosen larger ones. Never enter a passage whose exit may be blocked by a settling stone. The limestone regions in which caves occur are usually stable; it is the sandstone or loose rocks that are really dangerous.

Sand Cave, in which Floyd Collins lost his life in 1925, is a small, tortuous series of passageways which only an experienced man could get through. Collins was in search of an entrance nearer the highway into Crystal Cave which he had discovered on his father's farm several years before. He had penetrated in Sand Cave to a depth of about 75 feet, and had apparently lost his sense of direction. He began crawling through some fragmentary rock and sand just beyond the more or less solid limestone area, and it was there that his movements dislodged the loose stones that trapped him.

The circumstances seemed particularly malevolent.

He was so tightly wedged into the bottom of the hair-pin turn that he could scarcely move his hands and his feet and his head just slightly. Water dripped relentlessly on his face. It was impossible to get beyond him to loosen his foot, and the slightest movement might send more rocks down, crushing his rescuers. Collins was dead when his rescuers reached him by digging a shaft down through the loose rock. This unknown countryman became the object of world-wide sympathy in his 19 days underground, and was given almost as much newspaper attention as Colonel Lindbergh's flight two years later.

When a cave has much running water in it, experienced men keep an eye on the water level.

Ernest A. Baker and Herbert E. Balch were once showing some army officers through the wild, savage, and water-torn Easterwater Cave not far from Wells, England. Easterwater is more of a vertical sink than it is a cave.

A sudden rainstorm drove the water so high into the channels that the party's return was cut off before they realized it. Either they had to find a higher level in the cave and trust the water would go down after a day or two's wait in the chilling darkness—or find another way out. Meanwhile on the surface, the soldiers commanded by the officers were frantically trying to dam up the stream pouring into the cave, knowing what had happened.

Fortunately, the army officers were in good hands. Baker and Balch probably knew as much about caves as any two men in England, and they did find a *new* way out, two of them in fact. The first was too tortuous for the stouter men to get through, and although the water was still rising, the leaders would not leave them behind. The second was a vertical chute which they climbed by placing their backs against one wall and their feet against the other, and inching their way up.

During a recent summer Charles Mohr and Kenneth Dearolf of Reading, Penna., were exploring Moore's cave near Springfield, Missouri, in search of blind cave fish—one of the rarest of creatures. Mohr photographs the cave life and has made it his field of scientific study. The entrance to the cave was like a manhole, dropping 30 feet to a waterfall, which in turn plunged into a large cavern below. Mohr went down the rope, hand over hand, at the side of the waterfall—the only place he could descend. The walls curved inward and he began to swing and sway on the rope. In a moment he was under the falls. The water blinded him, soaked him, filled his boots, and drove him onto a rock pile below—all in a split second. He landed heavily on his side and crawled away from the pounding water. No bones were broken and his electric lamp still worked, so like any real caver he began to explore . . . wet clothes and all. Wading knee deep in a muddy pool, he saw the white blind cave fish he was after . . . but, like many another fish, it got away.

Suddenly he realized that the water was rising and that Dearolf was shouting to him over the water's roar. Chilled and worn out, Mohr started climbing up at the side of the waterfall and wondered how he could ever get through it. Halfway up, he could go no farther. The water poured over his head and shoulders and he was only grimly hanging on when his toes touched a narrow ledge where he could rest a moment. From there he swung himself out of the water and climbed on up to where Dearolf was waiting to help him the last few feet. When they got to the surface, the meadow brook which they had stepped over on the way to the cave had become a fifty-foot torrent pouring more and more water into the cave.

Three weeks later they went back, and with new tackle managed to get down the waterfall more easily, caught the blind fish and a female crayfish carrying large white eggs attached to her body—the first in this condition ever found.

Mountain climbers tie themselves together with ropes to avoid falling, but you can't do that very well in caves.

Recently, however, Italian mountain climbers utilized their equipment to explore certain Alpine sinks or "swellets" which go down almost vertically for hundreds of feet. Using extensive gear, including silk ropes and steel-runged ladders for the last several hundred feet, a group once descended into the earth 2090 feet or about twice the height of the Empire State building. Three of the drops were 410, 522, and 384 feet, with an inky lake at the bottom. Imagine yourself climbing a twisting and turning rope ladder down the side of the Washington Monument at night, and you will have an idea of what these men did.

Today in Mammoth Cave visitors take a pleasant boat ride on a pool called Crystal Lake. They look at a stalactite resembling *September Morn*, and the guides advise the wives to keep an eye on their husbands. Everyone smiles. The scene is peaceful now, but it wasn't when four explorers first set eyes on it.

One of the men was let down on a rope from the top of the pit to see what was at the bottom. Most pits in Mammoth are dry. The man swung down about thirty feet, hand over hand, and when he was a few feet from what he thought was the bottom, he let go the rope. To his utter surprise he went down, down, down, into icy water. He came up coughing and sputtering. His light was out, and his companions' light

above was practically worthless. He could swim round and round with all his clothes on, wondering if he would get the cramps and go down before his friends could get him. The walls were smooth—nothing he could hang onto. So he swam round and felt the walls at the water level until his groping fingers found a ledge (now called Plymouth Rock) and with all the thanks of a pilgrim, he pulled himself up.

Jim White, who explored Carlsbad years before the safe comfortable trails were constructed, was once being let down a pit about a hundred feet deep. He had a kerosene torch which didn't give very much light and things seemed, as they often do underground, quite unreal and fantastic. Lower and lower he went until one foot went into water. Now there was thought to be *no* water in Carlsbad, so one can imagine his surprise. He quickly signaled on his "life line" to be pulled up, but his signals were misinterpreted and he was dumped tackle and all, into the water. His light went out, and it was pitch black as only cave blackness can be. He was thrashing around in the water, his arms and legs enmeshed in the rope, when he discovered that he could touch bottom!

Most American caves are not as tremendous underworlds as Carlsbad and Mammoth, but the smaller ones offer just as great thrills to the person who wants to go where no one has gone before. They may have beautiful formations, or be partly filled with mud, but no two caves are alike, and there are other attractions besides the weird beauty produced by nature in her more fantastic moods.

Cave animal life suggests earlier ages and epochs long gone. Scientists find the bones of the woolly rhinoceros, cave bear, sloth, and small horse. Some very interesting finds of this kind have been come upon by amateurs, and one should be careful never to disturb such remains until qualified men can examine them. In a few caves are found blind white fish, crayfish, and salamanders, strange translucent creatures who live mainly on each other and whatever bits of food may float down to them. Snakes or reptiles do not live in caves, except perhaps at the entrances, because the temperature is a little too low for them. Bats fly to and fro—certainly not among the loveliest of God's creatures, but among the most interesting and the most maligned. To scotch a popular notion, one authority says there is no authentic instance of a bat getting entangled in anyone's hair. Like the caves themselves, these fluttering, furred creatures are anthropologically very old, carryovers from the pre-historic.

Caves rarely contain precious minerals, but they constitute a scientific treasure-house of information on the forgotten peoples who roamed this continent when the world was young. Indian remains that tell a poignant story have been found in many American caves. Pottery, sandals, tools, baskets, and artifacts of all kinds have been found in American caves, particularly in the Southwest, and well-considered opinion is that the most illuminating and impressive archeological finds have not yet been made.

Two years ago in Mammoth cave the mummified body of an Indian was found two miles from the entrance, high upon a ledge, where he had been chipping gypsum from the wall. No one knows just what this gypsum was used for—possibly as a pigment or for some presumed medicinal value. In a precarious position on a narrow ledge, he had moved his foot and thereby dislodged a key stone from under a seven-ton stone which fell upon and crushed him. One can imagine his scream of pain, then utter silence, as he lay there for centuries. Just when this tragedy took place is not known, but scientists estimate it was at least before Columbus set foot on the new world, and possibly before the time of Christ.

Some years ago a young Frenchman with imagination, Norbert Casteret, was exploring a most unimpressive, mud-filled grotto at the edge of the Pyrenees. It was but a hundred feet or so in length, but he believed that the present cavern might lead into a still larger one—if he could get beyond a place where the muddy water lapped the ceiling. Into the icy water he dove, trusting that there was air on the other side. There was—and he came upon a series of chambers in which were clay figures, molded by prehistoric men long since extinct . . . the oldest statues in the world! It was an archeological find of the greatest importance.

There is no reason why some of our American caves should not tell as interesting and dramatic a story—judging by what already has been found. Somewhere there is a restless young American with imagination who, with the proper scientific guidance will find such evidence of vanished life as has never before been found. He won't find it by casually stumbling upon it, but by climbing, worming, digging, diving, or crawling on hands and knees, until suddenly he will stand awe-struck before some unfinished drama of ten thousand years ago.

☞ We acknowledge receipt of "First Scratch" (Vol. 1, No. 1) of the *Grotto Grapevine* (1/21/44), a newsletter from the V.P.I. group. It is a single, mimeographed sheet, edited by A. I. Cartwright and others, and carries the news of latest Grotto exploits.

A SUBTERRANEAN ADVENTURE IN DIAMOND CAVERNS
Park City, Ky.

By L. E. WARD, Toledo, Ohio
Member: Records, Exploration and Location Committees
National Speleological Society

These Caverns were last visited by the writer on October 10th and 11th, 1942. Our party consisted of Lou Klewer, "Outdoors Editor" of the Toledo Blade and a member of our Society; George White, civil engineer, Harland Wood, representative of the Portland Cement Association, and Elmer W. Hinkleman of the Greyhound Bus Lines, all from Toledo, Ohio. The main purpose of the trip was to visit and explore in Diamond Caverns, where new avenues are being constantly opened—a Speleologist's paradise, in fact. The Management's cooperation in making this expedition possible, was greatly appreciated by all concerned.

The cave is located 1½ miles northwesterly of Park City, Kentucky, on new State Highway Ky-255, connecting Park City with Route 70, leading to Mammoth Cave, which is 6½ miles northwesterly of Diamond Caverns. The caverns are situated in what is known as the Great Scenic Wonder Basin, a descriptive term which can only be fully appreciated by those who have visited this beautiful basin-like valley, which is bordered, in circular form, by Kentucky's majestic, wooded, mountainous hills.

Many former trips to these caverns, as well as to others in that vicinity, have been made by the writer during the past fifteen years; also again on August 20th, 1942, when I was accompanied by my regular "cave partner," George Parke, of the Toledo City Engineering Department, who is a member of the National Speleological Society, and who also intended to join our party of October 10th, but was unable to be with us on account of sickness. Due to his genial personality and wide caving experience, his presence was greatly missed by all members of our group, especially in view of the fact that it was anticipated that possibly this might be our last major trip for the duration of the war, as impending gas rationing regulations were drawing nigh.

Up until about 18 years ago, this cave was reached by travelers via the Old Mammoth Cave Railroad, which ran from Glasgow Junction to Mammoth Cave, Diamond Caverns being the only stop made enroute, and was shown because of the interest it created due to the great amount of "formation" found therein. A stage coach also conveyed sightseers from Glasgow Junction to Mammoth Cave during the days of Jessie James. On numerous occasions this famous outlaw held up the stage coach as it made its winding way over what was then an unimproved, mountainous and rather dangerous road. A section of this old historic road, now partly overgrown with vegetation and neglected, may be seen within a few hundred feet of the caverns.

We arrived at Diamond Caverns at 8:30 a.m., Saturday, October 10th, having driven through the night from Toledo. Three cottages were made available for our stay by Mr. John King, Superintendent of the caverns, and after having washed up, we got into our old clothes and were then ready for a combined inspection and exploration trip underground. The cave clothes were for the exploration end of our journey into crawl-ways and avenues where the public is not permitted to enter. The entrance way to these caverns is located in the main entrance building and access is gained through a beautiful built-up, arched rock enclosure, which is further protected from the outside world by a heavy swinging gate with iron bars.

After throwing the master switch and lighting the first section, we started on our descent to the first level of Diamond Caverns. Concrete stairways and platforms make this an enjoyable experience as the first glimpse of the beauties of these caverns comes into view. We were now in the "Rotunda" or main "Reception Hall."

At this point I would like to say that very few people actually realize just why caves are so fascinating and so interesting. In the first place, the cave was man's original primitive home; it is the safest place in the world to live. Early man thought of the cave as his home, a place of safety where he was protected and sheltered from all harm. It is my opinion, therefore, that the average individual unconsciously harbors these thoughts or impressions and that these inner urges, lingering in our sub-conscious mind, create within us a desire to explore these mysterious underground beauties. Many thousands of years ago this cave area in Edmundson and Barren counties, Kentucky, was covered by an ocean. The rivers then carved out these underground caverns; the dirt and the rock was washed out. Then the surface waters came through the limestone, bringing mineral deposits from the rock. These deposits form stalactites, stalagmites, draperies, columns, and all the other varied types of formation that may be found in these underworld passage-ways of nature.

The 10 sections or "stations" in Diamond Caverns constitute that many different types of cave avenues, formation and structure, with no two sections alike, yet all contained within and shown on the one cave trip. This unusual feature is a treat to the eye and

mind, and interest never diminishes but increases as each section is electrically illuminated by the guides, while passing through these passageways of wonderous design and color.

THE ROTUNDA

Unlike many caverns, it is not necessary to walk great distances in this cave before coming to formation. As we left the stairway, our attention was called to a great onyx haystack formation directly to our left; to a peculiar type of formation resembling "lava" oozing out from a crevice in the left cave wall; also to a large stalactite that resembled an "inverted tulip," due to its lower petal-like structure.

Onyx Ball and Pit

This large circular room proved to be very interesting, as we passed still another and larger "haystack" enroute to a concrete bridge which took us safely over a yawning chasm, into which had fallen, centuries ago, a great ball of onyx. Directly overhead may be seen a broken stalactite several feet in diameter from which this fallen mass of onyx had broken away, due to its extreme weight.

After crossing the bridge, we passed under a wide limestone arch, the ceiling of which has a "honeycomb" appearance, which, I am informed, was thus carved by marine worms thousands of years ago, when this cave area of Kentucky was covered by an ocean. Our pathway then led us past a series of onyx cascades to another concrete stairway, circling downward to the right, through a passageway that had been blasted through solid limestone, bringing us to the second level of these caverns. We were now looking into a most amazing avenue of riotous colors, filled with formation of wonderful design.

BEAUTY PARLOR

Words are entirely inadequate to describe and pictures are utterly unable to portray, the silent, strange majestic beauty of this under-world corridor, that only the eyes are capable of perceiving—a sight that truly demands personal experience in order to appreciate these subterranean wonders. As we stood facing Beauty Parlor, our backs were turned towards an enormous "water fall" formation that extends down from the first level of the caverns and around which, we made our descent through the passage-way above mentioned.

Directly overhead, in the carved limestone ceiling of this avenue, could be seen a perfect "hornet's nest." This flint rock formation, being harder than the other rock, was created by the one-time swift underground river currents that washed around it, leaving it in the ceiling. Extending downward from the ceiling and slightly to the left of the hornet's nest, may be seen a large stalactite, approximately 10 feet in length, the bottom part of which resembles a twisted "fish tail," which was turned off of its natural course when the little cones that normally drain internally and extend this type of formation, became clogged with sand or other foreign substance, causing the water to flow down and over the outside surface of the stalactite. This process, together with air currents in the cave avenue, brought about the twisted, drapery-like creation at the tail-end of the formation. There are many draperies in this section of the cave, some of which have white borders, which receive their color from the calcium in the water, while the rich red formations are colored by the oxide of iron.

Onyx table-tops

Our party then moved about 20 feet ahead and stopped in front of a large block of onyx, measuring approximately three feet in diameter, that had been sawed, or more literally worn in two. Two men operated the saw, while a third man poured in sand and water, a laborious process employing the use of a long two-handled smooth-blade saw, giving a polished table-top appearance to the block of onyx thus exhibited. Several other and much larger blocks, similarly treated, are shown in other sections of the cave under special lights.

Giant Stalactite

At this point, over-hanging draperies and flow-columns abound in wild confusion, creating a mysterious, awesome effect, which is climaxed by the presence of an enormous, giant stalactite, brilliantly illuminated. It is the largest, perfectly-formed, independent, living, self-supporting stalactite in the entire cave region, measuring 21 feet from top to bottom, 4½ feet in diameter at its center, and weighs from 10 to 20 tons. The most conservative geologist estimates its age at 200,000 years. It is ingeniously anchored in the cave ceiling, as if by expert human hands, as only Nature can safely do. This Mammoth Stalactite is one of the featured attractions in Diamond Caverns. Its color is red, while the attending stalagmite, created by the minerals in the water dripping from this great stalactite, is of a dark greenish cast, a weird combination of colorful contrast, design and structure. Our steps were now taking us past "Mirror Pool," the waters of which reflected a perfect picture of the red carved limestone ceiling, 50 or 60 feet above our heads; as well as a mass of "sponge" formation on the under-side of a drapery shelf that extends from the left cave wall at this point.

NABOTH'S VINEYARD

This section of the caverns derived its name because of the "grape" formations clinging to the cave walls, created by the evaporation of water thereon, which accounts for the "dryness" of the floor. It is a most unusual section of the cave and its beauty is further enhanced by the weird red carved limestone ceiling with draperies forming overhead, where the two side-walls of the avenue nearly meet, about 60 feet above the floor level, thus forming an overhead crevice, through which the eye may follow the ribbon-like course of the flat limestone cap-rock ceiling, that worms its way onward far overhead, like a river seeking a direction of least resistance.

The Old Meteor

Lodged in the side of the right cave wall, two feet above the floor level, may be seen an old "Meteor," which was evidently carried into the cavern by a torrent of water from where it fell to earth on the outside, thousands of years ago. Geologists have carefully examined this remarkable "rock"; they have proclaimed it to be a meteor and agree with the theory herein given regarding its appearance in this underground avenue.

Our next stop in this section of the cave brought us to a station switch box, from where a powerful flood light was thrown in brilliant illumination against the left cave wall a hundred feet ahead, where the cave turns abruptly to the right. In bold relief, upon the cave wall, could be seen the faces of what looked like an old "Cave King" with half of his mustache shot off, an "Old Witch" with beaked nose, big eye, white hair and protruding chin; also the life-like figure of a balking mule. When passing by the spot where these three objects were thus illuminated, depressions in the rock faintly outlined the figures that appeared so real when subjected to the beams of a powerful spot light.

Radio Hall

The turning of the cave avenue to the right at this point forms a large semi-circular room, and for which the name "Radio Hall" was at one time given. It is a beautiful room. The limestone walls and arched ceiling, are red in color and the water markings are of strange design and pattern. In the early days of radio, it was found that reception was perfect at this location, in spite of the depth at this level of the caverns.

Fish-tail Stalactite

In moving forward toward a point where the cave made another abrupt turn to the left, our attention was called to a series of beautiful drape formations, high on the left cave wall, formed by the water from the "bedding planes." Directly ahead of us, at the next turn, could be seen a large onyx pillar, with the stalactite coming down, the stalagmite going up and the drapery at the bottom, the latter being formed by the water from the bedding plane, and the stalactite and stalagmite formed by the water from the crevice. Under special flood lights, could also be seen an enormous "Fish Tail" Stalactite. This formation, however, was more curved at the bottom than the one previously described in Beauty Parlor, due to swifter air currents in this section of the caverns. The fish-tail portion of this creation was of the color and appearance of breakfast bacon, translucent under the light.

HANGING PARADISE

Silent darkness

Before turning on the many brilliant lights that illuminate the onyx wonders to be seen in this section of the cave, and in order to prepare our eyes to better appreciate the wonders about to be shown, all lights were cut off for several moments at this point, and we stood silently in total darkness, with only the faint, rhythmic drip, drip, drip of the eternal ages to disturb our thoughts.

Light

The indescribable beauties of this section of the caverns never fails to bring forth exclamations of delight and wonder from tourists visiting therein. Not so, however, with the more experienced members of our party. We just stood there and silently "drank in" the sight of this majestic underworld of beauty and miracle, created in colorful glistening onyx by the Great Architect of the Universe.

The Ex-Slave's Story

Before moving forward over the trail that was to take us through this beautiful onyx corridor, our attention was called to the date "1862," that is scratched on the left cave wall. It looks as fresh as if it was carved there only yesterday. I mention this in order to illustrate the slow process of visible change. About 17 years ago the management of this cave heard of an old Negro who guided in Diamond Caverns as a young slave prior to the Civil War. He was brought into the cave and when asked if he could notice any change in 80 years, he said he couldn't, and he pointed to this date. He was brought here because he had told a story about going down into a crawlway at the back end of the cave and coming through to an opening several miles from here. He was bribed as a slave to show this secret passageway to a man who owned land adjacent to this, for which he received the sum of one dollar.

He claimed to have made the trip, but when his master heard of it he gave the colored boy a sound thrashing and made him close up the crawlway. Later, explorers went through this section and "discovered" a new cave, larger than the old one that was shown to the public at the time of this incident. It was the writer's good fortune to be visiting the owner at the time this old Negro was brought into the caverns. He was a most unusual character and I was greatly impressed by his story; also with his account of an experience when he served as "water-boy" for Jesse James and his gang of outlaws when they were operating in the cave district years ago.

Massive Formation

It is in Hanging Paradise that you see the "massive" formation. No sculptor ever carved more patiently, more exquisitely, more colossally, than He who carved these magnificent onyx creations of beauty in this section of these caverns. We were now passing by an enormous stalagmite, extending from the floor at a 45 degree angle and towering above our heads, directly under a large overhanging "fish-tail" stalactite. An electric light, placed on the tip end of this formation, gave it the appearance of a large "seal" balancing a light on its nose.

At this point I would like to call your attention to the fact that the relation which is observed to exist between the size of a stalactite and its corresponding stalagmite, gives evidence concerning the rate at which they are formed. During the growth of a normal stalactite, after the filling of its central "tube," the water flowing downward in thin films, is more or less evenly distributed over the surface, resulting in a roughly cylindrical or tapering pendant mass. If, however, after the clogging of the central passage, the path of the water is for some reason confined to a single side of the original tube, deposits of additional calcium carbonate will take place only along this side, and a thin sheet will be formed with an inclined edge along which growth takes place, which may curl and twist in a most fantastic manner. Such drapery-like formations are abundantly exhibited in this cave.

Overhanging drapes extending from either cave wall, like mammoth elephant ears, and large stalactites growing from the ceiling, literally fill the air high overhead, and massive stalagmites and columns, many feet in diameter on either side of the path-way, form an "aisle" through which our party passed enroute to the further end of this most interesting onyx grotto.

The Old Cemetery

An alcove built by nature in the right cave wall had all the appearance of a "cemetery," due to the existence of numerous small stalagmites growing up from the floor thereof. The illusion is further created under the eerie glow of a flood light, and this realistic picture never fails to draw comments from visitors passing by, when they are told that it is here that the "cave spirits" are buried.

The Chimes

A few steps further brought us to the foot of a large stalagmite, 5 feet in height, which stands directly under a series of overhanging draperies. By striking the surface of their leaf-like clusters with a long wooden pole, a "sound effect" resembling musical chimes is obtained, and we amused ourselves in this fashion for quite some time, with each member of our party trying to outdo the others in an attempt to play a tune on this natural, though primitive musical instrument.

A Giant Column

We next stopped to examine what appeared to be the sawed-off portion of a petrified tree stump. The "heart," with ever-widening tree growth circles or "life rings," seemed to be sharply reflected through the highly polished surface of this massive block of pure onyx. We were now standing at the base of a hugh column of onyx, nearly four feet in diameter and over 20 feet in height, at the top of which, extending downward from the ceiling, the stalactite portion of this formation had the appearance of a "Giant's Arm and Hand." These column or "mightytites" are created by the continued downward growth of the stalactite and the upward growth of the stalagmite, resulting in their eventual junction, and thus a column rises from floor to roof—formed in this manner.

Objects at every hand

We were now approaching Capital Dome at the end of this long corridor—so named because of its fluted dome-like appearance, a formation of pure onyx, with the lower portion of its extremity broken off, in order to provide a pathway between it and an adjacent stalagmite, leading to a room at a higher elevation on Onyx Mountain. On our left, our attention was called to several formations of interest—a stalactite and stalagmite meeting to form a pure white onyx "hour glass," a stalagmite of "cactus plant" design; a "Medieval Castle" of pure onyx structure; a six foot "totem pole" stalagmite of proper design, complete with markings, and a stalagmite extending from the floor at an angle and of such a design as to resemble to a remarkable degree, the "Leaning Tower of Pisa"; while many feet overhead are suspended, perpendicularly from the carved limestone ceiling, two large "fish" of shark-like

appearance and size, complete with head, body and tail, as though poised for action.

Capital Dome

Some time was spent in examining the formation structure of Capital Dome, particularly the small cones, made visible by the "hand of man" when the lower part of this onyx stalactite structure was broken away for the reasons above given. It is evident that the passageway of these small cones or tubes had been clogged, causing the water to flow downward over the outer surface of the formation, thus creating the dome-like effect herein described. By placing our flash-lights against the surface of this natural dome, the transparent nature of its onyx construction was closely observed.

Fat Man's Misery

Standing to our left, a huge column, connecting floor and ceiling, formed the left wall of a passageway known as "Fat Man's Misery." However, by turning slightly to the left, ample body room is provided between this column and a "bulge" in the right cave wall.

ONYX MOUNTAIN

From a point midway in Hanging Paradise to Capital Dome, the floor elevation continues gradually upward, but from Fat Man's Misery to the "Upper Room," the climb is very steep, and it was necessary to construct concrete steps in order to make this part of the journey safe. This section of the Caverns is often referred to as a "Natural Museum in Mountains of Onyx," and were it not for the numerous stalagmites and columns rising from the floor and the stalactites and draperies extending from the ceiling and sidewalls, obscuring the view, the water-fall, flow-stone, mountainous effect would be complete. It was observed that one of the steps mentioned above is carved in the onyx floor. The flow-stone or onyx extends from the top of the Onyx Mountain and to either side wall, downward, having been built up from the trickling of water from the rock. The lime carbonate, released from solution on entering the open cave, has accumulated masses which resemble ice that forms on a cold winter's day near a stream of running water. To distinguish this material from that deposited by "dripping" water, it may be called flow-stone.

The Upper Chamber

Quite some time was spent by our party in this very interesting "upper room." To our right, as we entered it, a natural fire-place in the right cave wall at floor level, drew our attention; while overhead, the ceiling was of the same "honeycomb" type as that mentioned in the first section of the cave, just prior to our descent to the second level, but with this difference: onyx "ridges" resembling forest ranges appeared thereon, with still another type of ceiling far above the one just described, that had the appearance of plaster work with chocolate cake covering flowing over a series of ledges immediately below.

An Onyx Saw

To our left stood a large double-blade smooth-edge saw that had been used in preparing several onyx stalagmite table-tops that are exhibited in Beauty Parlor under special illumination. Two men operated the saw, while the third workman poured sand and water in the pathway of the blades, thus literally "wearing away" rather than cutting through the onyx, leaving a highly polished surface. This laborious though effective method consumed approximately one week's time for each cutting. On our right, we examined still another table-top stalagmite, from which an onyx slab had been removed by the "saw method" and later replaced. An electric light, ingeniously placed beneath this slab, illuminated the transparent beauty of its onyx structure in a most remarkable fashion.

A Final Inspection

Before leaving this upper chamber at the top of Onyx Mountain, quite some time was spent in examining the water markings in its limestone ceiling. A Ram's head, with the wool pulled down over his eyes, a large King's Throne, and numerous other interesting objects held our attention, until the element of time commanded that we "continue our journey" to the next section of these caverns.

NEW DISCOVERY

A series of concrete steps, winding downward through an opening made by blasting intermittent strata of onyx and limestone, brought us safely to a large circular room many feet below. We were now standing in the first room of the New Discovery or "addition" to the old cave—the beginning of the extension avenue whose existence the old Negro had predicted many years ago. Hundreds of overhanging stalactites, red in color, painted by nature through the medium of oxide of iron bearing waters, and the general roughness of the stalagmite-studded floor, had created here a scene of wild, natural beauty.

A Historic Crawl

Before the remaining halls and avenues in the new sections of the cave were opened to the public in 1935, this grotto marked the "end" of the tour through these caverns and the sightseers were returned to Hanging Paradise by way of a circular tunnel which entered that avenue at the base of Onyx Mountain. In 1928

before the two man-made entrances were blasted, the writer was one of a party of five to first enter this cavity, that seemed so far beyond and away from the main avenue of the cave. The illusion of distance can be explained by the fact that it was necessary for us to enter a small crawlway, beneath a stalactite at floor level, near Onyx Mountain. I shall never forget that crawl, especially the portion thereof where the passageway turned sharply to the right, and it was necessary to turn on my left side and "caterpillar" my way through. A hundred-foot lead-light, carried by one of the men ahead (a brother of Floyd Collins), and the fact that still another one of the boys weighed nearly 75 pounds more than I, assured me, when the going was tough and the mud was oozing over my chin, that I would get through somehow, and that the unknown place we were headed for would be amply illuminated.

It was a tired and certainly an unattractive, mud-spattered group of explorers that entered this room on that August day in 1927. We sat around for nearly an hour examining and admiring its formations and were reluctant to leave because of its beauty and the realization that our party was the first to have ever entered this chamber. Also the very thought of the long, muddy and extremely tight crawl that separated us from the rest of civilization, and through which, of physical necessity, each one of us had to make his own individual passage, contributed in no small degree to our hesitancy in starting on our way back to the main avenue of the caverns. At that time and for several years afterward, there were no apparent indications of an outlet avenue leading from this room to other subterranean chambers beyond.

Exploring onward

In the fall of 1934, after numerous experimental tests had been conducted, it was decided to blast a man-made tunnel in the north wall of this circular room. All formation obstructing such operations was broken away at this point and many charges of dynamite and several weeks of hard manual labor finally resulted in the successful connection with a small crevice opening, after the tunnel had been thus driven through the limestone for a distance of approximately 25 feet. From then on, it was simply a matter of patiently enlarging that opening downward and following the ceiling crevice as it pointed the way onward.

ONYX CATHEDRAL

The sight of this beautiful "treasure room," entered into by way of the above described tunnel-avenue, amply rewarded the workers and explorers for all the time and money spent in opening this new addition to the caverns. As our party paused at the foot of a concrete stairway leading to an elevated platform, our attention was concentrated on the extreme beauty and strange grandeur of this cathedral-like room. A battery of 12 light switches controls the illumination of its many interesting features. As we gained the platform we were facing an onyx shelf, the floor of which, studded with numerous translucent stalagmites of varying dimensions, extended like a sloping terraced hillside to meet the onyx-covered sidewalls; while overhead, hundreds of stalactites ranging in size from several feet to ¼ inch in diameter at their base and extending downward to nearly meet the floor in many cases, presented a scene that might be compared to an "inverted petrified forest," with a color scheme ranging from pure white to bright red. Hidden lights, ingeniously placed in the background, illuminated, in consecutive order, the various high-lights of this nature-built picture. And this entire section of Onyx Cathedral, as a climax, was brought forth into blazing brilliance by a battery of well-arranged flood lights.

Not one of the formations have been broken since their discovery. The deep water markings in the ceiling covering the greater area of this room, are of strange design and beautifully colored; while extending from the ceiling and cascading downward to the floor, on the opposite side of the Cathedral room, a frozen water-fall of great beauty and size, commanded our admiration. A series of ledges and overhanging drapes extend high overhead in semi-circular fashion; while on either side and in back of the water-fall, draped stalactites illuminated by brilliant lights, had the appearance of sparkling icicles. An onyx altar, also individually illuminated, completed our inspection of what I consider one of the most beautiful rooms in the cave. After all the members of our party had taken a "turn" in experimenting with the various lighting effects at the switch box control, we were ready to continue our journey onward.

As we passed under an overhanging ledge and through a small avenue, our attention was called to an onyx shelf extending from the left cave wall, upon which a pure white "elephant," formed by the sculptural hand of nature, stood silently with its tusks and feet buried in the onyx; also standing on this same shelf could be seen a perfectly formed "hippopotamus." We were now entering into a room whose ceiling was richly studded with overhanging stalactites of many colors, size and design, some of which were of lead pencil diameter, while others were of helictite formation. A little farther on, a natural archway indicated that we were

passing through another break-down and were again coming to an avenue with a high ceiling.

Many feet above our heads, a large water-hole in the limestone ceiling drew our attention. At the edge of this opening, on the floor of an upper chamber, stood two transparent "blood red stalagmites" whose glowing beauty was perfectly illuminated by a powerful flood light placed behind these remarkable formations. Countless stalactites, water carvings and a number of interesting "cave domes" were the dominant attractions in this section of the caverns, where the centuries are still being measured as Nature deposits one cubic inch of onyx every hundred years. Here, as well as in practically all the other parts of the cave, may be heard the constant dripping of water from the limestone ceiling and from the formation growing thereon, thus signifying that we were in a live, growing cavern. The absence of such a condition and the presence of "dryness" is a sure indication that a cave has ceased "growing," and the deteriorated condition of existing formation, if any, offers further proof in support of this statement.

HANGING GARDENS OF BABYLON

We were now in an enormous avenue of great height, the grandeur of which was brightly illuminated by special lights concealed at various points. Looking down and across this avenue from a position near the left cave wall, an entire section of the right wall, under the beams of powerful flood lights, appeared to resemble a beautiful "Hanging Garden," animated by innumerable life-like faces and forms. An "elephant" with a hump on his back, gives you the impression that he is about to leap through the air; while clusters of monkeys, in grotesque positions, appear as life-like as those exhibited at a public zoo. It was not without justification that this is sometimes also called Monkey Mountain.

The Cave Explorer

Of special interest to Speleologists, the life-size form of a man may be seen on this towering, terraced cave wall. It is the crouched figure of a "cave explorer" climbing over an onyx-covered incline between two stalagmites, complete with cave cap and explorer's clothes. His right arm is extended upward at an angle, braced against the side of a stalagmite, in a pulling position, as though clutching for a "hand-hold" and his right foot and bended knee are in such a position as to enable him to successfully reach his objective. One of the boys remarked that it looked like Lou Klewer from the "rear." Our friend objected to this, however, stating it has never been his practice to wear a cap while exploring.

Some distance forward, we stopped to examine two stalagmite formations on the floor and under the left cave wall in this avenue. The "fast" drip from an overhanging stalactite was destroying one of them, the minerals not being given time to deposit; while the "slow" drip from another stalactite was "building up" a perfect stalagmite, thus presenting a remarkable comparative illustration.

At this point in the caverns the main avenue is very wide and the ceiling extremely high. Overhanging drapes and stalactites abound in great profusion and the entire scene defies written description. Even photography cannot correctly portray its colorful beauty or dimensional proportions. Large, scattered stalagmites stand as "sentinels" amidst the rough formation of the floor, in the same position as when originally discovered; while in the cave ceiling, a large center stalactite, surrounded by a circular ring of smaller formation, completed a most unusual picture of Nature's handiwork.

Three-Ply Drapery

By following a pathway along the right cave wall, we were brought into full view of a beautiful white onyx three-ply drapery, extending from a ledge along the left wall just below the high ceiling of the avenue. Under the illumination of flood lights, the presence of colorful, fantastic formation was noted, created by the water, thousands of years ago as it came out of the bedding plane, and from which reflections that resembled diamonds were clearly discernible.

Crossing over to the opposite side of the avenue, we descended to the level of a subterranean water course, many feet below. Concrete steps and hand rails made this experience both enjoyable and safe. This "river" winds its way through a large, arched tunnel-like opening in the rock for a distance of several hundred feet. Thorough exploration of this lower avenue, however, has not yet been made.

SUBTERRANEAN NATURAL BRIDGE

Upon ascending to the floor level of the main avenue of the caverns and while standing near the south approach to a concrete bridge of modern design, spanning the water course we had just visited, a "featured attraction" of "Believe-It-Or-Not" importance commanded our undivided attention. We were now gazing upon a natural limestone bridge, approximately 65 feet above our heads, connecting both tapering cave walls. The length of the structure from wall to wall, is about 25 feet, with a width of approximately 18 feet, and its floor is of great thickness and strength. Powerful flood lights, reflecting upward, illuminate both sidewalls as they meet to form a ribbon-like crevice 10 feet above the center of the bridge. After crossing over the concrete

structure spanning the water course, we stopped at a point where even a more beautiful view of this great natural bridge was obtained, and which also brought the three-ply drapery, heretofore described, into the picture.

A Dangerous Climb

As we stood there gazing upward at this enormous limestone creation, the question was raised by one of the members of our party regarding the possibility of scaling the right cave wall, in order to reach its dizzying height. I informed them that a member of our Society, Mr. George Parke, who was unable to be with us on this trip, had accomplished that feat in 1938. At that time George and I were visiting these caverns and accompanied the owner to this section of the cave. Lawrence Arterbern, who was then Superintendent, was given the assignment of placing a large electric light on the heretofore dark surface of the natural bridge. After throwing the master switch, the avenue would have been in total darkness had it not been for the four flash-lights we were carrying. How this man made the climb while burdened with electrical supplies and wiring, with only the aid of our flash lights from below to light the way, I shall never be able to tell; in fact, the truth is that my memory of his skillful act is still vague and uncertain, due to the suspense and excitement of the occasion. The remarkable reputation that he had built up as a cave explorer and climber, however, I could understand after he had finally "reached the top," and, at last, stood there safely, waving to us from the bridge.

Letting George Do It

Before completing the electrical installations on the bridge, and while this section of the caverns was still in semi-darkness, Arterbern announced that if he had someone up there to give him a "boost," he would like to explore the cavity beyond the crevice, overhead. In the meantime Parke had been casting calculating glances at the side-wall, and this "invitation" was all that he needed to get him started. The first 30 feet of his climb was comparatively easy, as the steps, formed by the rocks and ledges, were well defined and quite accessible. From there on, however, the "going" became tougher as the wall became more perpendicular, and finally graduated into an "overhang," which caused the element of gravity to enter into the picture. By this time our friend, with the aid of the spot light from the bridge and our two lights from below, had worked his way upward along a narrow ledge, between two small stalagmites and was relying solely upon the advice he was receiving from overhead, as each move was carefully planned and executed. He was now within 7 or 8 feet from the floor of the bridge, but in order to reach a niche-like shelf just short of the bridge it was necessary to pass over a barrier in the form of a stalagmite. The space between this formation and the wall was not great enough to permit passage in that direction, while any attempt to pass around same on the "other side" would have resulted in a fatal fall, as there was nothing but space and huge jagged rocks and ledges many feet below that point, which would have cut him into ribbons.

The problem was solved by George's acrobatic ingenuity and ability in following the suggestions of his companion who had previously "passed that way." The technique required was that he lie over the stalagmite with the center of that formation pressed against the pit of his stomach. Then by lowering his head and shoulders on the wall-side and with his feet swinging in a clock-wise manner, he found himself on the "other side" of the barrier and was soon standing on the bridge with Arterbern. During his climb my partner and I were tempted many times to wise-crack and it was with great difficulty that we suppressed our desire to laugh at the ludicrous though dangerous positions in which George found himself. To do so, however, might have distracted his attention with disastrous results, because of the slippery condition of the rock and formation surface over which he was crawling. At times we fairly held our breath, when it looked as though he wasn't going to make it, and I shall never forget this extraordinary experience in that dimly lighted cavern when for nearly 45 minutes I watched, in utter helplessness, a most realistic drama of human endurance and danger. After exploring an upper avenue, approximately 30 feet in height, which they reached by crawling up through the ceiling crevice, our two "mountain climbers" returned to the floor of the bridge, where they connected and placed a large flood light. The lights in this section of the caverns were then turned on, and the boys finally made their way back in safety to the floor level of the main avenue.

After moving forward a few feet, our party stopped to examine some very peculiar formations on the left cave wall, which had the color and appearance of "hot dogs"; while on the floor, directly below, a large quantity of "brown beans" likewise appealed to our appetites. A miniature overhead bridge marked the turning of the avenue to the right, which followed in that direction for some distance.

CANYON HALL

We were now walking in a large avenue with a very high and beautifully carved, water-marked ceiling. At our right, we stopped to examine a deep water carving in the sidewall, which serves as a "spillway" for water

entering through an opening in the limestone ceiling directly overhead. A bowl-like shelf or ledge, about 5 feet above the floor, weirdly carved by the force of the falling water, completes the picture, all of which is illuminated by a large flood light that is anchored on the shelf. The cave walls in this section of the caverns are dark grey in color and canyon shaped. The avenue curves gently to the left, while from a crevice in the ceiling, 50 feet above our heads, beautiful draperies appear to be just forming.

George Washington

The profile of a face, formed in limestone on the left cave wall, resembling the features of our first President, is brought into bold relief under brilliant illumination. This sculptural creation is approximately 10 feet in height, and never fails to draw comments of admiration and wonderment from those who gaze upon the silent majestic calmness of this remarkable white limestone face, carved by the patient hand of nature thousands of years ago when this canyon avenue was being formed.

Frankenstein's Stairway

As we approached the end of this long and beautifully colored avenue, a most unusual sight greeted our eyes: A long, sloping concrete stairway, rising from the floor and extending upward over a break-down to a point within 7 feet from the high distant ceiling, while at the base of this incline, a great "prehistoric bird" carved in the right limestone wall, seems to stand at vigilant attention as though to guard the secrets of nature that are hidden beyond the small passageway at the top of the breakdown. An enormous slab of limestone, about 3 feet in thickness, that evidently broke away from the roof thousands of years ago, stands at an angle extending from the left iron hand rail of the stairway, for a distance of many feet to a point near the top of the left cave wall. It was while looking upon this sight, that I expressed the opinion that here would be a perfect setting for a "movie thriller," with Frankenstein's Monster slowly descending the stairway carrying his bride. The members of our party agreed that my imagination was certainly functioning in high gear.

Over another break-down

Upon reaching the top of the long stairway, we entered a narrow channel-avenue, through which it was necessary for us to walk in single file. This strange passageway near the ceiling level of Canyon Hall, may have been caused by "heat action" in connection with the formation of the canyon. At the time of its discovery, it was merely a small crawlway, 30 or 40 feet

(*Continued on page 37*)

BRANT'S AND GRAPEVINE CAVES

By J. L. WINGFIELD*

On Friday, July 10, 1942, John Suter, George Mann, Leroy Frazier, and myself set out for Lewisburg, W. Va., to see what caves, if any, could be found in this area. We stayed at a tourist home the first night and were out early the next morning ready for anything we could find. With advice from local people we set out on a road leaving the city which runs parallel to Route 219, but below it, toward Charleston.

The first place we investigated was a small cave on H. L. Brant's farm. To enter the cave one must descend on a rope or ladder about 25 feet, and from there on the going is easy. As a matter of record, Mr. Brant has a pipe through the ceiling of the cave from which he used to get water which was pumped from a pool in the bottom. The pool is now dried up and apparently the stream has gone to a lower level.

Mr. Brant was the one who advised us to go to the hole on Col. H. B. Moore's farm which finally was named by us, as "Grapevine Cave." This cave has its entrance on the side of a hill which has a very gradual slope. It is near midway on the slope, and is surrounded by a clump of trees as have been most caves of this type.

We figured the entrance was 105 feet deep and that the three rooms totaled approximately 175 to 200 yards long. Incidentally, the entrance was a straight drop and you could not reach the walls on the descent. A combination of rapell and safety rope was used to reach bottom. We were hauled out hand-over-hand by our two companions, Suter and Mann on top. We did not get to take temperature readings or compass directions. This will be done on our next trip.

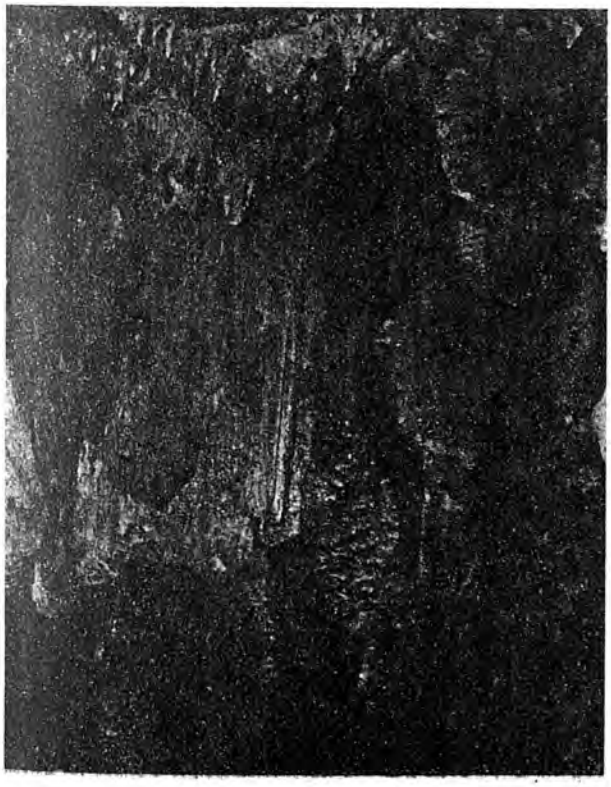
A thing of great pleasure to me was the fact that I was the first person ever to reach the bottom of the shaft and view its beautiful formations. Incidentally, I think that the formations in this cave are about the most beautiful I have seen in any uncommercialized cave in the state. The farmers around there have been dumping their dead and diseased cattle into the hole as a means of disposal, and therefore the bottom of the shaft is not the most pleasant smelling place in the world. When you are in the nicest side of the cave there is no odor, however; and after getting a few feet away from this spot, it becomes a pleasurable trip.

After completing the photos of this cave we explored three other small ones which were very pretty—but nothing to arouse much enthusiasm.

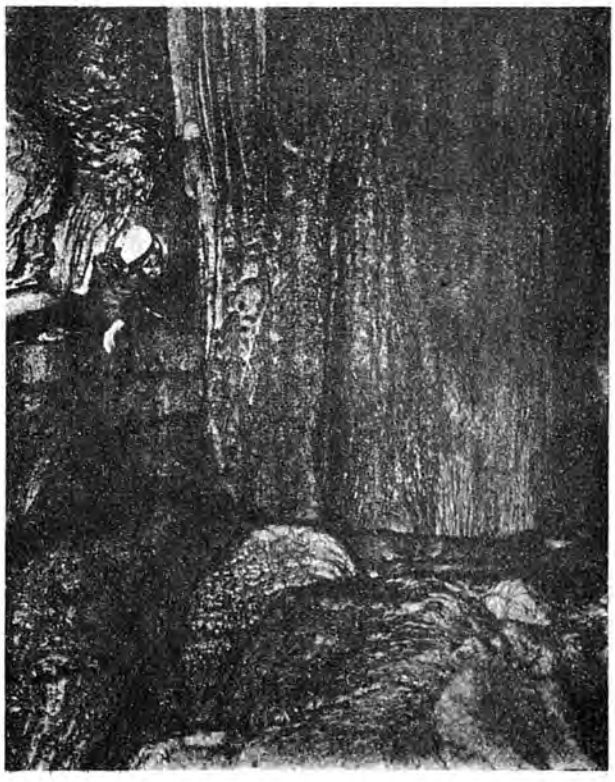
*Although the text of the story indicates it should perhaps be included among the Cave Trip Reports, the photographs by the author have made it something more than ordinary. A selection, only, of photographs appears here.

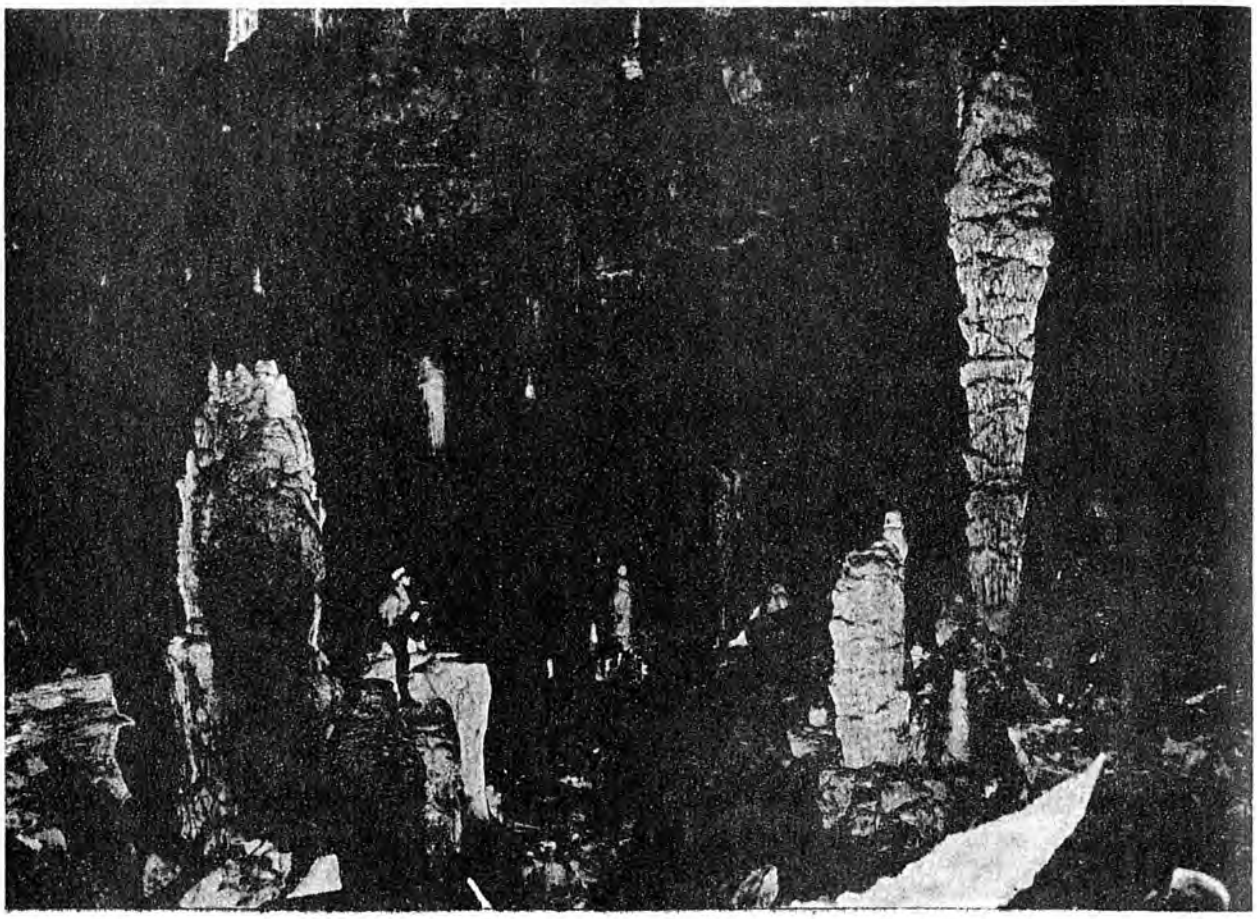
Grapevine Cave—George Mann on grapevine over entrance.

Brant's Cave—(A) Note the small black port hole at lower right in photograph. This is where Leroy Frazier left the room shown to enter room in (B).



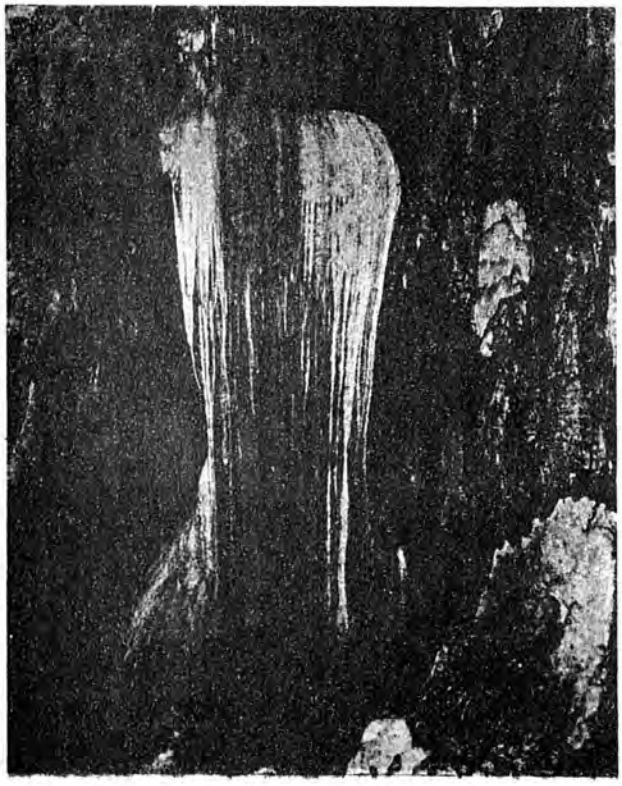
Brant's Cave—(B) Frazier entering flowstone room through porthole shown in (A).



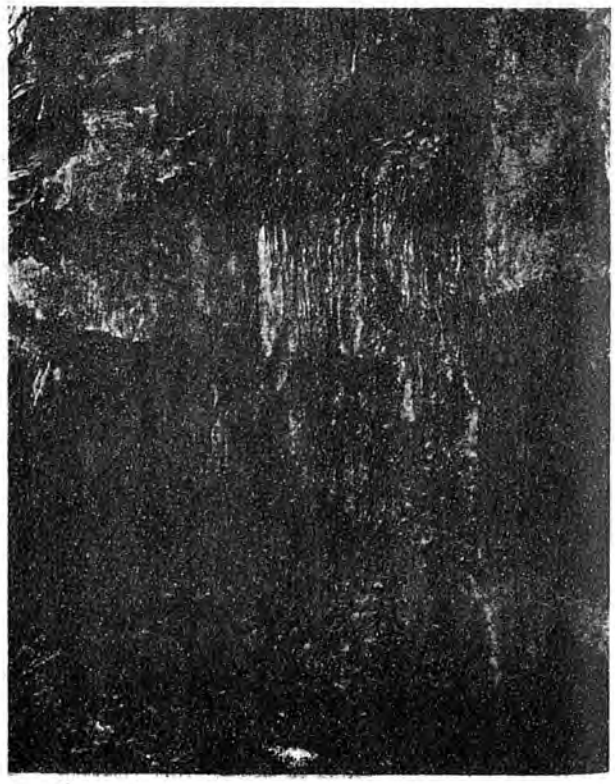


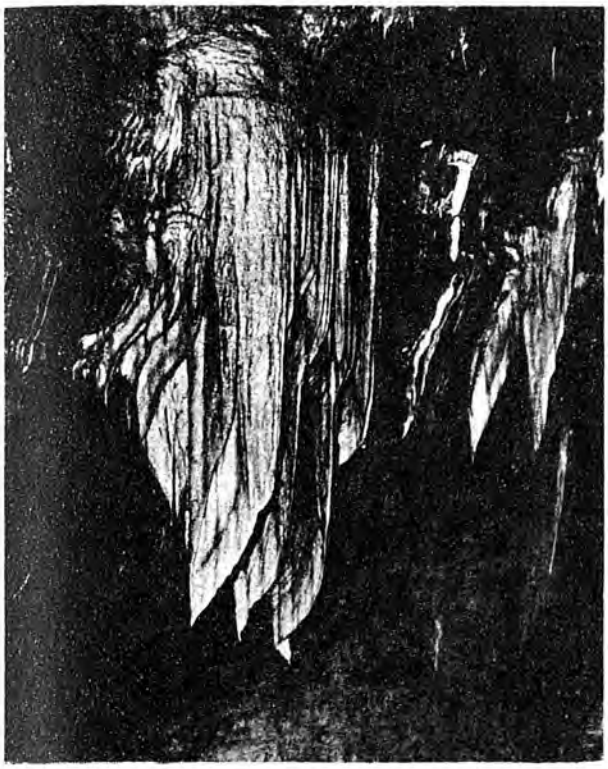
Grapevine Cave—General view of large room inside.

Grapevine Cave—This formation is a beautiful tan and white, and is about 50 feet high.

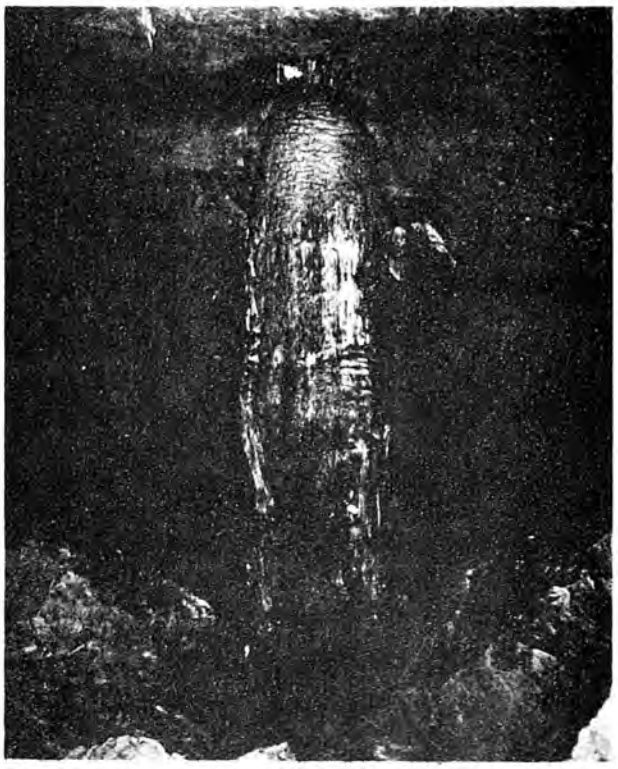


Brant's Cave—Frozen waterfall, 7 feet high.

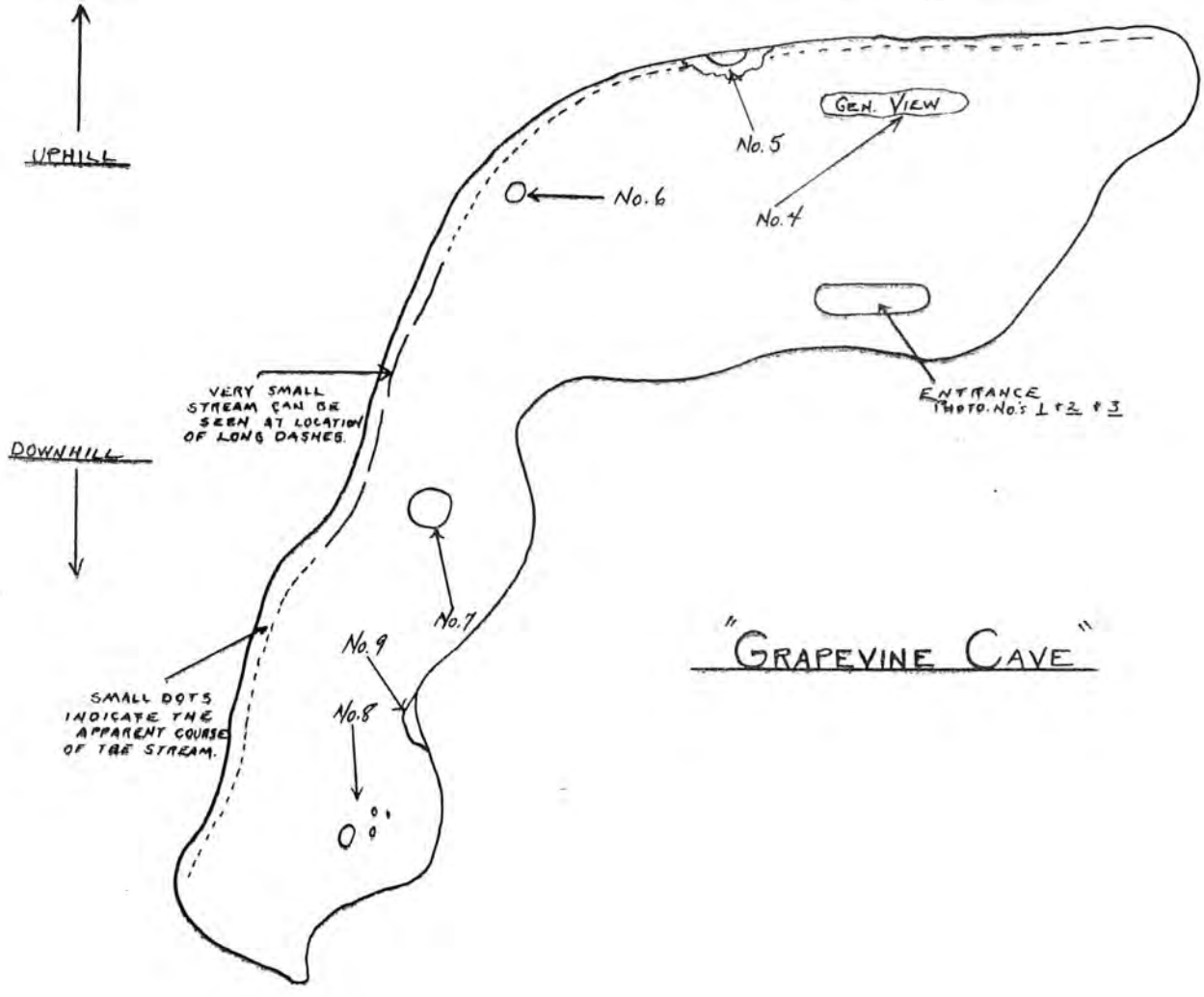




Grapevine Cave—These folds are 5 feet to 6 feet long.



Grapevine Cave—This formation does not reach the ceiling as it appears.



ADDITIONS TO "INDEX OF ALL THE KNOWN CAVES OF THE WORLD"

By ROBERT E. MORGAN

Since the publication of the last *Bulletin*, several letters have been received by the Society suggesting improvements, additions, and corrections to my original list of known caves of the world. There is presented here, therefore, a supplementary listing of the names and approximate locations of caves which have been reported since that list in BULLETIN No. 5 was compiled.

All of the material received has been incorporated in the records of the Society, and most of that which pertains to the United States has been included below. Only additions of caves in the United States have been included at this time, as it is planned to present a much more complete and accurate listing of foreign caves in a future BULLETIN.

A question has been raised as to what caves should be included in a listing such as the present one. It has been held that some of the caves named are little better than rock shelters and should not, therefore, be considered. It is the opinion of the writer that many of the smaller caves are equally as important as the larger ones since they may contain paleontological or archeological remains. Since it is not possible to visit personally most of these caves or even to obtain accurate information concerning many of them, it is believed that the policy of listing all caves on which data has been published is justified. When a cave has two or more names, each name is listed so as to make our records as complete as possible.

The New England caves listed in the book UNDERGROUND NEW ENGLAND, by Clay Perry have been included in this list.

Much of the material listed as having been taken from the unpublished records of the society has been furnished by Edwin W. Bischoff.

Since the present listing was compiled, several hundred additional names of caves have come to hand, many of which are in the states of California and Texas. These will be included, together with any new material received, in the next BULLETIN. Any further information and listings which can be furnished by readers will be greatly appreciated and credit will, of course, be given for any information used.

Name of Cave	County or Nearest Town	Ref. No.
Alabama		
Santa		26
Arizona		
Bell		23
Burial	Tsegi Canyon	7
Mitchel		26
Rampart		15
Twin	Tsegi Canyon	7
Arkansas		
Beauty (Fitton's)	Harrison	2
Blowing (Logan)	Siloam Springs	26
Crystal (Mystic, Mansion)	Harrison	17
Denny's (Horsethief)	Alabam	26
Ferrell (Cushman or Blowing)	Cushman	26
Melbourne (Wideman)	Melbourne	26
Swindler	Batesville	26
Wonderland	Bella Vista	26
California		
Backbone	Siskiyou Co.	26
Bat	Siskiyou Co.	26
Beacon Light	Siskiyou Co.	26
Bearfoot	Siskiyou Co.	26
Big Painted	Siskiyou Co.	26
Boulevard	Siskiyou Co.	26
Boyden's	Kings Canyon Natl. Park	21
Caldwell	Siskiyou Co.	26
Catacombs	Siskiyou Co.	26
Capt. Jacks	Siskiyou Co.	26
Cave	Siskiyou Co.	26
Copper Rock	Siskiyou Co.	26
Cox	Siskiyou Co.	26
Coyote	Siskiyou Co.	26
Craig	Siskiyou Co.	26
Crystal	Siskiyou Co.	26
Deep Creek	Glenville	26
Dragons Head	Siskiyou Co.	26
Fern	Siskiyou Co.	26
Hawver's	Auburn	26
Horse	Siskiyou Co.	26
Iceberg	Siskiyou Co.	26
Frozen River	Siskiyou Co.	26
Heppe	Siskiyou Co.	26
Indian Well	Siskiyou Co.	26
Juniper	Siskiyou Co.	26
Labyrinth	Siskiyou Co.	26
Mammoth	Siskiyou Co.	26
Mitchell's	Essex	17
Nameless No. 1	Siskiyou Co.	26
Nameless No. 2	Siskiyou Co.	26
Nameless No. 3	Siskiyou Co.	26
North Bend	Siskiyou Co.	26
Post Office	Siskiyou Co.	26
Putnam	Sequoia Natl. Park	21
Rock	Siskiyou Co.	26
Round	Siskiyou Co.	26
Sentinel	Siskiyou Co.	26
Ship	Siskiyou Co.	26
Silver	Siskiyou Co.	26
Skull	Siskiyou Co.	26
Soldiers	Tulare Co.	26
Stinking	Siskiyou Co.	26
Stone Man	Shasta Co.	6
Symbol	Siskiyou Co.	26
Trichnov	Siskiyou Co.	26
Unnamed (eleven caves)	Siskiyou Co.	26
Upper Ice	Siskiyou Co.	26
Vasquez Rock	Saugus	26
Kirck *White's*	Siskiyou Co.	26
White Lace	Siskiyou Co.	26
Wildcat	Siskiyou Co.	26
Colorado		
Caverna Del Oro		22
Tabegauche		11

Name of Cave	County or Nearest Town	Ref. No.
Connecticut		
Bashful Lady	Salisbury	16
Black Sal's	Box Mt.	16
Bolton	Bolton	16
Boy's Halfway River	Monroe	16
Chief Ponus	East Canaan	16
High Crevice	Salisbury	16
Indian No. 1	East Lyme	16
Indian No. 2	Killingsworth	16
Indian No. 3	Norwalk	16
Indian No. 4	Waterbury	16
Indian Jack's East	Indian Heaven	16
Jack's	Indian Heaven	16
Jack-In-The-Pulpit	Salisbury	16
Judges (West Rock)	New Haven	16
King Phillip's	Avon	16
Leatherman's (several)		16
Moodus	Moodus	16
Newgate Prison	Granby	26
Pootatuck Council	Sherman	16
Queen Anne (Queen Victoria)	Avon	16
Squaw	Bolton Notch State Pk.	16
Squaw Rock	Plainfield	16
Tory	New Milford	16
Tory	Plymouth	16
Twin Lake (Bashful Lady) (Jack-In-Pulpit)	Salisbury	16
West Rock (Judges Cave)	New Haven	5
Wolf's Den	Pomfret	16
Georgia		
Bartow County	Bartow	26
Saltpeter	Cartersville	26
Idaho		

Most of the information on Idaho caves has been reported to the Society by Mr. E. W. Bischoff who states that there are over 30 caves in the vicinity of Orchard, Idaho, on which data is not yet available.

Blow Hole	Near Castleford	26
Burley Wind	Milner	26
Canyon Basin	Paris	26
Cave Falls	Yellowstone Park	26
Clay	Hansen	26
Crater Rings	Cleft	26
Danskin Canyon	Prairie	26
Eureka Lava	Mt. Home	26
Formation	Soda Springs	25
Higby Cave	Orchard	26
Hot	Amsterdam	26
Ice	Paris	26
Kuna	Kuna	26
Lava (several)	Shelley	26
Nameless	Boise	26
Porcupine	Bear Lake Co.	26
Snake River Gorge	Near Hagerman River	26
Swan Lake	Soda Springs	26
Teakettle (Dead Horse etc.)	Bliss	26
Timmerman Hill	Bellevue	26
Twin Buttes (Lava)	Midway	26
Warm Springs	Cape Horn	26
Wind Cave	Milner	26
Indiana		
Bottomly Springs Cut Off		21
Carnes Mill Cut Off		21
Corydon	Corydon	5
Danner's	Mauckport	17
Epsom Salts		5
House Rock	Shoals	26
Landon	Mauckport	17
Pitman's	Mauckport	17
Sibert Well	Near Wyandotte Cave	26
Silkett's Well	Mauckport	17
Sheep's	Mauckport	17
Squire Boone's	Mauckport	17
University	Greencastle	18
White River	Bedford	26
Burksville (New Design)	Burksville	26
Illinois		
Council	Ottawa	26
Devils	Near Aurora	26
Wet	Anna	26
Iowa		
Edgewood State Park Ice		26
Marquoketa	State Park	26
Kansas		
Daly	Woodson Co.	26
Kentucky		
American White Onyx	Glassgow Jct.	26
Boone	Valley View	5
Cascade Caverns	Carter Co.	26
Crooked Creek	Crooked Crk.	5
Dead Goat	Near Diamond Cave	26
Dunn's	Dick's Dam	26
Dynamite	Near Diamond Cave	26
Horse (Hidden River)		26
Passenger Coach	Vance Farm	26
Russell's	Lexington	26
Maine		
Anemone Cave	Arcadia Natl. Park	16
Broocher's	Monhegan Is.	16
Capt. Kidd's	Deer Is.	16
Cave	Gouldsboro	16
Cave	Wales	16
Cave Hill	Waltham	16
Cave Mountain	Roxbury	26
Cross Island	Cross Island	16
Houston Brook Cave	Pleasant Ridge	16
Ledge House	Turner	16
Lost	Allagash	16
Mermaid	Schooner Head	16
Molly Locket	Freyburg	16
Monhegan Island	Monhegan Is.	16
Moose	Grafton Notch	16
Moose	Upton	16
Oak Hill	Otis	16
Old Indian	Sanford	16
Orland	Orland	16
Raymond	Raymond	16
Rockland	Rockland	16
Searsmont	Searsmont	16
Sears Port	Searsport	16
Swanton's	Dexter	16
Underground Passage	Vassalboro	16
Wentworths	Greenwood	16
Maryland		
Athey		26
Beaver Run		26
Cavels Den		26
Carroll County		26
Dead Horse		26
Devil's Den		26
Ditto	Downsville	26
Goat Cave	Cumberland	26
Harwell	Harwell	5
Hughes		5
Murley's Branch		26
Round Top		26
Sand		26
Snively's		25
Massachusetts		
Adams	Adams	5
Barn Dog	Farley	16
Bee-Hive	Upton Center	16
Belcher's	Great Barrington	16
Birch Tree	Northfield	16

Name of Cave	County or Nearest Town	Ref. No.
Brown's Boulder (Baker Quarry)	Lanesboro	16
Cat Hole	New Marlboro	16
Cave	Lincoln	16
Cellar (Bottle) (destroyed)	Adams	16
Chester (View)	Chester	16
Cliff	West Chesterfield	16
Counterfeiter's	Goshen	16
Counterfeiter's	Hancock	16
Counterfeiter's Crevice Constitution	Lanesboro	16
Counterfeiter's	Wales	16
Counterfeiter's	Woronoco	16
Crevice	Hancock	16
Crystal Pool	Egremont	16
Dead Cow	Hancock	25
Disappearing Brook	Lanesboro	16
Eldon's	West Stockbridge	16
Elm Street (Hawk Ledge)	Pittsfield	16
English Grass	Montgomery	16
Great Radium Springs	Pittsfield	16
Gregory's	Lanesboro	16
Growling Bear (Waterfall)	Egremont	16
Gulf	Wales	16
Hawthorne's Cave No. 2	Great Barrington	16
Hermit	Erving	16
Herrick	Conway	16
Horse Thief	Otis	16
Ice (Robber's Roost)	Great Barrington	16
Ice	Northfield	16
Ice	Sunderland	16
Indian	Wakefield	16
Island	Otis	16
Jane's	Alford	16
Lanesboro	Lanesboro	5
Lost Cave (Bandit's Roost) (Goodrich)	Pittsfield	16
McMaster's	West Hatfield	16
McMasters (Williams)	Williamson	16
Millers River (Mineral Hill)	Millers Falls	16
Money Brook	Mt. Greylock	16
Natural Bridge	Nahant	5
New Marlborough (2)	New Marlborough	5
Panther	Middlesex Falls	16
Peck's Falls	Adams	16
Peter's	Lee	16
Pirates	Sakomet	16
Plunkett	Monson	16
Porcupine	New Ashford	16
Pot Hole	Egremont	16
Powder House	Cheshire	16
Purgatory	Sutton	5
Rattlesnake Gutter	Leverett	16
Ravens Crag	North Adams	16
Red Bat (Baker)	New Ashford	16
Revival	Savoy	16
Rhena's	Williamsburg	16
Richmond	North Adams	16
Saddle Mt.	New Ashford	16
Seace's	Pittsfield	16
Scalped Woman	Richmond	16
Sheep's	Gill	16
Sky Peak (Hawthorne)	Stockbridge	16
Sunderland	Sunderland	5
Swallow's	Nahant	16
Tory Diamond Coon Hollow	Langsboro	16
Tory	Lenox	16
Trurans	Richmond	16
Venner, Elsie	Pittsfield	16
West Stockbridge	West Stockbridge	5
Williams (Tri-State)	N. Y.-Vt. line	16
Minnesota		
Dalles' of the St. Croix	Taylor's Falls	26
Mississippi		
Copper River	Copper River	5
Great Spirit		5
Missouri		
Ashley's		5
Enon Cave	Enon	26
Jacob Cave	Versailles	17
Jacob Cavern	Pineville	17
Meramec	Stanton	26
Missouri	Leasburg	26
Mushroom	Sullivan	17
Sequiota	Springfield	17
Smittle	Grove Spring	17
Spanish	Ponce De Leon	17
Montana		
Ice Caves in Snowies	Judith Gap	26
Indian Caves	Billings	26
Lost Creek (Foster Creek or Garrity Cave)	Anaconda	26
New Year	Lewiston	26
Pictograph	Near Billings	26
Nebraska		
Jesse James (Robber's)	Lincoln	27

Nevada

According to *The Masterkey*, Sept. 1932 issue, (a publication of the Southwest Museum, Los Angeles, California) M. R. Harrington explored over 30 caves along the Nevada-Utah border during 1932.

Baker Creek	White Pine Co.	8
Cave Creek	Elko	26
Cave Valley	No. Lincoln Co.	26
Coshute	White Pine Co.	26
Lovelock	Lovelock	14
Medicine Rock	Humboldt Co.	14
Mineral Hill	Eureka Co.	26
Mormon (also Cave Valley Cave)		26
Northumberland		26
Ocala	Ocala	14
Pole Creek	White Pine Co.	26
Quejo	Willow Beach	26
Sandal		10
Jedediah *Smith*	St. Thomas	9
Snake Creek	White Pine Co.	26
Star Peake	Pershing Co.	26
Unnamed Cave No. 1	Douglas Co.	26
Unnamed Cave No. 2	Lincoln Co.	26
Unnamed Cave No. 3	Elko Co.	26
Upper Baker Creek	White Pine Co.	8
Whipple Cave	Sunnyside, Lincoln Co.	26
New Hampshire		
Devils		5
Fairy Grotto (Sulphur Caves)	Lake Massebesic	16
The Flume	Franconia	26
Horton's Cave	Waterville	16
Ice	Dixville Notch	16
Indian Camp	Deerfield	16
Indian	Lake Sunapee	16
Indian	Moulton Borough	16
Jasper	Berlin	16
Lost River (10 or 12)	Lost River	16
Medicine Man	Bedford	16
Miser's	Plymouth	16
Oven	Raymond	16
Patee's Caverns	North Salem	16
Straw's Mountain	New Durham	16
New Jersey		
Faery Hole Rock Shelter	Warren Co.	28
McAfee Station	McAfee	28
Moody's	Newton	28
Pines Lake	Pines Lakes	28

Name of Cave	County or Nearest Town	Ref. No.
New Mexico		
Cerro De La Bandera	Gallup	13
New York		
Bear's Den	North Stephentown	16
Bentley's Cave	Berlin	16
Blow Hole Gorge	Boston Corner	16
Canaan	Canaan	16
Clarksville	Clarksville	16
Esopus		5
Haile's Caverns	Altamont	24
Ice Gulch	Petersburg	16
Indian Oven	Acram	25
Master's	Copake	16
Mitchell's	Root	4
Monito (Devil's abode)	Wiewam	5
Niagara		5
No Bottom Pond	Chatham	26
Schoharie	Schoharie	16
Secret Caverns	Cobleskill	17
Watertown	Watertown	26
North Dakota		
Medicine Hole	Killdeer Mt.	26
Oregon		
Catlow	Harney Co.	26
Charcoal		3
Cloudcap	Klamath Co.	26
Edison	Deschutes Co.	26
Horse	Deschutes Co.	26
Ice	Deschutes Co.	26
Indian	Cascadia	26
Lava River Cave (State Park)	Deschutes Co.	26
Little Belknap		26
Lao Rock (Lava)	Klamath Co.	26
Malheur	Harney Co.	26
Marble Mountain	Josephine Co.	26
Modoc Lava Bed Nat. Mon.	Merrill	26
Nash Crater (Lava)	Linn Co.	26
Redmond Lava	Deschutes Co.	26
Sawyer	Bend	26
Skeleton	Deschutes Co.	26
Skylight	Deschutes Co.	26
South Cave	Deschutes Co.	26
Surveyor's	Deschutes Co.	26
Pennsylvania		
Coudersport Ice Mine	Coudersport	26
Hall	Huntingdon Co.	26
Phillips (Dan)	Berks Co.	26
Rattlesnake Den	Hillside	26
Dauphin County	Swatara	26
Rhode Island		
Pirates		16
Purgatory	Newport	5
Spouting	Newport	5
South Carolina		
Great Flat Rock		26
Lover's Leap		26
Parler	Parler	17
Tennessee		
Arched		5
Canoe	Knoxville	26
Cherokee Bluff	Knoxville	26
Chilhowee Park	Knoxville	26
Cudjo's	Cumberland Gap	26
Painted Bluffs	Knoxville	25
Roaring Springs	Knoxville	26
Texas		
Cascade Caverns	Boerne	26
Cave without a Name	Boerne	26
Hammets	Cypress Mill	17
Longhorn Cavern	Boerne	26
Richland Springs	Richland Springs	17
Williams		1
Wonder (San Marcos)	San Marcos	17
Vermont		
Abbott	Thetford	16
Brandon (2)	Brandon	16
Bristol	Bristol	16
Calvin	Chippenbrook	16
Catamount Hill Cavern	Allenstown	16
Cave	Burlington	16
Cave of Winds (Chin Cave)	Mt. Mansfield	16
Caverns	Newport	16
Center Sandwich	Center Sandwich	16
Clarendon Springs	Tinmouth Channel	16
Cold River	Clarendon	16
Cuttingsville (Cow Cave)	Cuttingsville	16
Deer Leap	Mendon Notch	16
Dorset		5
Ethan Allen	Lake Dunmore	16
Everett (Conklin)	Bennington	16
Gotham's	Maidstone Lake	16
Ice	Mt. Horrid	16
Indian	Carvers Falls	16
Lunenberg	Lunenberg	16
Maidstone	Maidstone	16
Middlesex Cave	Middlesex	16
Miles Mt. (2)	Essex	16
Monckton	Monckton	16
Mt. Aeolus (Dorset)	Mt. Aeolus	16
Old Bat (Nickwackett)	Chaffe Mountain	16
Pittsford Ice	Pittsford	16
Plymouth	Bridgewater	16
Skinner's	Mt. Equinox	16
Skinners Hollow	Manchester	26
Smugglers	Stowe	16
South and West (2)	Plymouth	16
Summit	Mt. Equinox	16
Tri-State	Pownal	16
Warner's	Mossalamoo	16
Widow's	Salisbury	16
Woodward's (Dun's Den)	North River	16
Wyman's (Kent)	Raven Rock Ledge	16
Virginia		
Alone Mill	Rockbridge Co.	26
Bathers	Near Lexington	26
Batterbrook Spring	Stuarts Draft	26
Bean	Stephens City	26
Beardsley's		26
Bell (3)		26
Blackwells	Lexington	26
Blue Hole		26
Bowls	Millwood	26
Bridge Water Hill (several)	Rockingham Co.	26
Bristerburg	Bristerburg	26
Buckhill	Natural Bridge	26
Canoe		26
Cartwright's	Blacksburg	29
Catawba Murder Hole		26
Churchville	Augusta Co.	26
Clover Hollow		26
Montell Coiner	Augusta Co.	26
Sam Coiner	Waynesboro	26
Collierstown	Collierstown	26
Daleville	Daleville	26
Death Hole (Pig Hole)		26
Earls (Pig or Death Hole)		26
Ellet	Montgomery Co.	29
Ely	Lee Co.	19
Endless Pit		26
The Glades Foxholes	Grayson Co.	26
Good's	Summit Point	26
Greenbriar		5
Henkel Sister's	Quicksburg	26
Hog Hole	Newport	29
Hollins Station	Hollins Station	26

Name of Cave	County or Nearest Town	Ref. No.
Johnson		5
Jones Rappelling	Newcastle	29
Kern	Woodstock	26
Lacey Springs (Porte Crayon)	Lacey Springs	26
Link's	Newport	29
Lucas's	Newport	29
McCoy	McCoy	29
Madison's		5
Maury River	Rockbridge Co.	26
Mile Long	Blacksburg	29
Mill Creek	Blacksburg	29
Miller's Pocketbook	Newcastle	29
Miller, Warren	Blacksburg	26
Mock Charles	Luray	26
Mock Will	Luray	26
Murder Hole No. 1	Catawba	29
Murder Hole No. 2	Newcastle	29
Natural Bridge	Natural Bridge	5
Natural Tunnel		5
New River	Goodwin's Ferry	29
Pig Hole (Formerly Earl's)	Giles Co.	26
Pipe	Staunton	26
Price, George	Prices Fork	29
Quarterman's	Newport	29
Reed's		5
Reid's	Hot Springs	26
Rich Patch	Aubuy Co.	26
Roger's		5
Slusser's Chapel	Blacksburg	29
Swink's	Lexington	26
Tolleys	North of Lexington	26
Two Mile	Newcastle	29
Unnamed No. 1	Harrisonburg	26
Unnamed No. 2	Lexington	26
Watts (Cave in Field)		26
Weyer's (Wiers)	Grand Caverns	26
Winchester	Winchester	26
Wreast's		5
Yellow Rock	Prices Fork	29
Zane		5
West Virginia		
Aggregates	Aggregates	25
Big	Monongahela Nat'l Forest	20
Big Springs	Parsons	26
Blowing	Head of Elk River	26
Blue Holes	Franklin	26
Bowden	Elkins	26
Brants	Greenbrier Co.	26
Cave Creek	Pocahontas Co.	25
Coffman's	Greenbrier Co.	25
Cornwelk	Masontown	26
Devil Chimney	Shepherdstown	26
Devils Dining Room	Slaty Forks	26
Falling Spring	Pendleton Co.	26
Fifth Quarry	Martinsburg	26
George Washington	Charlestown	17
Grapevine	Greenbriar	26
Haywood	Haywood	26
Indian	Chester	26
Indian Cave No. 2	Pendleton Co.	26
Indian Church (Same as Nestle's Quarry)		26
Indian House	Monongahela Nat'l Forest	20
Jordan's (The Great Cave of the Cheat River)	Hendricks	12
Keyhole	Whitman	26
Lindberg's Hole	Charleston	26
McCoy's Mill	Thorn Run	26
Mingo	Randolph Co.	25
Moyer's	Pendleton Co.	26
Perry's	Clip	26
Perry's Hole		26
Pickle Mt.	Franklin	26
Pinetree	Slaty Fork	26
Porter's	Milboro Springs	25
Rains, Luke (or Mystic, Teterton or Timber Ridge)	Teterton	26
Ridgeville	Ridgeville	26
Ruddles		26
Sharpmill	Shady Forks	26
Sharps	Shady Forks	26
Shepherdstown	Shepherdstown	26
Simmons, K. E.	Cave	26
Sinks	Randolph Co.	25
Sinnitt's	Thorn Creek	26
Slatey Fork	Slatey Fork	26
Smoke Hole Cave No. 2	Monongahela Nat'l Forest	20
Steele's	Monroe Co.	25
Stevens Hole	Marlington	26
Stevenson (Hundred Holes)	Martinsburg	26
Teterton (Mystic, Timber Ridge, or Luke Rains)	Teterton	26
Third Quarry	Martinsburg	26
Thorn Bottom	Wardensville	26
Timber Ridge (Luke Rains, Mystic, or Teterton)	Teterton	26
Trout Rock		25

BIBLIOGRAPHY

1. Ayer, N. Y.—*Archaeological and Faunal Material from Williams Cave, Guadeloupe Mountains, Texas*, Acad. Nat. Sci. Phila., Proc., Vol. 88, p. 599-618, 1936.
2. Connell, George L.—"Fitton's Cave," *The Arkansas Democrat*, March 31, 1940.
3. Cressman, L. S. and W. J. Perry—"Charcoal Cave, Oregon; an Archaeological Puzzle," *Oregon Historical Society Quarterly* Vol. 39, p. 39, March 1938.
4. Eights, James—"Notes of a Geological Examination and Survey of Mitchell's Cave, Town of Root, County of Montgomery, N. Y.," *American Journal Agriculture*, Vol. 7, p. 21, 1848.
5. Feuchtwanger, Dr. Louis—*Treatise on Gems*, N. Y., Appleton & Co., 1859.
6. Furlong, E. L.—"Stone Man Cave," *Science*, Vol 94, p. 414, Oct. 31, 1941.
7. Hargrave, Lyndon L.—"A Recently Discovered Basket-Maker Burial Cave in the Tsegi," *Museum Notes*, Museum of Northern Arizona (Flagstaff), Oct. 1934, Vol. 7, No. 4.
8. Harrington, M. R.—"American Horses and Ancient Men in America," *The Masterkey*, Vol. VIII, No. 6, Nov. 1934, p. 165.
9. Harrington, M. R.—"Archeological Explorations in Southern Nevada," Los Angeles, Cal., *Southwest Museum*, June 1930.
10. Harrington, M. R.—"Sandal Cave," *Masterkey*, Vol. II, No. 2, Feb. 1928, The Southwest Museum, Los Angeles, Cal.
11. Hurst, C. T.—"Tabegauche Cave, Colorado (Preliminary Work 1939), *Southwest Lore*, Vol. 6, p. 4, June 1940.
12. Jordan, George—*The Great Cave of the Cheat River*, Baltimore, Hanzsche & Co., 1855.
13. Lee, Willis T.—*Stories in Stone*, The Chautauqua Press, Chautauqua, N. Y., 1927.
14. Loud, Llewellyn L. and M. R. Harrington—*Lovelock Cave*, Berkeley, Cal., University of California Press, 1929.
15. Nimmons, R. T.—"In the Lair of the Prehistoric Monster," *Travel*, Sept. 1938, p. 20.
16. Perry, Clay—*Underground New England*, Brattleboro, Vt., Stephen Daye Press, 1939.
17. Petrie, J. S.—"Commercial Caves," *Speleological Society Bulletin No. 4*, p. 58-63.
18. Reasoner, John P.—"University Cave, Greencastle, Putnam Co.," *Indiana Dept. Geol. and N. H. An. Rept.*, p. 73, 1884.
19. Shaler, N. S.—"On the Age of the Ely Cave," *Harvard Coll. Mus. Comp. Zool.*, Memoir 10, No. 2, p. 9-13, 1885.
20. Studebaker, Bert—"Smoke Hole," *Highway Traveler*, Aug.-Sept. 1943, p. 10.
21. Thornbury, W. D.—"Bottomly Springs Cut Off," *Proc. Indiana Academy of Science*, Vol. 40, p. 237-242, 1930.

22. Thorpe, R. W.—"Caverna del Oro, Colorado," *American Forests*, Vol. 41, p. 558, Aug. 1935.
23. "Bell Cave"—*N. Y. Times*, June 22, 1941, pt. 10, p. 13.
24. "Description of Hailes Cave—Indian Ladder Park," *N. Y. Times*, July 25, 1933, p. 8, col. 2.
25. *Speleological Society Bulletin No. 5.*
26. Speleological Society Unpublished Records (largely by E. W. Bischoff).
27. Reported by: Austin, Mrs. L. V., Richmond, Va.
28. Johnson, M. E., State Geologist, New Jersey.
29. V. P. I. Grotto—Caves discovered or explored by V. P. I. Grotto of National Speleological Society. Data furnished by Edward F. Moore, Secretary.

To BLOWING CAVE in PANTHER DALE

Scrambled by Jay Espy, with apologies to Byron*

There is a pleasure in the solitudes,
There is a rapture in the muddy chore,
There is society, where none intrudes
In the deep cave, and music in its lore:
I love not man the less, but caverns more.

Where the footpaths are soft as the feet they entwine,
And all save the spirit of man is divine.

Time writes small wrinkle on thy rocky brow;
Such as Creation's dawn beheld, thou sleepest now.

Sleep on, thou deep and dark dank cavern, sleep!
Ten thousand trips sweep into thee in vain;
Man marks the earth with ruin;—his wild jeep
Stops at thy door!

He sinks into thy depths with ne'er a groan,
Without a grave, unknell'd, uncoffin'd and unknown.
He dies,—but, first, he has possessed,
And, come what may, he has been blessed.

1-17-44

*Childe Harold's Pilgrimage
The Bride of Abydos
The Giaour

☞ Clay Perry of the New England group, through his O.W.A.A. affiliation News Supplement, sends us an item in the form of an open letter calling for outdoor writers to "prick up their ears and see what they can pick up. . . . There are so many good stories about caves," he says ". . . human interest stuff." So, in the name of the Society and himself as Chairman of the Folklore Committee, he asks that there be sent to him "whatever data they may come across about American caves, and especially the folklore about them."

☞ J. A. Fowler spoke on "The Fauna of Caves, with particular Reference to the Vertebrates," at a joint meeting of the Biological Society of Washington and the N.S.S., on December 11, 1943. R. S. Bray, Corresponding Secretary of the Biological Society, arranged this meeting and presented a report on some recent additions to cave literature he had found.

Editorial . . .

POTHOLE

☞ Our new "Reprints" section invites comments, should suggest items to submit for publication. If you don't have a long article in your system, by the way, write a short one for "Random Notes," or a "Letter . . ." Tip us off to newspaper, book, or magazine items relating to cave lore, etc., or send clippings, pictures, folders.

☞ Are there any books on caving you want, or do you have any to sell? Let us know: we'll arrange a little section to permit you to advertise the fact.

☞ Do you wish to accept regular advertising in the Bulletin? If so, write us why—yes or no; suggest some possible advertisers or, better yet, send us the copy for a legitimate ad for submission and discussion at the next Board meeting.

☞ An office colleague brought us from Venezuela, a cigar—"a good 5c cigar, Venezuelan style," he said. The interesting part of the fact is that the trade-name of the cigar was "Guacharo de las Cuevas" ("The guacharo of the caves"). Venezuela's best tobacco is grown in the limestone area of the country; the cave there is so called because the guacharo bird inhabits it—the only exclusively cave-dwelling bird known. Fowler (ut supra) mentioned the bird; Bulletin No. 7 will have a reprint bringing bird and cave together. (We gave the cigar, with wrapper, to the Society for the library.)

☞ When photographs are taken by anyone—member or non-member—on a cave trip, it would be appreciated if he would *please* send prints and legends attached either to the Editor or Chairman of the Photography Committee. Three main purposes are thus served: pictorial reference records are maintained; they may be subsequently used in the BULLETIN; members of the party photographed may wish to buy prints for their own records.

☞ For two years your Editor has been working upon his friend Ellery Queen to do a radio mystery with a speleological background. It was an agreeable surprise, therefore, when there came over the air at the regular time on Saturday, April 15 (the evening the Board met at the Editor's house, to make it nicer!), "The Mystery of the Haunted Cavern." Hope you heard it.

The Editor

ELEMENTAL SPELEOLOGICAL EQUIPMENT

By WM. J. STEPHENSON

The matter of cave equipment at best is a very controversial subject. Almost everyone after only a few times visiting caves apparently forms definite ideas of what he personally likes to wear and carry, and often even what equipment others should use.

It is not the aim of this article to be dogmatic as to what is the best equipment for the speleologist. Rather, its purpose is to review the field briefly, presenting what I believe are the advantages and disadvantages of the various types of basic equipment, in order to help the neophyte in his selection, and to mark off a starting point for possible eventual standardization of complete caving toggery.

For this discussion, Equipment is divided into two main classifications: Personal and Party.

I—PERSONAL EQUIPMENT

Clothes

First thing to consider before going into a cave is clothes—you don't usually go anywhere without them. Once inside a cave, one will generally first feel cool because of the cool cave air of about 52° to 56°. After a short while one then gets quite warm from working around, but when one stops moving you get cool again. Therefore, one's clothes have to be somewhat of a compromise. Clothes should be relatively warm but not too warm for hard work.

Probably the best basic clothing to wear in a cave is that made of wool, flannel, or an equivalent which will absorb perspiration and yet not remain wet.

Clothes from Exterior Down

Probably the best thing for outside wear are coveralls of the usual gas station type. It is our hope that the Society will be able after the war, to have a coverall made to its own specifications. An ideal coverall should not have the usual types of pockets especially on the hips. When crawling through restricted places they are apt to become caught on any projection. If this merely results in torn pockets the wearer is lucky. If the coveralls have hip pockets when bought, they should be sewed up tightly. Slit pockets through the coverall to interior pockets are generally all right. Breast pockets do the least harm. Generally speaking, the best idea is to have no pockets at all as they merely tempt one to use them unnecessarily. The next best thing to coveralls are overalls. Ordinary overalls are usually satisfactory but have a few more buckles and like gadgets to get hung up on. Again it is repeated that a smooth exterior covering with no breaks is most important so as to eliminate all possibility of catching, hanging or tearing.

Large bulky sweaters or leather jackets are generally undesirable. If one gets in a restricted hole too small to squeeze through and has to back out and the jacket or sweater catches on something, it will crawl up on you and there you will be caught like the fish on a fish hook. It is easily possible for a person with a sweater or leather jacket to get so completely stuck that he will be unable to free himself except with someone else's help. It is recommended that sweaters or jackets not be used generally and never for any strenuous exploring.

Many people, especially the novices who have not yet purchased special equipment, just wear old clothes. They are usually quite satisfactory for beginners or elementary work, and are far superior to leather jackets or sweaters. Old clothes should usually consist of some heavy work shirt which is tucked into the pants. If you work through a hole too small you may catch on your belt around the pants but then you can always back out. One in this situation may also push forward if the belt is not too tight, thus leaving the pants to be collected at one's leisure. Old clothes though satisfactory are still not the most desirable thing. Old clothes should always be so old that they will not be hurt by a liberal coating of cave mud. For this reason, good outdoor hiking clothes are not desirable.

Girls in particular have found it very convenient as a cave outfit to wear a regular pair of sweat shirt and sweat pants. The pants tied at the waist band would come off before one got stuck.

Underneath the coveralls one can wear most anything; old sweaters, regular clothes or anything else. Old-fashioned heavy underwear is very desirable. The flannel next to the skin will not only absorb perspiration but give all the warmth one actually needs. Long underwear also gives a certain amount of protection to elbows and knees. One will be surprised at what a difference that layer of flannel can make. It is recommended that the long underwear be cut off shortly below the knee and elbow since, as normal cave work often produces wet arms and legs, if they become wet in sleeve or leg they flop and worry one and will also be cold. Before the war, suitable cheap underwear could be bought at nearly any store for about $1.00. This long underwear is suitable for both men and women.

Shoes

Shoes are more trouble than any other item. No ideal cave shoe has yet been found. Boots, tennis shoes, baseball shoes, football shoes, golf shoes, have all been

tried, but not a single ideal shoe has yet been found. Tennis shoes are probably the best in dry caves where rocks are dry. They enable one to get a good grip and jump from one rock to another very well. But on wet rocks they become exceedingly slippery. Boots are good all around provided the cave does not have deep pools or streams. Any type of leather waterproof boot, fishing boot, rubber boot, etc., is all right as one can wade in comfort until the water goes over the boots. The main disadvantage of boots is that if one gets in relatively deep water, over the boot tops, then they must be bailed out. Plain ordinary type shoes such as a farmer wears, are probably as good as one could possibly get as they have ankle bracing and are cheap, rugged, and easy to put on and off. Cleats are excellent in a muddy cave. In the East probably about 75% of the caves have slippery mud. Football, baseball or track shoes all cleated, have been tried, and are satisfactory. However, baseball shoes offer the best all around resistance to slipping. Baseball cleats can be purchased and attached to any pair of old shoes and this makes a quite satisfactory cave shoe. Caution should be taken when using cleats of any kind to be sure that they are attached securely enough to stand the rough usage to which they will be subjected. Cleats have one outstanding disadvantage—that is, they will throw or trip one on the boulder or uneven rock floors of dry caves. A fairly suitable compromise has been found, that is, a high tennis or basketball shoe with a standard golf rubber. On dry rocks one can take the golf rubber off. The golf rubber gives gripping on muddy surfaces and keeps feet relatively dry in small streams. If one goes over the shoe tops, the tennis shoes will dry out easily and do not become stiff.

For the girls, one caution should be added, that is, that high heel shoes are definitely out of place in a cave. For her first trip, regular tennis shoes will probably be as good as any.

Hats

It is believed that everyone who goes in a cave should wear a hat. The third or fourth bump on the head will convince most anyone. There is a great amount of hanging material in caves, portions of original ceiling that are eroded, stalactites, other irregularities, and so on. When one strikes his head, even a felt hat or stocking cap will usually give warning of the coming bump, often in time to cause one's reflexes to retract the head sufficiently to avoid the bump entirely. In all cases, the felt alone has amazing shock absorbing qualities. The best thing to wear is some hard helmet of the regular miner type. The probabilities are that a helmet with an entire rim is better than the cap type as it gives better protection from falling stones. Usually there are falling stones only when someone is working on the ledge above you, and that is not usually often enough to justify the increase in cost and the bearing of the added weight of the full brim over the cap type brim hat. All hard hats should originally have a bracket for a head light. If a head light is not desired, nothing is lost; whereas it is exceedingly difficult later to add a light bracket to a hat that did not originally have one.

Guards

Knee guards and elbow guards are quite desirable. Special knee and arm pads can be built right into the coveralls. Basketball knee guards have proven very satisfactory. Padding for rappelling can also be built into the coverall. The amount of padding desired depends largely on the individual. Leather patches on the seats of the britches have also proven to be highly desirable. All padding should be either under or on the inside of the coverall, while leather and canvas reinforcements should be sewed carefully and tightly on the outside in such a way that no sharp edges are left to catch on any cave projections.

The preceding discussion has all been directed to clothing or what may be called *personal* personal equipment. Now let us consider some more or less necessary items that each individual should have for efficient cave work, which may well be called general personal equipment. Such items are mainly lights and aids to keep from getting lost. Collecting or mapping equipment, photographic equipment, etc., will be briefly dealt with later as special equipment.

Lights

Several types are available for use in caves. In the order of their size, they are:

1. Hand gasoline lanterns.
2. Large carbide lights carried in hand.

Either of the above will give off a tremendous amount of illumination. One or two to a party is about all that would be needed.

These first two types will be considered together. They each possess many advantages, the main one, of course, being the great quantity of light which they give off. A second and nearly as important advantage, is that they each possess a large fuel reservoir and thus often make the carrying of additional fuel into the cave unnecessary. Both types of lights usually carry fuel for six or eight hours continuous use. The gasoline lamp will give a greater and more dispersed illumination but has the disadvantage that it must be handled carefully

to avoid breakage of the mantels. Either type of these lights is hard to handle in small caves or caves involving much crawling. They are better suited to caves with large chambers and open passageways.

3. Hand electric lamps. Hand electric lamps are available that are run on heavy duty dry cell batteries. The hand lamps do not usually give anywhere near as much light as the gasoline lanterns or large hand carbides. They are more rugged than gasoline lanterns and give a good light for five or six hours and will burn continuously for ten hours or more. They are not generally recommended unless the going is too tough for gasoline or large carbides and, even in this instance, probably the smaller lights will prove to be more satisfactory.

4. Flash light and small carbide lights. One of the advantages of the flash is that you do not have to worry about changing carbide or burning anyone. Carbide generates a very hot flame and is a danger in burning the person next to you. Also a regular flash can be made waterproof and if dropped even in water, one can see it shining and rescue it. If one drops a small carbide lamp, the light usually goes out and must be lighted up again. Often the tip will become clogged and need cleaning. Also there is a bad odor from carbide when it is changed that some people object to. However, in spite of its disadvantages, the carbide gives a generally superior light. It throws a beam of light not only as far as the average flashlight but also gives an excellent dispersal of light on the sides. It is also valuable as an aid in detecting the presence of bad air (excessive concentrations of carbon dioxide), as it will die down or even go out before the carbon dioxide concentration gets too great to be dangerous to human life. Both of these small lamps (carbide and electric) have the disadvantage that they require changes of fuel and ample reserves. A carbide will require a fuel change every 1½ to 2 hours while a flashlight begins to loose its effectiveness after about 2 hours steady use and will usually require a battery change by 4 hours. Of course, the life of the flashlight battery is much longer—usually about 10 hours if they are not used continuously.

5. Candles. Candles have been used for exploring caves from earliest times and for some purposes cannot be improved on. They give a very nice soft light for a small room. They are very easy to carry. No one should go into a cave without a candle that he can fall back on should his other lights fail. Candles not only are an excellent supplemental and emergency light source but they are very useful for lighting up a room as they may be placed around the room at different points and left burning, thus lighting up the whole outline of the room evenly. Candles will not burn if the air is bad. If one has any suspicion about bad air the candle will prove this as they will cease to burn long before the point where the CO_2 concentration reduces the oxygen content of the air below the point that it will support life. If the candle does not easily light, do not stay to investigate, just get out.

Hand vs. Head Lamps

There are also two other distinct types of lights: (A) those carried in the hand, and (B) those carried on the head. The big advantage of the light on the head is that it leaves the hands free. The head type light has the disadvantage that the first time it is worn, it usually gives one a headache. This is probably due to the weight of the light which throws an additional strain on the muscles at the back of the neck since the head tends to tilt forward. After being used for a while one will get used to these head lamps. Another disadvantage of the light on the head is that if one happens to hit the head hard enough to knock the hat off, the light is also gone. This is a rare occurrence—some people also drop hand flash lights. One can get electric head lights with the batteries carried on the belt and the wire running through the back of the coat. Carbide lights come the same way with a supply of carbide on the belt and pump gas up to the hat through a rubber tube. Most people who do collecting or other work prefer the type of light on the head, with the means for keeping the light going carried on the belt. The big advantage of this type of headlight is that more fuel can be carried on the belt and the weight on the head is much less. Where much crawling, climbing, squeezing, etc., is encountered, the belt type headlight is not so good as not only is the bulge on the belt from the battery or carbide container undesirable, but there is danger of the connection between the light and its power source being pulled loose.

Hand lights require little discussion. Their disadvantages are obvious while their main advantages are primarily cheapness and versatility.

Means for Keeping from Getting Lost

Everyone who enters a cave should have some means of marking his course to keep from getting lost. Elaborate equipment is not usually necessary. The best thing is to study the cave as you go along just as people study landmarks on the surface. This works probably nine out of ten times. However, when one has missed one of his land marks, he may be out of luck. Therefore, everyone should have some sort of physical aid to prevent getting lost. One of the easiest is plain chalk, as direction arrows can be put on the walls. They are

easy to rub off and will not permanently disfigure the cave. With a carbide light, one can mark letters from soot from the flame but this is left permanently. The same is true of markings hacked with an ax or knife. One of the surest means to use is string. By tying a string at the point of branch from a main passage and unwinding it, it can then be followed back. If there have been other parties and other strings, caution should be taken to be sure to follow one's own string and not that left from other parties. Of course, the specific means used must fit the type of cave. In large long caves, string may not be practical due to the excessive amount required. In some types of caves rock cairns can be built and other identification left at intersections. Often string can be left just through the intersections and then disconnected. Candles are also fine for this purpose. They can be left burning at the mouth of the return passage to provide a welcome light on return if they are still burning. If they burn out their wax deposit will remain as a landmark.

Another item of equipment that will help one from being lost is a pocket compass. This, of course, is of use only in case one has made a compass traverse or mental note of direction.

(To be continued)

A SUBTERRANEAN ADVENTURE IN DIAMOND CAVERNS

(Continued from page 24)

in length. By lowering the floor, a safe and convenient passage was provided, thus leaving considerable formation in the top of the crevice undisturbed.

ROCK HALL

To the "uninitiate," after walking through the long tunnel-like passage-way over the top of this last breakdown, it is an awe-inspiring experience to find one's self suddenly standing on a hill at the far end of a wide subterranean chamber. "Rock Hall" is a most appropriate and truly descriptive name for this great underground room. Large flood lights, indirectly arranged, brightly illuminate the high limestone ceiling, and as we descended the graded walkway towards the center of this chamber, our attention was called to the many large overhanging rocks, beautiful water carvings, and the presence of a peculiar red formation on the left cave wall. An opening in the floor, surrounded by a protecting iron hand rail, invited closer examination. By leaning over the rail and then directing the beam of a flash light downward, the floor of a large unexplored room, many feet below, was brought into view; while directly ahead of us we were facing "Rocky Mountain"—a huge break-down, above and beyond which, to the right, the rough irregular ceiling, reflected by flood lights, cast long shadows into seemingly void spaces. Beautifully colored draperies along the top ledge of the right wall were also examined from a distance.

The Dinosaur

The form of a huge limestone "Dinosaur" was next observed: A great ledge, several feet above the floor, appears to support its enormous weight. The long tail, high ribbed-like back, front shoulders and lowered head, give you the impression that this mammoth beast is attempting by brute force, to clear a pathway through the break-down directly ahead of its massive body. The overall length of this natural limestone formation is approximately 22 feet, and the animated illusion is most realistic.

Beyond

Around the far sidewall, to the right, there is a deep pit; beyond a light at the top of the break-down barrier is a high dome, and for several years, up until the latter part of July, 1942, visitors were informed by the guides: "We are at the end of the trail, but not at the end of the cave. When you come again, we hope to be able to take you over Rocky Mountain, let you stand on a bridge, look down into a pit, up into a high dome, and then take you into an avenue as yet unexplored." Recent exploration developments indicate that such "expectations" are not likely to be realized—in that direction. It appears that Nature has made different plans. And so we come to the end of our trip through Diamond Caverns, that is, the regular route now open to the general public.

(To be continued)

Aspects of Cave Protection

It is possible that my suggestions on Pan-American cave protection will be worthless until they have gone through the hands of a lawyer, but we have a small hold on an organization that is already a going concern if we should find it possible to cooperate with the Archaeological branch of the American Scientific Congress. It may simmer down to what lawyer with ability to pass on Latin American matters would say about artifacts belonging to the owner of the fee, or to the finder. I have made a copy of Jesse L. Nusbaum's remarks, on the yellow sheets, and also of the National Act on the Preservation of American Antiquities. Perhaps my advice can go no further than to ask if it can be made legal to include bone and fossil remains under the same

law as archeological artifacts, so far as cave finds are concerned. No doubt this point of view will also interest the Chairman of your Archaeological Committee to whom I have already dropped a note about other matters.

In addition to that, comes up another possibility that in no Nation may a cave owner open a commercial cave for guide service with public fee unless they submit to some state department which will look after the safety of the visitors just as the U. S. Bureau of Mines has to enforce safety for miners. If this sort of law were adopted in both Americas, it would be a help toward the first endeavor to make archaeological and paleontological finds under rights of the state, or eminent domain, instead of the rights of the owner of the land, whose ownership is really guaranteed by the state. This would follow a similar legal procedure as the sovereign right of ownership in wild game. I hasten to add that I am not legally trained, and that it undoubtedly requires legal advice to be sure how to proceed. Nevertheless, the American Scientific Congress is made up of many men who are scientists or conservationists that will gladly see that state's priority rights of Nations and of scientists should have precedence of irresponsible vandalism.

A third possibility has a little more of the American flavor. If we could devise a way to award public recognition to people who discover things of importance in caves, without in the same breath succeeding in their destruction, it would teach many amateurs to be careful and might not be unpleasant praise to a grown-up scientist. If it were no more than a printed card of congratulation or appreciation from the National Speleological Society and was awarded for real merit, it might do more to make non-members, as well as amateur members look on it as an award for achievement. I do not believe that the money award is half as important as recognition from a National Society; and it should be awarded either by the President or the Executive Board, and lie with some committee as to whom such cards of appreciation be sent.

I admit that perhaps I have not thought this out to all the logical conclusions, but there is nothing that I could do to help establish the future importance of the National Speleological Society more than help you line it up with other leading groups striving for the betterment of knowledge in America. Sometimes it is more important to be known for the crowd we go with than it is to be so very learned.

A. C. Burrill, Curator,
Missouri Resources Museum,
Jefferson City, Mo. (1943)

HONORARY MEMBERS

VERNON ORLANDO BAILEY

One of America's foremost naturalists, Vernon Orlando Bailey, died at his home in Washington, D. C., on April 20, 1942.

His lifelong course of scientific study of birds, mammals, reptiles, etc., would have alone endeared him to any Society whose membership included exponents of

Vernon Orlando Bailey

these outdoor pursuits. That he devoted himself to the preparation of two particular volumes, CAVE LIFE OF KENTUCKY and ANIMAL LIFE OF CARLSBAD CAVERN AND YELLOWSTONE NATIONAL PARK, makes it especially fitting that he should have been selected for first (though post-humous) Honorary Membership in the Society, for 1941.

Born in Manchester, Michigan, June 21, 1864, Dr. Bailey became associated with the Bureau of the (then) Biological Survey, U. S. Department of Agriculture, as a young man. He served as that agency's Chief Field Naturalist from 1887 until his retirement in 1933. In this capacity he served five decades tirelessly, producing for them a vast literature of works upon mammalogy, ornithology, herpetology, and plant distribution; and complete biological surveys of the states of Texas, Oregon, North Dakota, and New Mexico.

He was an active member in a dozen learned societies, among them the Ornithological Union, Forestry Association, Biological Society of Washington, and the Society of Mammalogy. He was President of the last-named Society from 1934 until his death.

RALPH WALTER STONE

Born in Camden, New York, on November 17, 1876, Ralph Walter Stone took his Harvard M.A. to the Geological Survey, U. S. Department of the Interior in 1901, the year he was granted it. For two decades thereafter he added steadily to his stature as a geologist, contributing more than fifty reports on the geological and mineral resources of his country to the bibliography of the Survey's published documents.

Since 1921, Mr. Stone has been Assistant State Geologist, Pennsylvania Topographic and Geologic Survey. In forty years, he has written upon a variety of subjects and more than 230 articles for technical and other periodicals.

It was as a writer of Pennsylvania State publications

Roy Jay Holden

that he wrote CAVES IN PENNSYLVANIA, since become for the Society one of its prime sources for reference upon a subject never widely treated, speleological geology. It is for this service, and the countless other aids he has rendered it, that the Society selected Ralph Walter Stone as its Honorary Member, for 1943.

Ralph Walter Stone

President of the Pennsylvania Academy of Science in 1939-40, Mr. Stone had been its Editor until then for 13 years. Now resident in Harrisburg, Pa., he is a member, among other organizations, of the Geological Society of America, the Society of Economic Geologists, and the American Association for the Advancement of Scince. Lebanon Valley College conferred upon him the degree of Doctor of Science in 1938.

ROY JAY HOLDEN

For more than half a century Roy Jay Holden, Professor of Geolcgy at Virginia Polytechnic Institute, has been a classroom teacher. To the members of the Society, however, he remains a teacher above—or below —ground, and has given unstintingly of his inspirational guidance and learning to all of us who sought him out. It is altogether fitting that he has been selected for Honorary Member of the Society for 1942.

Born at Sheboygan Falls, Wis., in 1870, Dr. Holden continued his education in that State, having had his Doctorate conferred upon him in 1905. That date, too, marked his initial association with V. P. I., although he already then had a decade of teaching experience behind him.

Dr. Holden's list in the ANNOTATED GEOLOGICAL BIBLIOGRAPHY OF VIRGINIA alone, runs to 27 published titles. For the Society, however, he is particularly an oracle in that most controversial field of

the helictite formation: "Helictites in Virginia" and "Helictites of Skyline Cavern," products of 1938, brought Dr. Holden to us as a speleologist.

Professionally a consulting geologist, Dr. Holden is a Fellow of the A. A. A. S., Geological Society of America; member of the American Institute of Mining and Metallurgical Engineers, American Association of Petroleum Geologists, Society of American Geolegists, and of the Virginia Academy of Science, among other associations.

Treasurer Welcomes Comments

It is customary for some organizations to bill for dues anywhere from October 1st., to January 1st. Considering the need we have for building up our balance again and how reluctant some are in sending in dues promptly, why wouldn't it be a good plan to bill dues each year about December 1st? This would insure some 1944 dues paid this year, if inaugurated now, and induce some delinquents to pay the current year's dues now instead of next January or February.

Unless the bills are already printed how would it be to note on the bills the different classes of membership or at least indicate the rates of Life Memberships for the current and subsequent years?

Would it be possible to obtain a list of visitors to one or more commercial caves? This could be done by someone jotting down the names and addresses of *recent* visitors or perhaps through the cooperation of the management itself. The management would stand to benefit indirectly by this assistance because of the maintained cultivation of general interest in caves by the Society of people who have indicated a wholesome interest in caves through visitation. A letter, addressed to these visitors signed by the President or any other suitable person, could tell of the Society, state its purpose of organization, its motives and plans and in general show how the Society could function in the interest of such prospective member. I would be glad to help prepare such a letter if this sounds like a good plan.

Another letter I had in mind was one to be addressed to prospective donors to the Society to be signed perhaps by myself as Chairman of the Finance Committee. This letter like the one suggested above could tell of the Society and solicit gifts now or bequests by will payable at a later date. This plan would require a submission of names by members and might not be successful for this reason.

LeRoy W. Foote
Middlebury, Conn. (1943)

Grotto vs. the N.S.S.

The question of the relationship of grottoes to the National Society has arisen several times in the past. As it is hoped that grottoes will be established with increasing frequency, this question is now assuming such importance that the following excerpt from a letter written to Dr. Felix Robinson is felt to be of sufficient interest to be published for the benefit of all our grotto members and those who may be considering establishing a grotto.

A Grotto, by the By-Laws of the Society, must be composed of ten or more active members of the National Speleological Society (Art. VII-Sec. (a)). Membership in the Society is a condition precedent to the establishment of any Grotto of the Society. The dues for all members are fixed, regardless of any grotto status, and the privileges which you at this moment have as a member of the Society are in no way different than the privileges that any other member enjoys, regardless of whether or not he is a member of a grotto.

The organization of grottoes has been provided for in the By-Laws in order to help individual members in a community to participate more fully in the work of the Society. The individual members of a grotto are the only ones in the Society who derive any benefits from said grotto. Therefore, it is believed clear that there is no logical reason why the Society should use its funds for the furtherance of any grotto's interest more than any individual's. Of course we recognize that an active grotto should bring more members into the Society than an unorganized group of individual members will.

When the Society does have funds available, the Board of Governors may perhaps appropriate some amount for the organization of grottoes. However, at the present time, this is impossible, for reasons which I believe you can clearly understand when you read the Treasurer's report for 1943 included in the coming Newsletter. As you can see from this report, practically our entire funds go for publication of our Bulletin, Newsletter, and for maintaining necessary correspondence.

I believe you will agree that the main justification for the Society lies in its effort to put caving on a scientific plane; in other words to do as the name implies, develop the science of speleology in all its ramifications. Our present organization visualizes attaining this aim through a number of committees, each of which is responsible for the advancement of the work of the Society in its respective field. These committees are designed to operate independently of any grotto organization, and are responsible directly to the national Board of Gov-

ernors. While the individual grotto may establish its own committees paralleling the national committees (and it is provided that the chairman of said committee shall be automatically a member of the national committee (By-Law VII, Section (c)) and it is hoped it will do so, the prime work of the grotto should be one of promoting field work in a local area, and social intercourse between members in that area. *It is not contemplated that the National Society will be composed of a confederation of self-governing local grottoes, but rather that local grottoes may be established to aid the individual members to enjoy more fully and participate more thoroughly in the general work and purposes of the National Society.*

With the above in mind permit me to explain a few things in the Richmond Grotto's constitution. I have looked upon it with favor because it is simple and highly flexible. It presumes that the members of the grotto are more interested in speleology than in parliamentary procedure, and for that reason places the entire control of the grotto in a small governing board or executive committee, but has a safeguard that the members of the grotto can override and actually remove the executive committee should they or their acts be found unsatisfactory. This set-up allows a maximum of time for speleology and requires a minimum of time for debating. You will notice that the Richmond Grotto does not in its constitution make any provision for grotto dues. The Executive Committee can assess such dues if found desirable. There is no provision for any proportion of grotto dues that might be assessed to come to the national treasury or vice versa. Thus, if the members of the grotto feel that funds are desirable or necessary for the grotto's work, they can tax themselves to raise the same. If they feel that they can get along without funds, they are at liberty to do so.

The experience of the Richmond Grotto is that a large amount of funds though of course desirable, is unnecessary. Their postage bill is very small, and what fund they have collected has gone into purchase of rope and similar grotto equipment. It has been able to raise the necessary funds through the medium of a trip tax (25c per member, 50c per non-member). This means that the ones who use and wear out the equipment are the ones who actually pay for the same. At their meetings they have collected a silver offering (averaging about a dime per individual) covering the cost of refreshments at said meeting, with an additional slight amount for the treasury. Here again, the ones who received the benefit of the meeting are the ones who paid for it. By this system of no prescribed dues it is possible to regard any member in the Richmond area as a Grotto member. He is so regarded by the Grotto when in their area, whether for a day or for a year, more or less, it being their intention to treat the member of any other grotto exactly as though he were a lifelong Richmond Grotto member during the time that he may be in the jurisdiction of the Richmond Grotto. A similar method of financing appears to be in vogue at the V.P.I. student grotto at Blacksburg.

As we see it, the purpose of a grotto is to stimulate interest and multiply effectiveness. All our other grottos so far organized have been in areas where members were already present, and it was merely a case of members banding themselves together. You are in the peculiar position of being the first to organize a grotto before the members existed in the area necessary to support the grotto, so of course you are encountering problems which were not hitherto faced. The way that you solve them will be watched with interest, inasmuch as you are pioneering a procedure which will probably become more common as time goes on, that is, as members carry the gospel of speleology to new fields.

I would recommend to your prospective members that they first become members of the Society and then perfect their grotto organization. There is no reason why you cannot do both simultaneously, but the individual memberships must be accepted before the national Board of Governors will approve or even consider grotto status.

W. J. Stephenson

Background

We are a persistent Society, and a growing one.

The sequence of notes following illustrate these facts, we believe, and there is some pride in our putting them down.

1—From NATURALIST AT LARGE, by Thomas Barbour, Little Brown and Company, Boston, 1943, "The Sea and the Cave," p. 80; "I became so interested in caves at one time (Ed.—About 1910?) that I suggested to William Morton Wheeler that we start a Society of Speleologists. He was enthusiastic, but we finally concluded that there was not enough of an interested group to make it worth trying."

2—If the famous scientist had once such an interest in speleology, he must still have, thought President Stephenson. So—a letter to Dr. Barbour, Director of the Museum of Comparative Zoology, at Harvard College.

The reply was not hopeful.

"I was most interested to see your letter giving the story of the organization of the Society for the Study of

Caves. If it were not for the fact that I am now too old and with somewhat lessened physical strength than I was a few years ago I would join your Society with the greatest pleasure but as things stand now I fear I shall have to decline to do so.

I appreciate your writing me very much indeed and had your Society been started earlier I should have been delighted to associate myself with it.

Sincerely yours,

(Signed) Thomas Barbour

3—A decent interval of time was allowed, then a simple application blank together with a copy of BULLETIN Number Five were sent Dr. Barbour.

4—The result was a happy one. Almost by return mail came a check for Life Membership in the Society.

Thus, we grew in stature.

Another Boost for N.S.S.

It is most fortunate that the National Speleological Society has been formed, as a campaign to preserve what is most important about our caves will certainly come to the front before long. We can not carry a cave away except piecemeal and put it in a museum; we can't give it over to vandals or to exploiting owners who don't know the relative values of what is to be found in caves other than strange rock formations, just by neglect; and we have to have some sort of organ to bring together the widely scattered notes about the many different caves. Only then can we begin to form some judgment as to whether they are worthy of being a National Park or Monument or become just a State Park, or merely a local attraction.

Moreover, if bombing comes to stay as a civilized way of war, many caves will be needed as places of refuge, just as they were in medieval and prehistoric days. The fact that Carlsbad and Mammoth Caves are already in the hands of the U. S. Dept. of the Interior, shows a trend that NSS is just in time to help foster, and to promote in the direction that the better informed speleologists consider wise. In a sense, they are making themselves specialists in this line of knowledge, so that when they become numerous enough, they will no doubt make themselves heard. American naturalists, biologists, archaeologist, and palaeontologist organizations will give us recruits in good time as they appreciate the special field we elect to cover.

Dr. A. C. Burrill

Commercial Caves

EAGLE CAVE, MUSCODA, WISCONSIN

By MRS. S. H. GILLETTE

Eagle Cave is located in the township of Eagle, Richland County, Wis., 17 miles SW of Richland Center, 8 miles NW of Muscoda, near Highway 60, one of the most scenic drives in the Badger State.

The cave is in the lower magnesian limestone, Ordovician in age—about 300 million years. It was formed by the solvent action of underground water slowly dissolving the limestone.

In the year 1849, according to legend, Peter Kinder, a hunter and trapper living several miles from the cave, heard of a black bear being tracked in the snow from

Peter Kinder who, according to legend, discovered Eagle Cave in 1849 while chasing a bear down a rock-hole.

the river bottoms to a dense woods. Wishing to enjoy some bear-steak, he and an Irishman named Murphy hunted this bear and chased him into a yawning hole in the rocks where he was killed. Neither man dreamed

then that this hole would some day prove to be one of Wisconsin's outstanding attractions.

In the spring of 1937, several business men formed a corporation and were granted permission from the State of Wisconsin to develop this cave. It was dedicated and opened to the public May 29, 1938, Judge Levi Bancroft of Richland Center delivering the address, with the Blue River High-School band entertaining the immense crowd on hand.

It was the first cave to be commercialized in Wisconsin, and the first underground wedding in Wisconsin was solemnized in this cave in July of that same year.

The temperature of the cave is 40 degrees F. in summer and 48 degrees F. in winter, too cold for much animal life to exist here.

The entrance of the cave is down a steep grade of 25 feet into a large room, 250 feet long, 75 feet wide, and 12 feet high. Here are found two large clay mounds extending from ceiling to floor formed by seepage through a channel overhead, no doubt millions of years in forming.

At the rear of this room are found millions of pure white "icicles," (stalactites), dripping and "growing." Many a tourist has enjoyed a drink of ice-cold water, caught in containers, flowing down the sidewalls out of small crevices in this room. A stalagmite called "Frozen Waterfall," 25 feet high and 15 feet wide and resembling a huge open umbrella, catches your eye when looking down over a ledge to the right.

As one leaves the front room, he passes to a lower grade and two glaring mounds appear before him.

Eagle Cave, near Muscoda, Wis.—Paul Bunyan's Toadstool.

These were once clay mounds but are now covered with "onyx." To the right is a stairway leading to a "Hornets' Nest." This peculiar Nest is 15 feet high, 5 feet wide, and cylindrical in shape. According to geologists, this space was a whirlpool in the early days. Its walls are covered with pinkish, satiny drapes and a pinkish stalagmite stands out near the ceiling as a monument. This is one of the most beautiful formations in the entire cave. Snail fossils are embedded in its walls.

Up the steps again you go, and under a huge limestone rock. Here we pause to see the "Boston Tea-Pot," "Giant Sun-fish," and a five-inch white onyx "V". Going farther on we come to "Bad Lands," "Eagle's Nest," then on to "Paul Bunyan's Toad-Stool Room." This latter is a two-story chamber with a toad-stool, 35 feet long, resting on "Mt. Vesuvius," a stalagmite 5 feet square with a light shining through it. A 12-foot stalagmite supports the ends of the toadstool. Paul's "Corn-Cob Pipe" and "Wisdom-tooth" are nearby. Up the stairs now into the brilliantly lighted "Diamond Room," where millions of "water" diamonds glisten under the lights. These are pure white stalactites hanging from the ceiling from an inch to a foot long, each one having a drop of water at its tip.

You now pass through a corridor about 60 feet long and 4 feet wide bringing you into the largest room in the cave. Many and varied are the formations found here. Various shades of green and burnt orange are the colorings on the walls and ceiling, an evidence of copper and iron in the ground. "Rock of Ages" here is the largest stalagmite in the cave, extending from floor to ceiling, about 30 feet high and 20 feet wide. It is pure crystal onyx.

Nearby is the "Leaning Tower of Pisa," also a miniature "Pipe Organ," 4 feet high. To the left is "Fairy Spring," a charming attraction to everyone. Gold-fish swim lazily in its waters. Along this walk you will find "Baked Potatoes," small onyx stalagmites on which to stub your toes.

On the ceiling and walls in this room you can read thousands of names and scores of dates of people who visited this room, one date being easily visible as 1862. The names of R. F. Powers and W. J. Stewart in large letters are detected at once.

It had been the custom years ago of old and young to spend their Sunday afternoons seeing the curious formations in the cave with lanterns and torches and one can guess that these men burnt their names on the rocks as a memorial. At the rear of the cave on a ledge is a sacred inscription, "Jesus Saves," printed in large letters, now covered with onyx which makes it indelible. The author is unknown; perhaps he was an early Missionary.

To the left is another spring called "Crystal Spring," a pool of clear water where tiny goldfish chase each other under the rocks. Near here are onyx "Bee-Hives," "Red-eyed Tiger," "Frozen Fish," "Oriental Lovers,"

and other odd formations. Bats by the scores hibernate here during the winter.

Some biology students from the University of Wisconsin banded some bats several years ago in March and took them along, and by late fall of that same year some of them had returned.

Not all of "Eagle Cave" has been explored or developed but will receive adequate attention as soon as the war is over.

The cave is situated on a high hill in a dense woods. A large orchard surrounds it. One can drive to the entrance on a good gravel road. The cave is electrically lighted throughout, and its walks are gravelled and stairs are railed. There are camping facilities, picnic-tables, fire-places, concessions, rest rooms, and trails of historic interest. Eagle Cave has been visited by more than 100,000 persons, many from foreign countries.

All Speleologists are cordially welcome here.

☞ Dale White, author of "Gem of Caves" (BULLETIN No. 5), had an article in *Family Circle* (10/22/43) on "Women in the Woods." She writes us she is now writing a novel with a "forestry" background and encloses a clipping from the (Butte) *Montana Standard* (1/4-5/44):

"A recent issue of the National Speleological Society BULLETIN carries a detailed article on the famous Morrison Cave located near Butte. The author of the interesting description of the Montana wonder spot is Dale White (Mrs. Howard Place) of this city.

"Tracing the cavern from the time of its discovery up to its present improved status, the Butte writer gives an interesting insight to the history of the project.

"The wonderful work executed at the cave by the late Civilian Conservation Corps members highlights the review, which is illustrated with a number of interesting photographs of the various chambers.

"As a result of her literary efforts, Dale White has drawn attention of American scientists to one of Montana's finest natural treasures."

☞ Back in November last year, Sam H. Allen gave talks on the Society and its activities before the Steubenville (Ohio) Toastmasters Club, and Foremen's Club of the Hoppers Company—"Ducky" Thompson accompanying the latter with his slides.

☞ *Science News Letter* (1/2/44): "A flashlight which can be held in the mouth leaving both hands free has recently been patented." Send 2c stamp for Gadget Bulletin 136.

Reprints . . .

THE PALEONTOLOGICAL EXPLORATION OF CAVES*

The paleontological exploration of caves has received systematic attention only in California and western Nevada where, for many years, interest has been continued as the result of the activities of Merriam, Furlong, and Sinclair. In the areas studied by these geologists attention has simultaneously been given to the erosional history, to the relations between the physio-

---

Ed. Note.—On June 1, 1926, Dr. David White sent a memorandum entitled, "The Paleontological Exploration of Caves," to some two hundred of the leading geologists in the United States and Canada. He urged a more systematic exploration of cave earths as an integral part of the problem of working out the history of land animals and plants of the North American continent from the late Tertiary to the present day. He sought information regarding the changes and disappearances and introductions of land animals and land plants of North America since the Pliocene. The immediate origin of our existing land floras and faunas, including man, is an exceedingly important chapter in the history of life on the globe and one that unfortunately has received little attention in this country.*

Dr. White suggested that field geologists and engineers take part at least in the preliminary work of cave exploration and cause of cave deposits, give the location of caves that appear to be favorably situated or offer encouraging features, and possibly even prospect the deposits of some of the caves.

The file of correspondence in response to Dr. White's memorandum contains a great many reports from geologists and other scientists. These reports represent the entire United States and parts of Canada. They give the location of many caves of special scientific interest to the National Speleological Society in the fields of geology, paleontology, archeology, and biology. References are made to specific caves in the Washington area, namely, in Maryland, Virginia, West Virginia, and Pennsylvania. The letters embrace the years 1924-26. A more detailed report of their contents will be published later.—Floyd Barloga.

---

graphic stages and sedimentation, and, of course, to the fossil vertebrates found in cave deposits. The work has been both stimulating and profitable and the discoveries have been of great paleontological importance. However, in other regions of the country very little attention has for a generation been given to the exploration of cave earths. A number of accidental discoveries have been made sporadically. The brilliant results of occasional early exploration in the Eastern States seem to have been forgotten by geologists, and there appears

to have been no systematic exploration of cave deposits, except a little prospecting by Professor Arthur M. Miller, of the University of Kentucky. Without financial backing he partially exploited the earths in several caves, being almost invariably successful in finding vertebrate remains.

The deficiency—almost a void—in cave exploration except on the Pacific slope is the more remarkable in view of the brilliant results of such exploration in southwestern Europe, where, stimulated by discoveries of fossil man, the systematic search of caves has gone forward with great ardor and with enlightened interest in human pre-history.

Barring the possible absence of pre-Indian man, American caves should not be less rich in vertebrate remains than the caves of the Old World, and the work of Merriam and his associates proves this to be true. In this country, especially in the Mississippi valley and Appalachian regions, limestones are in general widespread in outcrops and penetrated by thousands of caverns, the bottom earths of very few of which have ever been examined by a competent eye. The search for saltpeter for the use of the Confederate Army during the Civil War led to a few interesting discoveries, the most notable of which were those in the Big Bone Cave near Elroy, in northern Tennessee, but generally there was at hand neither the attitude of mind nor the training necessary for the intelligent recognition of the bones shoveled over by the diggers. When extending the Western Maryland Railway through a limestone ridge near Cumberland a few years ago, the workmen cut into the earth filling a chamber beneath an old sinkhole. The bones found there were supposed to represent buried live stock, and carloads of the earth were hauled away for filling beneath the new railroad bed. It was the final observation of some strikingly curious specimens that attracted the notice of an engineer and led to the collection of skulls and other remains by Dr. J. W. Gidley, of the National Museum.

The remains of extinct vertebrate animals which Doctor Gidley was able to salvage included an eland very closely resembling the species now living in Africa, a crocodile, five extinct peccaries, a tapir, a mastodon, an extinct bear, and a horse. In all, about thirty extinct species, including many of less sensational interest than those just mentioned, have been described from this deposit. This association of animals, falling into a sinkhole scarcely one hundred and thirty-five miles from the National Capital, is of striking significance as to the geographic distribution of vertebrates at that presumably early Pleistocene moment, and as to the climatic conditions then prevailing.

Among several widely separated caves from which important animal remains have been recovered, mention may be made of the Crystal Hill cave, 5 or 6 miles north of the Wisconsin glacial moraine, near Stroudsburg, Pa., where 28 species of vertebrates were found; the Port Kennedy cave, in Montgomery County, Pa., from which Leidy, Cope, and others described four species of giant sloth, two horses, a tapir represented by numerous specimens, three peccaries, a mastodon, five cats, including two species of "saber-tooths," and a bear (Arctotherium) larger than the grizzly, in a total of 54 mammals, 41 of which are now extinct; Cavetown, in western Maryland, where, among 22 species of vertebrates, including two horses, several peccaries and one saber-tooth tiger, 12 species are extinct; a sink near Ivanhoe, on New River, Virginia, from which Cope, in 1868, described 24 species, nine of which, including a Giant Sloth, a horse, and a tapir are extinct; limestone crevices near Rogersville, Tenn.,[1] in which a mastodon, a horse, and a peccary were found; Lookout Mountain, below Chattanooga, Tenn., where a giant sloth, a fossil tapir, and other vertebrates were found in deposits, one layer of which included remains of fossil vertebrates mingled with potsherds and hornstone chips, and bones cracked for their marrow—all of which raises the question as to whether human relics had later been worked into one of the bone-bearing layers, or vice versa, or whether possibly man, tapir, and giant sloth lived together in this region at a time referred by Dr. O. P. Hay, on the basis of the fossil vertebrates, to the Sangamon stage; the Big Bone cave in Van Buren County, near Elroy, Tenn., where the air was so dry that cartilages and horny sheaths of claws are preserved in a remarkable deposit of very late, probably post-Wisconsin, age; the deposit, over 25 feet deep, in a limestone fissure near Willcockson, in the Ozark region of Arkansas, where thousands of bones, skulls, and teeth of fossil musk ox, fossil horse and other animals, in all referred to 52 different species, 24 of which are no longer living, were found; and the discoveries of bones of elephants, giant sloths, camels, etc., in caves cut in limestones in the upper Mississippi Valley.[2] Mention should be made also of the Bulverde, Tex., cave, where elephant, mastodon and "sabre-tooth" remains were found, and, in particular, of the Potter Creek cave, in Shasta County, Calif., where Merriam, Sinclair and Furlong found forty-four species of mammals, including

[1] In 1918 T. L. Bailey located and described more than 100 caves of considerable size in this State. See Resources of Tennessee, Vol 8, 1918, pp. 85-142.

[2] A review of all published discoveries of fossil vertebrate remains in deposits of Pleistocene age east of the Rocky Mountains, by O. P. Hay, will be found in publications of the Carnegie Institution of Washington, Nos. 322 (1923) and 322-A (1924).

an *Arctotherium* larger than the living Kadiak bear, another fossil bear, the gigantic "dire" wolf, two cats, a large ground sloth, two kinds of giant sloth, a camel, a bison, a *Euceratherium* related to the muskox, a peccary, two horses, a mammoth, and an elephant.[3]

There must be scores—probably many hundreds—of caves in the Appalachian region containing animal remains not less interesting than those found near Cumberland, a part only of which were ever recovered. Further, it is reasonable to expect that equally interesting remains of vertebrates, and possibly of man, are to be found in the Ozark Mountains of southern Missouri and northern Arkansas and in the limestone mountain regions much farther to the south and to the west. The caves of the latter regions have been given even less attention by the geologist and paleontologist than have those of Pennsylvania, Virginia, or Tennessee. In proceeding toward the Southwest, we are going farther from the areas invaded by the great Pleistocene ice sheets, but we are likely to find not less interesting evidence of animal migration and climatic changes during relatively recent geologic time. In the Southwest we should find buried remains of animals along the routes of migration between South America, Central America and North America and northeastern Asia. Here, too, if other men antedated the North American Indian on this continent, as the writer believes, we may hope to find their remains. In the caves of this region we may find the precursors of the Maya people, or perhaps still earlier migrants from Eurasia.

The southeastern region of the United States can not fail to furnish a rich store of information as to the animals living in eastern America before or between the cold intervals of the Glacial Epoch. They should tell stories of the disappearance of animals driven to extinction by the ice sheet invasions of the Northeast. Was not man present in America before the disappearance of the horse, the camel, or the elephant from this continent? The debated indications of such contemporaneity found in certain gravels and alluvial deposits may find incontestable confirmation in the earth flooring of some of our caves.

In the Southwest we should also gain invaluable information relating to Pleistocene and Recent climatic changes—rainfall and temperature—conditioning the vegetation and habitability or greater aridity of regions now relatively arid, if not actually desert. We should gather most important chronologic data from the associated vertebrates. The paleontological results should bear directly on the ages of peneplains and benches.

Without going into a detailed discussion of caves, the geologist may be merely reminded that caves are to be viewed as belonging to three somewhat distinct groups: (1) Shelter caves with overhanging roofs. Beneath these may be found bones of man and other animals, generally of very late date. Prospecting by Professor Miller in Kentucky shows that most such caves, if relatively large and well located with reference to streams and attractive country, contain human remains. (2) Caves of refuge or accessible chambers within the rock itself. These are perhaps less apt to contain vertebrate remains unless well located, but they may reveal material of greater interest, and the bones are rather likely to be of greater antiquity. Pictures may be present if the caves were ever inhabited by man. Some caves of refuge have afforded very important material. (3) Trap caves—that is, chambers and channels beneath sinkholes. The deposits in these caves are fairly certain to contain fossil bones, which in some cases may date back to latest Tertiary or even earlier times.

The antiquity of caves must, of course, vary greatly. No one is so competent as the geologist or the physiographer to evaluate this question, for he is best qualified to consider the cave with reference to terraces, peneplains, or the physiographic cycles in general, and especially with reference to the existing water table. Caves at or near water level and now the sources of streams are, other things being equal, not likely to be so old as those higher up and they are not so apt to contain thick deposits of earth or carbonate formations. Caves well above water, especially those on ancient peneplains or terraces, are more likely to have thick deposits of cave earth, relatively greater antiquity, and richer deposits of carbonate in the form of stalactites and stalagmites. If such caves are dry, without evidence

[3] For a list of Potter Cave mammals see J. C. Merriam and Chester Stock, in No. 347 (1925), p. 10, of the same series. (Footnote 2.)

Extract from memorandum to Editor: "Miss M. L. Johnson, Secretary of the Division, is turning over to you Dr. David White's file of correspondence on the paleontological exploration of caves. You will recall from our first conversation that this file is loaned to the Speleological Society for examination and study by its members and that the file of original material is to be returned to the Division of Geology of the National Research Council after this examination and study.

"Recently you and I talked over the telephone about the possibility of publishing Dr. White's mimeographed circular of June 1, 1926, entitled 'The Paleontological Exploration of Caves.' Miss Johnson and I agree with you that Dr. White's expressed intention not to publish the material on cave exploration arose from his belief that this material did not in itself constitute a scientific contribution but was useful solely as a means of stimulating interest in a neglected field of inquiry. Inasmuch as it is in precisely this spirit that you propose to publish the circular, I believe that due consideration can be given by a brief editorial from you stating Dr. White's original intention in preparing the circular and your purpose in publishing it at this time." (Sgd.) William W. Rubey, Chairmman, Division of Geology and Geography.

of recent depositions of calcite or other carbonates, it may be concluded that the cave is not only old, but that the water level has sunk or the stream has been diverted from it. Finally, cave systems which are partially eroded may be presumed to be ancient.

Sooner or later a more widespread interest in caves will develop and the attention of both naturalist and reader will be turned to the great store of unexplored material which for so many years has been lying dormant and neglected in this country. It is not unlikely that wealthy citizens interested in natural science may take part in bringing to light and placing in our museums some of the really extraordinary material relating to the latest stages in the evolution of some of our living animals, and bearing critically both on some most important questions of intercontinental connections and relations, as shown by animal distribution, and on the problems of climatic changes—all of which are of not less interest to man. Of the possibilities for and of the supreme interest in the discovery of Pleistocene or pre-Indian remains of man in this continent, nothing further need here be said.

It will fall to the geologist to examine the genetic features of the caves and determine the relations of the cave to the physiographic history of the region. He will formulate initial or tentative conclusions as to the age of the cave and the extent of its erosion.

Meanwhile, it is hoped that geologists and engineers will give attention to this neglected field. The intelligent investigator may have as good luck in locating rich deposits as the geologist. In many cases opportunity may be had for examination and even for some testing of the earths of the cave floors without physical danger, though many caves are dangerous to the inexperienced. In some cases prospecting will be impracticable if not impossible. The thorough exploration of these caves and the discoveries of importance should be turned over to experts. It should be left absolutely to the experienced paleontologist.

In any event, however, it is hoped that explorers will note the occurrence of caves, especially trap caves, by which is meant exposed cross sections of chambers beneath sinkholes, and well located caves of refuge. These caves may be more or less promising at the outset according to their situation with reference to topography, forage, water supply, fishing, game, accessibility, protection, etc.

Geologists and engineers may lead to invaluable finds if they only report the locations of caves that look promising or are said by farmers or hunters to contain bones. The Division of Geology and Geography in the National Research Council will welcome reliable information as to finds of fossil bones in caves, and it hopes to be able later to arrange for the exploration of some of the more encouraging locations, in the expectation that the results will be of such significance as to lead to the more systematic exploitation of caves in the same and in other regions. Our cave earths must conceal a wealth of critical and important knowledge of the most recent geological past, of which we should, at the earliest practicable date, take scientific possession.

David White, Chairman
Division of Geology and Geography
National Research Council,
June 1, 1926.

BOYS SAVED FROM 'TOMB'

SYRACUSE, N. Y., Sept. 27, 1943.—Trapped for 16 hours in a cave 60 feet underground, three Syracuse Boy Scouts were rescued today little the worse for their terrifying experience.

The boys, Raymond Solberg, 15; William McDonald, 14, and Leroy Appel, 15, who left the Boy Scout camp at Ram's Gulch, 10 miles east of Syracuse, yesterday for a hike into the Devil's Cage area.

Descending into one of the many deep fissures in the limestone of the area, the boys were trapped after dropping 10 feet down a sheer wall at the bottom of the fissure. They found themselves in a large cave.

State police, deputies and parents of the Scouts at the camp discovered them after an all-night search.

☞ Clay Perry lectured Nov. 30, 1943 at Berkshire Museum, Pittsfield, Mass. on "On the Trail of the Glaucus—Cave Crawling in Color." He has given the Museum its "first collection of cave formations collected from cave floors." His article in *Travel* (illustrated) containing "brief summary of the scientific angle of Society work, as well as human interest tales about New England caves," was called "The Last Frontier." He had one also in *View* (pictures mostly) in the Christmas 1943 number. He advises, read GRANDFATHER WAS QUEER, by Richardson Wright, for much cave folklore in the East—especially New England. *Esquire* sends us a promotion blurb: "'High Climber in a Hurry,' a short story by Clay Perry, well-known writer on outdoor subjects and a member of the N.S.S., appears in the February (1944) issue of *Esquire*."

Random Notes . . .

SCIENTIFIC

Note on Collecting Cave Flora

Inasmuch as a committee on cave flora has recently been authorized by the Board of Governors of the Society* it would seem appropriate at this time to suggest some methods of collecting and preserving cave plants.

The brief references to cave flora found in the literature would indicate that the underground flora may contain representatives of each of the four major groups of plants, namely Thallophytes, Bryophytes, Pteridophytes and Spermatophytes. Each of these groups presents a special problem in collection. In the first group are the Bacteria, Algae and Fungi. You will probably not see bacteria and for the time being it would be best to disregard them. Algae should be collected in screw-top vials of water, preferably the water in which they are found growing. Fungi will be the plants most commonly encountered in caves, especially in zones of total darkness. The fleshy fruiting bodies of many fungi such as mushrooms, shelf fungi, coral fungi, etc. should be collected in vials or bottles of weak 5% formaldehyde solution. Woody specimens which will not dry out too much may be collected in boxes or other similar containers. Filimentous fungi—that is, the mold-like forms —should be scraped into sterile screw-top vials.

The Bryophytes contain the liverworts and mosses. These are most likely to be found near cave entrances and in the zone of partial darkness. Liverworts are usually quite succulent and should be collected in screw-top vials or bottles of weak 5% formaldehyde solution. Mosses will revive sufficiently to be recognized even after having dried out, so they may be collected in match boxes or other similar small wooden or cardboard boxes. When possible collect a small clump of the moss including the organic material upon which it is growing.

The ferns and their allies are included in the Pteridophytes. These too will most likely be found near the entrance and in the areas of partial darkness. Probably the best way to collect these plants is to spread the fronds out flat between the pages of a note book if the plants are small enough. Larger plants may be brought out of the cave and spread out between folded newspapers or pages of an old mail-order catalogue to dry. When the plants are abundant collect the whole plant, roots and all. Where only a few are present collect only a single frond. Be sure to collect a frond that has the brown fruiting bodies on the under sides or margins of the fronds whenever they are present.

The last group, the Spermatophytes, contains the seed plants. Whenever possible the whole plant should be collected; when this is not possible collect a part or branch of the plant with several of the leaves. These specimens will probably be quite succulent and fragile, so for the time being it would seem best to preserve them in a 5% formaldehyde or a 30% alcohol solution.

All of these suggestions are merely suggestions and will probably be modified as we become more familiar with plant life in caves. Be sure to include a complete label with your specimens giving location of cave, location in cave and name of the collector. Also include any notes of interest about the specimen, such as its abundance; and, since preserving solutions remove color, be sure to note any color which may be present in the specimen when collected.

C. E. Cox

"Condensation" Rooms in Caves

The existence of a condensation room was first noted in Blow Hole cave at Teterton, West Virginia. Just beyond the narrow entrance a sharp change in temperature was felt. Investigation lead to the discovery that the walls and ceiling of this room were covered with drops of condensed water. Lack of a thermometer made an accurate check of this observation impossible.

Since that time several other condensation rooms have been noted, but not checked. The first opportunity for an accurate investigation of the phenomenon occurred on a recent Society trip into the cave region around Blacksburg, Virginia. On entering the first room of New River Fault cave a slight drop in temperature was felt. As this change in temperature was to be expected upon entering a cave no note was made of the matter.

Farther back in the cave the party split in order to investigate the upper and lower levels, and it happened

---

*An outline of the setup of a committee on cave fauna would be as follows:

Purpose—To collect, identify, record and catalogue the plant life of caves, to make this information available to the membership of the Society and to give annual reports on the progress of such work.

Members—Any member of the National Speleological Society interested in specializing in Botany. It is recommended that the committee be composed of a chairman and one member each for the four classes of plants; the spermatophytes (flowering plants), the pteridophytes (the ferns and their allies), the bryophytes (mosses and their allies), and the thallophytes (fungi and allies).

Proposed duties

1. To identify and catalogue material obtained by members of the National Speleological Society.
2. To publish records periodically in the BULLETIN of the National Speleological Society.
3. To peruse literature for previous records.
4. To prepare formal progress reports, to be given at the Annual Meeting of the National Speleological Society.

that James A. Fowler and the author were the first to return to the entrance. Upon noting a drop in temperature in the first room we decided to take readings of the outside and inside temperatures.. It was found that the cave air was 52° F., the outside air was 53° F. and the air in the first room or condensation room was 51° F. These readings establish the fact that some caves, at least, have condensation rooms. It is believed that only caves with a definite room just inside a small entrance will be found to have this feature.

Other than the two instances given above the same phenomenon has been noted in Twiggtown Cave, John Friend's Cave, and Needy's Cave. M. H. Muma

Interesting Report to Dr. A. C. Burrill

In excavating in Lovelock Cave, Nevada, we dug through the bat manure, rat manure, straw, sticks, and wind-blown dust to obtain specimens left by Indians. In strata of these materials there are bones of coyote, skunk, or other recent carnivora that have died in the cave, and also the bones of their victims. There are no extinct animals whatever, counting the American antelope as not being extinct, although no longer living in the region. There are no lime incrustations whatever as occur in caves of some regions. The cave and materials are so dry that a respirator has to be constantly used. We dug down to what is for our purpose "bedrock." This is a pure white powder that reacts violently to acid, undoubtedly lime dust that became air slacked and fell from the roof of the cave before the time of man's arrival.

Because of my interest in the cave, I have wished that geologists might dig into this powder and beyond into the talus. As indicated on Plate 3B and page 30 of my publication "Lovelock Cave," there is probably 30 or 40 or 50 feet depth of this talus above the Dendritic Terrace, which was the shore of Lake Lahontan several 100,000 years ago. This terrace level is 320 feet above the present level of Pyramid Lake. Theoretically much of this talus would be deposited in a very short period of time some 25,000 or 30,000 years ago when the Sierra ice cap suddenly melted and flooded the Lahontan Basis to a level of 530 feet above the present level of Pyramid Lake. There would be some deposit of talus since the ancient lake dried up to a level below the cave. In this more recent period carnivora would make the cave a dwelling place in which to die, as well as a banquet hall in which to leave the bones of their victims.

If paleontologists should work the cave at levels below the strata of white lime powder, they would have to transport the materials entirely out of the cave as there is little room to shovel material to one side. I am afraid that the expense would be prohibitive; that the faunal remains would be too meager for any great degree of satisfaction; that these remains would be mainly recent species; and if by chance bones of ground sloth, camel, or other extinct animal turned up, it would be impossible to fix their date with any reference to the time of arrival of man in the region.

There are innumerable caves and rock shelters around the hundreds of miles of shore of the ancient lake when it was at the Dendritic Terrace level. These caves are simply the under-cutting of the cliffs by the waves of the ancient lake. Later debris fallen in front of the cliff formed the cave behind. What I have written about Lovelock Cave would apply pretty much to all of them, as well as to caves on the shores of Lake Bonneville.

Besides my own work in 1912 and 1924, various students have done considerable exploratory and excavation work in the Lahontan Basin and at Wendover on the the Nevada line. You undoubtedly know of the work of M. R. Harrington at caves in the region of Baker, Nevada, near the Utah line.

An entirely different type of cave is the wet or stelagmitic caves. One is located near Auburn 35 miles northeast of Sacramento.. We have in our series, *American Archaeology and Ethnology*, a report by W. J. Sinclair on fossil remains in Potter Creek Cave, in Shasta County, 18 or 20 miles NNE of Redding (see vol. 2 No. 1).

L. L. Loud, Univ. of California,
Mus. of Anthropology, Berkeley 4, Calif.

Stone to Burrill on Fossils

The Helderberg limestone is basal Devonian and the Loyalhanna limestone is Mississippian, correlated with Ste. Genevieve or upper Meramec.

As I know of only one cave near Carlisle, it would seem that the "Carlisle Bone Cave" must be the one that I called Conodoquinet Cave. Furthermore, human bones are reported to have been found in the cave I described. A detailed manuscript map of the area shows that this cave is in the Chambersburg limestone. It lies above the Beekmantown limestone and is the uppermost member of the Trenton group of Ordovician age.

In descending stratigraphic order the bone caves are:

Loyalhanna limestone	Barton, Dulany
Helderberg limestone	Dales, Frankstown, Nareh New Paris, Wonderland
Trenton limestone	Historic Indian, Woodwar
Conestoga limestone	Refton
Beekmantown (?) limestone	Port Kennedy

The Loyalhanna is Mississippian; Helderberg, basal Devonian; Trenton and Chambersburg, Middle Ordovician; Conestoga, Lower Ordovician; Beekmantown, basal Ordovician.

As for fossils in the bedrock, I recall only a coral reef in Wonderland Caverns, Bedford County. The reason for scarcity is that the Loyalhanna limestone is a very cross bedded sandstone cemented with lime, and I believe almost devoid of fossils. The Ordovician limestones are sparsely fossiliferous. The Helderberg is good hunting ground for brachiopods and trilobites; however, perhaps because of poor illumination, they are rarely observed in caves. I do not know that anyone has searched for fossils in the walls of Pennsylvania caves.

R. W. Stone,
Harrisburg, Pa. (1943)

"Bat Egg" from Clover Hollow

You recently expressed interest in a report on a "bat egg" brought to me by a group of students. This curious formation was reported from Clover Hollow Cave on a trip in July 1943. One group had entered the cave Saturday afternoon and spent the night there. I arrived on Sunday. Those who returned from the greater depths reported finding a bat incased in an egg shaped clay covering about an eighth of an inch thick. This clay case was said to have been smooth outside and in. When it was broken open a live bat, which I judge to have been a pipistrelle, was found inside. The bat eventually flew away. On a later trip down into that region I was shown a ball of clay which had been molded by hand and was told that this was the remains of the above case, which had thus been destroyed.

I have endeavored to check on the veracity of this report in every way possible but have found the boys to be consistant with one another whether reporting together or separately. No evidence of falsification has been observed. I would like to inquire if you have ever heard of a similar report and if so, something of the circumstances. As far as I am aware this is a completely unusual behavior for bats and certainly under ordinary circumstances the report would not be credited.

H. W. Jackson, Asst. Prof. of Biology,
Virginia Polytechnic Institute, Blacksburg, Va. (1943)

Fossils from Blowing and Nearby Caves

Certain fossils I spoke of before compare almost exactly with the ones at the end of Blowing Cave, but are found in much drier caves. These smaller caves are three or four hundred feet east of Blowing Cave, and are about twenty feet above the Three Sisters. These caves seem to connect with each other and I imagine they originally connected with Blowing Cave.

I noticed that the air currents in Blowing Cave die down when the air is cool outside, and that the stream inside is somewhat warmer than the Cowpasture River. It might be interesting to you to know that part of the Cowpasture disappears at a point about a mile below the cave, and comes out some three miles below at Nimrod Hall. A bottle thrown in the current will disappear and come out at Nimrod Hall. I imagine all of those hills paralleling the river are honeycombed with caves.

Briscoe B. Guy,
University, Va.

Lessons in Fluorescence and Cave Climate

There has been forwarded to me a polished section of a cave formation which was sent by you, as coming from Eagle Cave in Wisconsin. It will be placed in our Speleological Society collection and will be Number 1 in that collection.

This specimen is made up of a core about 2 inches in diameter, surrounded by concentric bands ½ inch or more in total width. The inner portion is almost colorless, while the band portion has some thin yellowish bands which alternate with bands of lighter colored materials.

In this polished specimen I am unable to determine with certainty the mineralogical composition. I think, however, that the interior portion is calcite, while the banded outer portion is aragonite. It is probable that the outer part of the inner portion is aragonite, while the inner portion is calcite.

Calcium carbonate cave deposits often show fluorescence and, less commonly, phosphorescence. I have tested your specimen under a 250-watt G.E. Purple X lamp, and also under a battery of eight 2-watt argon glow lamps. The former is much the most powerful and naturally shows stronger results. Aside from the quantitative effect there is probably little difference in the fluorescent effects of the two lights but still probably some. The purple-X light causes a deep reddish purple to all non-fluorescent materials. Any other color is to be considered as a fluorescent effect. The argon lights in contrast with the other are more definitely purple without much red and the colors given to non-fluorescent materials by this light have only a faint purple tinge.

Under the purple-X light, the center shows a rather delicate opalescent green shade. The inner portion of the banded portion shows a reddish color by the purple-X light, while the outer portion of the band shows a bright

yellowish green. Phosphorescence persists distinctly for about a second, after the light is cut off, and fades out completely at the end of two seconds. It has most prominence in the outer green bands.

Under the argon battery the fluorescence is similar but less prominent; and the green, shown up so conspicuously under the purple-X light, is seen only faintly.

Your letter has been referred to me in the matter of cave temperatures and onyx, also. I do not know much about cave temperatures; but I can offer these general suggestions, and I hope that in them lies the answer to your question.

Below a certain depth, which is usually about 50 feet, the temperature within the earth increases more or less regularly and the rate of increase is roughly 1° F. for about 90′ in depth. For the upper levels of the earth down to a certain depth, which I have assumed is 50 feet, the earth's temperature varies with the seasons.

Under the conditions outlined above, there is necessarily a depth at which there is no seasonal change. The temperature at that depth will be the average annual temperature of that locality.

In mines with two openings, one considerably above the other, if there is a continuous passage between, there will be a natural circulation. At one season of the year circulation will be in one direction, and at another season the circulation will be reversed. I suspect that the seasonal change of temperature in your case is due to this same reversal of circulation mentioned above, or some modification of this general idea. Possibly the 41° temperature represents the earth's temperature a little modified by surface air temperature. The 50° temperature represents a modification of these natural cave temperatures caused by the entrance of outside air. I suggest that you check the circulation directions in different parts of the cave at different seasons of the year. This can easily be done by means of a little smoke.

I might make the following comment about your inquiry about onyx. Your banded materials are properly called Mexican onyx. Various other names are given, but Mexican onyx is the name generally given to well-banded material.

I presume that all of your cave deposits are chemically calcium carbonate. Onyx without the Mexican restriction is not calcium carbonate but silica. Mineralogically it is chalcedony. Banded chalcedony is onyx. The banding is usually black and white, or red and some other color. Onyx is the material from which cameos are cut. It seems to me very probable that you have no true onyx and that all of your material is Mexican onyx. Dr. R. J. Holden (1942)

Committee Reports

REPORT OF THE COMMITTEE ON PROGRAMS AND ACTIVITIES

By James H. Benn, Chairman

During 1943, attempts were made with some success to place before the public educational features of our society, by sponsoring popular lectures setting forth the recreational, economic, and scientific values to be realized from the study of caves. For that reason the chairman of your committee accepted an invitation to give a talk on Cave Minerals before the District of Columbia Mineralogical Society on November 20th, 1942. He also, for this same reason, consented to talk on Cave Formations to Sigma Gamma Epsilon, Geological Fraternity of the George Washington University, on December 12th of last year. At both of these lectures the activities of your society was given a prominent place.

On February 7th, 1943 the lecture room of the United States National Museum in Washington was obtained for a meeting of your Board of Governors. At this meeting your Chairman on Programs and Activities was honored by a formal invitation to this chair, the duties of which he had been performing unofficially for several months prior. One other business meeting was held later in the Spring.

The most outstanding lecture of the year was the illustrated talk by Mr. Earl Trager, formerly with the United States National Parks Service, given on March 14th, 1943 in the National Museum at Washington. His subject was, "Caves of our National Parks and Monuments." Having explored many of these caves in person, Mr. Trager was well qualified to talk on the subject, and his lantern-slide illustrations were excellent. Invitations to attend this meeting were sent to the National Capitol Council of the Boy Scouts of America, the District of Columbia Mineralogical Society, Sigma Gamma Epsilon, and a general invitation was extended to the public through the newspapers. This manner of publicity resulted in a splendid turnout at the lecture.

In September of this year an invitation was received from Mr. B. H. Thompson of Harrisonburg, Virginia, to visit caves in this vicinity. Other regions of interest for future activity and investigation by this society are the gypsum caves in the Red Beds of Oklahoma. A verbal report of this region was given to your chairman by William Salter of the United States Geological Survey. In general it is as follows: at Freedom, Oklahoma, a gypsum cave of fair size has been commercialized; its

walls and ceilings are decorated with large platy selenite crystals which are further glorified by the use of artificial lighting. The name of the owner could not be recalled.

More of these caves in an undeveloped state are to be found at Colony, Corn, and near Fairview, Oklahoma. Some of them are decorated with rosettes of gypsum impregnated with iron, which gives to these forms a delicate pinkish color. Groups of radiated clear selenite crystals are not uncommon.

In Salt Creek Canyon, near Southard, Oklahoma there is also evidence of caves in the vast gypsum deposits. And, too, this Canyon is the old home of the famous Indian Chief, Black Kettle, and the scene of rattlesnake hunts every Spring by the Indians still living in the area. This bit of historical background should add zest to the activities of the would-be explorer.

The whole region of caves in the Red Beds of Oklahoma is an area of considerable extent, covering portions of Wachita, Woods, Major, Blaine, Caddo, Custer and Dewey Counties. Comparatively few of the caves have been explored and being in ancient Indain territory should prove a rich field for the cave investigator and the collector of Indian artifacts alike. Many of the caves are inhabited by bats but so far as could be ascertained, no systematic study of the cave life has been made. Your Committee is at present trying to obtain more detailed information on the region.

The Committee on Programs and Activities of the National Speleological Society is composed of five members including the chairman. However it is the desire of this committee eventually to have a member in each grotto to act as representative of the National Committee in furthering efficient cooperation between it and the Local Committees on Programs and Activities. With our country at war, making necessary all the individual sacrifices that go to insure victory, your National Committee aims to continue sponsoring lectures of educational value and to carry on its activity of encouraging speleological investigation.

REPORT OF THE COMMITTEE ON FOLKLORE

By Clay Perry, Chairman

About the most interesting bit of folklore about a cave to come to the attention of this committee lately is contained in a letter from D. C. Robinson, Knox Cave, Altamont, N. Y. Mr. Robinson writes:

"This story has come to our attention. Sixty-three years ago the man who told it to me, helped his father draw a large boulder to close the mouth of a cave. The owner of the cave could not keep people off his property or from going through his crops. This man told us that he went into the cave which was extensive. The only thing that made a lasting impression on him was the first large room. On the floor of this room partly covered with clay, he counted 12 human skulls and a number of skulls of cows. These cows were not like any he had seen, as the horns were about twice the ordinary size next the head. The walls of the room were covered with pictures and writing he could not read, cut or scratched in the rock.

"There is some evidence to support his story, not much . . ."

Mr. Robinson frankly states he wrote me as he expects to rent the cave and reopen it to the public and hopes I can give him some publicity after the war, etc., so he can give jobs to some men.

I have written him that the New England Spelunkers' Grotto, No. I, should have first crack at this cave, to explore it and publicize it.

That is a grand idea—collecting the folklore of caves; but do you know what a whale of a job that is going to be? I know you can guess. I took about three years digging up what I got on New England caves, and there is more of it uncollected and unpublished. But it is also a fascinating subject and might lead to something very wonderful. I know that my own experience proved a grand surprise—but I had a wonderful start, with a big box of notes, photos, clippings, and books loaned me by Roger Johnson, the original New England cave man (Springfield) whom, I note, you have suggested for my committee. A fine choice, indeed. Another member I'd like to add or substitute, is Russell Trall Neville, "The Cave Man" of Kewanee, Ill., who has collected more stuff about American caves than any other man and some of whose manuscript I have read, as he was preparing it for possible publication.

In this connection, I suggest also that some overtures should be made to him toward helping him publish this, after you get the other one done and on the market. If the Society would sponsor his book, later on, it would be a grand thing. Indeed, I do not believe anyone has so much material to work on and with, for he has, as you knew, traveled the entire country for over 25 years, actually cave-crawling for over 5000 miles and traveling overground over 25,000 miles, taking over 5000 photos in caves.

You will be interested to know of a recent result of my spelunking that appeared in print, a short story entitled "Guides With Wings," published in *Boys' Life*, February issue, 1943. Also a small personal experience

article will soon be out in *Short Stories* magazine, "Life's Worst Moment," another cave-inspired tale.

Clay Perry

REPORT OF THE COMMITTEE ON MINERALOGY AND FORMATIONS

By Dr. R. J. Holden, Chairman

The work of the committee has been limited to correspondence. James Benn and Alfred Hawkins have accepted membership on the committee and are cooperating.

The writer personally has contributed to Dr. Muma's glossary. The committee has considered certain formation names, one of which is entirely new: "shillelagh." The use of this term has been approved by all members of the committee. Formerly the term "knob" was used by the writer, but was unsatisfactory. We had some hesitancy in submitting a wholly new word. It was only after various terms had been considered through some weeks that this term seemed most appropriate of all that were suggested.

Another term approved by the committee is "palisade." For this writer had previously used the term "fresco," but the standardized use of fresco is such that it does not apply to the phenomena which we are attempting to describe. Its deficiency is chiefly lack of relief. The term which indicates more relief is "bas-relief." The customary use of this term does not indicate the relief which is characteristic of the structure which we are trying to describe. It appeared that the term palisade had been prevouisly used to describe this phenomena. However, this use was unknown to the writer at the time he proposed this term, and we now propose it to cover vertical half of stalactitelike forms which sometimes coat vertical cave surfaces. This term seems to meet the approval of all three members of the committee. We realize that a broader knowledge of this phenomena is desirable and we invite contributions to the variety of phenomena which should be included in this term.

The term "helictite" was considered by the committee and continuation of its use was approved. Since this term has been used to include various phenomena, including shillelagh, we realize that there may be some objection to our ideas.

Our conception of the distinctions between dripstone, helictite, and shillelagh are on a genetic basis, dripstone being formed under the influence of gravity, shillelagh and helictite in defiance of gravity, and controlled by the superior effects respectively of capillarity and the force of crystallization.

REPORT OF THE COMMITTEE ON EXPLORATIONS

By Erwin W. Bischoff, Chairman

It seems that the war will seriously curtail the activities of your chairman of exploration, as I am going into the armed services. I have been expecting this for some time—so it is no surprise. I am hoping that during my travels while in the military service I will have an opportunity to visit some new caves. If so, I will make notes and send them on to you.

Meanwhile, my wife has my files and other notes. She will be glad to furnish any information you may want. She has also taken over the task of finishing the compilation of cave information on Washington and Texas. This will be forwarded to you when completed.

I have not been able to find time to put out another committee bulletin, but have had some excellent results from my last one. Letters from Clyde Malott, L. E. Ward, V. P. I., and others—have provided me with some valuable and interesting information.

At present, I am endeavoring to compile a list of caves and locations in Texas—and have secured fine cooperation from Mr. Galloway, Mgr. of the Longhorn Caverns; Dr. A. H. Deen of the University of Texas; and several others. I hope to send you this list in the very near future.

It was rather fortunate that I had done some preliminary research on Texas caves, as my lot in the Army has been to be sent to this state. I have completed a list of Texas caves and locations, made from references and the results of mail inquiries, which I intended to send you. But now that I am actually *in* this state, I hope to visit some of the caves and secure some on-the-spot information to add to and round out the list.

This may be a good time to let you know some of the results of my correspondence as chairman of the Exploration Committee:

In answer to my call for information on the Sloan's Valley cavern system, Clyde Malott of Indiana University replied with a copy of an abstract presented by him before the Indiana Academy of Sciences, entitled "An Unusual Case of Unified Cavern Drainage," which describes the cave and explains its formation in great detail. He also enclosed a photostat map of the entire cave system. His letter also discussed his theories of cave formation as opposed to those of W. M. Davis. All in all, the abstract and his letter were the most informative and interesting pieces of speleological writing I have ever read. Perhaps we could persuade Professor Malott to allow us to reprint the abstract (and letter) in our society BULLETIN.

Earl Beardsley, before his entry into the armed service, sent me reports on visits to Blowhole Cave and Snively's Cave.

Willis Nelson has just sent me reports and sketch maps of the following Montana caves: Garrity, Rams Horn, chasm in the Snowies, Lick Creek, Woodward's, Spring Hill, Shell Creek, Chestnut, and also of the Hell's Half Acre section of Morrison Cave.

There was much other correspondence, but no other actual cave information.

The Army is keeping me moving about quite a bit—but I hope to have time to look into Longhorn Cavern, Austin Cavern, and possibly Boerne. I will send you reports on these—if and when.

REPORT OF THE COMMITTEE ON ARCHEOLOGY

By Floyd Barloga, Chairman

Dr. & Mrs. Martin Muma of 4504 Guilford Road, College Park, Maryland, have submitted some very interesting study material to the Chairman of the Archeology Committee.

On July 4 and September 12, 1943, Dr. Muma collected the specimens listed below in a large refuge cave known as Sand Cave in Garrett County, near Loch Lynn, Maryland.

76 Flint chips
2 Flint flake knives
2 Flint chipped knives
3 Triangular flint arrow tips
1 Shouldered, square base, arrow head
2 Broken arrow points
1 Flint core
1 Bone pottery tool
1 Grit tempered pot sherd of red and blue clay
A number of small animal bones, many charred and burned, some broken for marrow.

On September 9, 1943, Dr. and Mrs. Muma collected a number of small, burned, bone fragments at the mouth of Beaver Run Cave, Baltimore Co., near Alesia, Maryland.

The letters following here, to and from Dr. Alexander Wetmore, U.S.N.M., are inserted as of archeological interest:

On a recent visit to Cudjo's Cave at Cumberland Gap, Va., we encountered evidence of prehistoric hearths which should be of interest to the Archeological section of the Museum. As we were leaving the cave, Mr. Holbrook, the manager, called my attention to ashes which underlay 2½ to 3 feet of flowstone and cave deposit. This stratum of ashes was discovered recently when he cut down the level of the floor in preparing a new exit from the cave. The point was not over 75 feet from the cave entrance, and well within the range of daylight. The area of the room at that point is quite extensive, and the portion of the stratum disturbed by the excavation was not over 4 or 5 feet in width.

So far as I am aware there have been no discoveries of hearths in caves in eastern U. S., and I believe this situation will well warrant extensive investigation. Our Society is not in a position to make such investigation and has no immediate plans for undertaking such work on its own. It believes that such finds should be referred to organizations which are experienced in this line. Mr. Holbrook states that he believes there would be no objection to excavating the remainder of the room where this stratum is located. This cave, situated at Cumberland Gap, one of the principal gateways to Kentucky, and the stratum being protected by more than two feet of consolidated material, together make for a situation having considerable promise archeologically.

Mr. Holbrook also stated that he knew of a cave in the immediate neighborhood owned by one Jim Howard in which he states are to be found Indian bones. These bones are reputedly little-disturbed, and many are supposed to be of giant size. Jim Howard has supposedly prohibited all disturbance of these bones up to the present time. Other caves in the area are also supposed to possess human remains. As we were pressed for time, it is regretted that at the time of our visit we were not able to contact Jim Howard personally and verify this report of giant bones.

Though you may not be in a position to make an investigation until after the war, I would recommend that an attempt be made at the earliest possible time, especially as regards to the giant bones which are not protected by any layer of cave deposit and which may conceivably be disturbed at any time. It would be appreciated if the Society could be kept informed of any work that you do in this matter, and the Society will be glad to help in any investigation which you may make in any way that it is able.

Your letter regarding your recent observations and findings concerning caves in the Cumberland Gap area is much appreciated.

The report of the prehistoric hearth in Cudjo's Cave indicates a site that is definitely worthy of examination. It is good that it has not been further disturbed since any excavation should be made by a trained archeologist in order that information available may not be misinterpreted or lost. We have some information on similar

hearths elsewhere in the East but, as you indicate, they have not been found frequently and merit careful study.

The report of the other cave containing bones is also highly attractive since there is a strong probability that there may be bones of extinct animals in addition to those of Indians if the site has not been disturbed.

During this period of war it is naturally not practicable for us to carry on investigations into matters of this nature. I am, however, putting this data where it will be available when peace comes again to us with the idea that we may be able to undertake a full exploration of these sites. The Cumberland Gap area is one that is highly interesting historically and that without question was used extensively by the Indians. I have learned recently that so much interest centers there that there is to be set aside a small park area in the region.

Your Archeology Committee would appreciate other reports of the habitation of caves and rock shelters by the American Indian for the Society's files and for further scientific study.

REPORT OF THE WORK OF THE COMMITTEE ON CAVE FAUNA

By James Fowler, Chairman

With the exception of new additions to the list of fauna collected from caves by The National Speleological Society and further additions to the list of the literature on North American cave fauna, the present report of the Fauna Committee comprises two reports received from its members.

The first of these reports is an original paper by Dr. Herbert W. Jackson of the Biology Department of Virginia Polytechnic Institute and is representative of the excellent work being conducted by this active Grotto of the Society. Of the species mentioned in this report, the records for the Cave Salamander, *Eurycea lucifuga*, are also being incorporated in a separate paper on the occurrence and distribution of this species in Virginia.

The second report is a reprint of a paper on cave snails by Leslie Hubricht, formerly associated with the Missouri Botanical Garden, St. Louis, Missouri, who has written a number of papers on cave fauna.

New Additions to the Cave Fauna List

Coleoptera

Neaphaenops tellkampfi Er.—10 specimens collected in Long Cave, Kentucky during the month of August, 1943. Det. by Dr. J. M. Valentine.

Amphibia

Order Caudata

Ambystoma jeffersonianum (Green).—1 specimen collected Hell Hole, Riverton, Pendleton Co., W. Va., July 21, 1940.

Plethodon cinereus (Green).—1 specimen collected November 12, 1938 in Rhea's Cave, 3 mi. north Millboro, Bath Co., Va.; 2 specimens collected October 30, 1943 in Showalter's Cave, near Lexington, Rockbridge Co., Va. in total darkness.

Eurycea bislineata bislineata (Green).—2 specimens collected January 19, 1941 at Skyline Caverns, Front Royal, Page Co., Va. by Dr. J. P. E. Morrison.

Eurycea longicauda longicauda (Green).—1 specimen collected May 12, 1940 in Silver Hill Caverns, 4 mi. south Newmarket, Shenandoah Co., Va.; 1 specimen collected September 20, 1941 in Spring Hill Cave, Lexington, Rockbridge Co., Va.; 1 specimen collected August 1, 1943 in Tolley's Cave, Va.

Eurycea lucifuga (Rafinesque).—1 specimen collected April 15, 1943 in Tony's Cave, Newport, Giles Co., Va.; 1 specimen collected May 9, 1943 in Canoe Cave, Newport, Giles Co., Va.; 2 specimens collected June 6, 1943 in Buck Hill Cave, Natural Bridge, Rockbridge Co., Va.; 2 adult, 1 juvenile, and 1 larval specimen collected October 30, 1943 also from Buck Hill Cave; and 2 specimens collected October 31, 1943 from Fish Hatchery Cave, near Newcastle, Craig Co., Va.

Of the specimens of *E. lucifuga* collected in Buck Hill Cave on October 30, 1943, the two adults and the larvae were collected in total darkness—the adults on the muddy floors and wet walls of the main passage and the larva in a deep pool in the main passage. The juvenile specimen was taken in the accumulation of leaf mold and other debris at the cave entrance.

In this same cave a single hatching salamander egg was found in a small pool fed by a trickle of water in a side passage. Since *E. lucifuga* was the only salamander observed in this cave there is a strong possibility that this may have been the egg of this species. This is of particular interest since the eggs of this species have not yet been described.

Order Salientia

Rana catesbeiana Shaw.—1 specimen collected August 4, 1940 in Showalter's Cave, Lexington, Rockbridge Co., Va.

Further Additions to the Literature on North American Cave Fauna

1938

*Dearolf, Kenneth. Molluscs and myriapods of some Pennsylvania caves. Proc. Pa. Acad. Sci. 12: 64-67.

Records of 12 species of gastropods, 6 species of millipeds, and 1 species of centipede from 37 caves mostly in the eastern and central part of Pennsylvania.

Hubricht, Leslie and J. G. Mackin. Records of distribution of species of isopods in Central and Southern United States, with descriptions of four new species of *Mancasellus* and *Asellus* (Asellota, Asellidae). Amer. Midl. Nat. 19(3): 628-637.

Of the species mentioned, 2 are from in or near caves as follows: *Asellus incisus* Van Name—spring, 300 yds. from entrance to Marvel Cave, Stone Co., Missouri; *A. brevicaudus* Forbes—Stemmler's Cave, 2 mi. s. Bluffside, St. Clair Co., and Morrison's Cave, 2 mi. s. Burksville, Monroe Co., Illinois.

Ives, J. D. Cave hibernation of mosquitos. Jour. Tenn. Acad. Sci. 13: 15-20.

1939

*Hyman, Libbie H. North American Triclad Turbellarians. X. Additional species of cave planarians. Trans. Amer. Micro. Soc., Vol. LVIII, No. 3, pp. 276-284.

Sphalloplana mohri n. sp.—largest of our cave planarians; Ezell's Cave, San Marcos, Texas.

Sorocelis americana Hyman—apart from one species in New Guinea, the genus *Sorocelis* is known from Asia only. Hence the finding of an American member of the genus is interesting. Collected from Bat Cave near Kansas, Oklahoma; Watson Cave near Prairie Grove, Arkansas.

*Loomis, H. F. The millipeds collected in Appalachian caves by Mr. Kenneth Dearolf. Bull. Mus. Comp. Zool., Vol. LXXXVI, No. 4, pp. 165-193.

Includes records of millipeds from 37 caves—8 in Pa., 1 in Md., 4 in Va., 8 in W. Va., 7 in Ky., 6 in Tenn., and 3 in Ga. The species reported include 13 considered as new; 2 new genera also described.

*Park, Orlando, W. C. Allee, and V. E. Shelford. A laboratory introduction to animal ecology and taxonomy. Univ. Chicago Press, pp. 272.

Pp. 117-126 are devoted to cave animals and include a unique "Key to the more common adult animals of Mammoth Cave and adjacent caves."

*Pearse, A. S. Animal Ecology. McGraw-Hill, N. Y., pp. 642.

Pp. 378-379 considers cave animals, food in caves, and ground waters; pp. 393-395, under the heading of "Caves," discusses Adjustments of animals to caves; Transient cave animals: trogloxenes and troglophiles; Permanent residents in caves: troglobites.

A Preliminary Check List of the Cave Fauna of Southwest Virginia

Dr. Herbert W. Jackson
Biology Department, Virginia Polytechnic Institute, Blacksburg, Virginia

The specimens mentioned in the list that follows are contained in the collection of the V.P.I. Grotto of The National Speleological Society.

Phylum Mollusca
Class Gastropoda

Fontigens sp: Tony's Cave, Newport, Virginia, 5-9-43, Det. J. P. E. Morrison. Collected from flowing stream.

Phylum Annelida
Class Oligochaeta

Earthworms. Tony's Cave, Newport, Virginia, 5-9-43; Clover Hollow Cave, Newport, Virginia, 8-15-43; Newcastle Murder Hole, Newcastle, Virginia, 5-30-43. Seem to belong to indigenous fauna of several caves.

Phylum Arthropoda
Class Crustacea

Cambarus sp: Mark Smith's Cave, Blacksburg, Virginia, 3-5-43; Two Mile Cave, Newcastle, Virginia, 5-30-43. Collected from stream.

Class Diplopoda

Pseudotremis sp: Smoke Hole, Newport, Virginia, 11-28-42. Det. A. F. Loomis. Collected from roof, deep in cave.

Class Insecta
Order Collembola
Family Entomobryidae

Springtails. New River Cave, Goodwins Ferry, Virginia, 7-18-43, Det. G. E. Glance. Collected from molasses trap.

Order Orthoptera

Ceutophilus gracilipes (Hald.) Mark Smith's Cave, Blacksburg, Virginia, 3-5-43. Det. H. K. Townes.

Hadenoecus putaneanus Scudd. Clover Hollow Cave, Newport, Virginia 5-9-43, 8-15-43. Det. H. K. Townes.

Order Diptera

Amoebaleria defessa (O.S.) Two Mile Cave, Newcastle, Virginia 5-30-43. Det. M. T. James. Clinging to walk and roof just beyond twilight zone.

Order Coleoptera

Pseudoanophthalmus gracilis Valentine. Clover Hollow Cave, Newport, Virginia 8-15-43. Det. J. M. Valentine. Collected from very deep in cave.

Pseudoanophthalmus punctatus Valentine. Clover Hollow Cave, Newport, Virginia, 8-15-43. Det. J. M. Valentine.

Class Arachnoidea

Nesticus tennesseensis Petrunkevitch. Fish Hatchery Cave, Newcastle, Virginia, 5-30-43. Det. W. J. Gertsch.

Phanetta subterranea Keyserling. Tony's Cave, Newport, Virginia, 5-9-43. Det. M. H. Muma.

Troglohypantes cavernicolous Keyserling. Clover Hollow Cave, Newport, Virginia, 8-15-43. Det. M. H. Muma.

Phylum Chordata
Class Amphibia

Desmognathus ochrophaeus Cope. Clover Hollow Cave, Newport, Virginia, 5-9-43. From splash pool at base of falls where stream enters cave.

Desmognathus phoca (Matthes) (same as above).

Plethodon wehrlei Fowler and Dunn. Nellie's Hole, Blacksburg, Virginia, 2-43. From leaves, etc. near entrance.

Plethodon glutinosus (Green). Small cave south of Newport, Virginia, 7-11-43. From leaves and detritus just within entrance.

Gyrinophilus p. porphyriticus (Green) Clover Hollow Cave, Newport, Virginia, 8-15-43. One larva, three adults collected from stream on third level down. Seemed to be indigenous.

Eurycea lucifuga Rafinesque. New River Cave, Goodwins Ferry, Virginia, 2-14-43; Luca's Cave, Newport, Virginia, 4-11-43; Tony's Cave, Newport, Virginia, 5-9-43; Smoke Hole Cave, Newport, Virginia, 5-9-43; Canoe Cave, Newport, Virginia, 4-15-43; Two Mile Cave, Newcastle, Virginia, 5-30-43; Fish Hatchery Cave, Newcastle, Virginia, 5-30-43.

Eurycea l. longicauda (Green). Two Mile Cave, Newcastle, Virginia, 5-30-43; Fish Hatchery Cave, Newcastle, Virginia, 5-30-43.

Class Pisces

Clinostomus vandoisulus (Cuvier and Valenciennes). (Rosey Dace) Tony's Cave, Newport, Virginia, 11-28-43. Seined from pool well up in cave; about half way through. Det. L. P. Schultz.

Cottus sp. (Artedi) (Miller's Thumb). Smoke Hole, Newport, Virginia, 11-28-43. Collected from rapids several hundred yards above entrance.

Class Mammalia
Order Chiroptera

Pipistrellus s. subflavus (F. Cuvier). Tony's Cave, Newport, Virginia, 11-28-42; Clover Hollow Cave, Newport, Virginia, 5-9-43; Two Mile Cave, Newcastle, Virginia, 5-30-43; Newcastle Murder Hole, Newcastle, Virginia, 5-30-43.

Eptesicus f. fuscus (Beauvois). Pig Hole Cave, Newport, Virginia, 2-21-43.

Remains of Miscellaneous Mammals Found in Caves

Didelphis virginiana Kerr. Pig Hole Cave, Newport, Virginia, 2-21-43. Newcastle Murder Hole, Newcastle, Virginia, 5-30-43.

Sylvilagus sp. Gray. Newcastle Murder Hole, Newcastle, Virginia, 5-30-43.

Marmota monax (Finn). Newcastle Murder Hole, Newcastle, Virginia, 5-30-43.

Mephitis sp. Geoffroy and Cuvier. Pig Hole Cave, Newport, Virginia, 2-21-43.

Procyon lotor lotor (Finn). Pig Hole Cave, Newport, Virginia, 2-21-43. Det. Schwartz.

Undetermined or Accidental Insects Collected in Caves—Washed in by Streams, etc.

Water beetle. Clover Hollow, Newport, Virginia. Washed in by stream, 5-9-43.

Terrestrial beetle. Lucas' Cave, Newport, Virginia. Under leaves and detritus in twilight zone.

Stonefly larvae. Clover Hollow Cave, Newport, Virginia, 5-9-43, 8-15-43.

Spider. Lucas' Cave, Newport, Virginia from twilight zone.

THE SNAILS OF TED CAVE, TENNESSEE*

By Leslie Hubricht

Ted Cave is situated on the west bank of Caney Fork River, about five miles east of Smithville, DeKalb Co., Tennessee. It is an ugly cave, without any of the formations which make many so attractive. The floor is littered with slabs of rock fallen from the roof, and over these is deposited a layer of slippery mud acquired when the river rose and flooded the cave. It has nothing to attract the tourist, but to the conchologist and evolutionist it is of great interest.

The mouth of the cave is a large opening on the bluff about twenty-five feet above the river. On the right-hand side, a short distance within, is an opening in the floor through which a stream may be seen about twenty feet below. This is Fall Creek, which enters the cave through a sink-hole, flows for about a quarter mile underground, and emerges on the bank of the river about forty yards down stream. The stream cannot be reached here without a ladder, but farther back the cave forks; a short distance along the right fork and down a steep, clay bank there is a small opening in the right wall through which the stream may be reached.

The winding channel through which the stream flows is about ten feet wide and just high enough for a man to stand erect, if he is not too tall. The stream has a good current, and is from six inches to a foot or more

deep and from six to eight feet in width. The bottom is composed of smooth, well-packed gravel or sand, with an occasional large rock dropped from the roof. Because the stream flows for several miles above ground before it enters the cave its temperature fluctuates with the seasons, quite warm in the summer, cold in the winter.

In the riffles the stream-bed is dotted with small snails with light brown shells, smooth or with weak spiral striae, about 4 mm. in diameter and would be about 6 mm. in height if the spires were not eroded away. These have been determined by Mr. Calvin Goodrich as a form of *Lithasia obovata* (Say). In the quieter water, among the leaves and sticks washed in by floods, another and larger snail, *Goniobasis edgariana* Lea, is found. This species has a plicate-striate shell about 5 mm. in diameter and 15 mm. in length (allowing for the eroded spire).

Both of these snails represent intermediate stages in adaptation to a subterranean life. *Goniobasis edgariana* has been modified the least. The colors of the animal appear brighter, due apparently to a reduction of the black pigment. The eyes are black and probably functional. The most marked difference is in the reduced size of the shell, being less than one-half the size of epigean specimens. Like the above species, *Lithasia obovata* has been greatly reduced in size. The animal is white or blue-white with a pink band across the snout and pink tentacles. The pigment has been reduced about 85 percent. The eyes are pink rather than black and are probably non-functional.

As far as the author was able to ascertain neither species occurs in Fall Creek above the sink or where the stream emerges on the bank of Caney Fork River. Both, however, are inhabitants of the Caney Fork tributaries elsewhere.

*Reprinted from *The Nautilus*, Vol. 54, 1940. Pp. 10-11.

Note on Australian Caves

From *Zoonooz*, published monthly by the Zoological Society of San Diego (Cal.). Aug., 1943, p. 5: in "The Zoo's Pioneer Expedition," by T. N. Faulconer, Dir., San Diego Zoo, 1923-25.

". . . long drive through the Jenoloan Caves in the Blue Mountain area (of Australia), where wallabies and koala bears, kookaburras, cockatoos, and parrakeets abounded. While I have no figures upon which to base conclusions, I imagine that the Jenoloan Caves rank in size with our own Carlsbad Caverns or the Mammoth Caves of Kentucky. In beauty and oddity of natural formations, I doubt that they are excelled anywhere in the world."

Cave Log . . .

FOUR V.P.I. MEN ON A "PRIVATE EXPEDITION"

One Saturday in November Drs. Hussman, Jackson, Fischer and I took off on another cave exploring jaunt. We went down to Newport (about 9 miles) and dropped off in the Smokehole for the day.

The cave is called by that name because the relatively warm air coming out of it on cold days (it stays about 52° the year around) turns to fog, and it seems as though smoke is coming out all the time.

It was a beautiful, clear, cold day, too pretty to waste underground, but we went anyway. It seems that, until I took a party of students and faculty into it some time ago, no one had ever been in it until three men went through it in 1913 and then came back with a friend to tour it again in 1915. The inside of the cave bore this out, too, for there were no signs of anyone ever having been in it before except that at the end of most passages is the inscription: ACP, AEP, or CGP, and 1913 or 1915. Even these signs, though, are few and far between.

The entrance takes your breath away to look at it. It is a hole in the ground, high on a hill. It drops in a right spiral for about 40′, then hits a room about 20′ square. Right at the side of where this lead comes into the room, so close that you go on down when you enter if you are not careful, the bottom drops out in a left-hand spiral for about 60′.

Then you go, on about a 20° grade, for about 300′ of fairly easy climbing and hit a young river. This stream is about 15′ wide with an average depth of 1½-2′, and goes like forty. Looking around and seeing no place to go but up the stream, you nonchalantly step in and gasp, for the water is as cold as ice! After catching your breath, you go on upstream through fairly clear but stooped going. The water is from 1-3′ deep, and the ceiling comes down to within 8″ of the water in places. Along here are some magnificent formations, sort of on the "grand" side. Pretty soon the roar of a waterfall deafens you and you expect to walk into Niagara. It is a disappointment. It is not such a big one: the confinement of the noises causes it to echo and reecho.

When you get to the falls, it seems as though you are at a dead end. Just a mass of jagged rocks with water spilling over and around them all and in between very sticky clay. But if you duck under the falls and climb through a little cat-hole, about 18″ square, you

can wiggle on for another 20′. Then it is wiggle and climb again for about 100′, and you come out in a room at the top of the falls.

This is a good time to get lost. It is very difficult to find your way back, much less onwards. However, if you persevere and investigate every little passage, you find one that leads down again. This is a lulu: drops, falls, and slides, and all of a sudden you are waist deep in the stream again, only on the upstream side of the falls. Now all is smooth sailing. You are in a perfectly smooth rock tube, oval in shape, about 3-4′ high and 12-25′ wide, with the stream flowing in the bottom like a mill race.

This lasts for about half a mile, then you turn off. The place where you turn off is peculiar. The cave, without warning, opens into a large room about 40 x 80′ and 50′ high; and 90° to the left, the stream enters this room through a curtained opening with about 6″ to 1′ clearance between the curtain rock and the water. Straight ahead, where you would expect the stream to be coming from instead of to the left, is first a beach of clean white sand and then a rock pile of boulders cemented with fine clay mud (cave variety, than which there is none stickier). It is apparently an old channel which is filled and cemented completely.

When you duck under the curtain rock you find another of those confounded squatting crawls: 2′ of water and 1′ of head room. Whenever I try to negotiate one of those places I am reminded anew of my two years in the office . . . just like one of those "high-behind" model telescopic slides.

After about 100′ of this squat-stoop-crawl we hit a fork in the stream. Here the main stream comes from a confused mass of broken boulders straight ahead. These are terribly new, geologically speaking, indicating a slide within historical periods. The whole mess was so uninviting that we saved it until last, although there was a perceptible air current coming down the slide. When we ducked under the curtain rock, the air current was very pronounced—quite cold; and so strong that it made our carbide hat-lamps flicker madly.

At this stream fork, the air currents seemed about equal, half from the rock slide and half from the left fork. Again we ducked under a curtain and followed the left fork about 100′ to a large circular pool. At the pool we were really lower down the main stream than when we left it, and on the left bank of it.

The pool was another junction point. Here the main stream circled the pool and came from the right (looking upstream). A small tributary came in from the left. We followed it through an old solution channel, with flues dropping into it about every 75′ which did not go anywhere, and came out in a large room.

This room was typical of the caves of the Shenandoah Valley in that it was large with an unsupported ceiling, and apparently of great depth but silted up with cave mud to within 10-60′ of the ceiling. This room was rather large, 10-60′ wide and approximately 300′ long, and at the far end pinched out in a mud slide. At the bottom of this slide was another small stream, flowing very slowly parallel to the main stream. This whole room ran parallel to the main stream. It had some formations, but was characterized chiefly by the broad, smooth, unsupported ceiling.

At the downstream end of this room, we slid through a fissure on the right into another channel and walked into another room equally large and fully as muddy, even a little more so. This room had numerous fissures and water channels opening off of either side, and we wasted a lot of time checking them. We were getting quite excited, for the signs were that there was another entrance nearby. We did not find it, though. In this room were thousands and thousands of bats.

At the far end of this room on the last trip we found animal tracks, clawed, and about 1″ broad, but no animal. However we did find parts of a skeleton of an animal. I looked at it and identified it tentatively as a granddaddy possum, but one of the boys on the first trip (a biology major) said no, it was a rodent. The only rodent we could figure growing that big was a beaver. He later checked and found that beavers had been populous in that section 40 years ago.

There was a good deal of sign of entrance here, but we had no luck finding it. Spreading out and crossing the cave, we found other signs of life: the most carefully arranged patterns of animal droppings you ever saw. Seemed deliberate! Dr. Jackson of the Biology department looked, studied, and finally pronounced: "It might be the grand-daddy coon of them all, boys, but its my belief that it is a bear!" Those are fateful words in a close space a long way from the surface! However, we stood the shock and managed to retain interest in the section. When we finished working back up the crevices on that side we worked all flues, chimneys, crevices, and so forth back to the circular pool I have mentioned before. All we got for our pains were some cuts on our hands from the razor-sharp crystal fragments in the clay.

Hitting the pool we worked upstream, crossing one of the most unusual displays of lily-pad dams I have ever seen, noting also a lot of streambed crystallization. Up about 200 or 300′, the stream just petered out (ducked under a rock with an inch of head room), so we left it and worked up through a difficult, vertical, sand clay

cat-hole. All uphill, on your stomach, crawling like a snake. Very narrow quarters, really too narrow to turn around in. I had anticipated something like that, so watched my way carefully.

Seventy-five feet in, Dr. Hussman, bringing up the rear, was mortified to hear Fischer at the head say "All out; end of the line." Hussman and I backed out on our stomachs, but Jackson and Fischer laboriously turned and came out head first. Fischer's bag of bats didn't do so well on that going. They squealed and growled for an hour over it. We tried two or three side passages coming down, finding one that had a cliff entrance below the pool. Hitting the pool, we went downstream, crossed the curtain and were out at the original forks. Everyone was a little tired by now so we sat and smoked and threw mud balls at each other. Never try and hit a fellow in the face, that's unsporting; throw carefully and knock his light off his head, its nicer and lots more upsetting!

After messing around here a little while we started up the "rock" slide. These were nice little pebbles, about the size of automobiles. Doc Jackson went under the slide, following the stream through crevices. I went over it, and Fischer and Hussman followed, catching side holes. Pretty soon I began to get pretty high and completely away from the others. Couldn't even see their lights. Then the thing petered out on me except for a lead to the right. I headed for it and what did I see! Yards and yards of smooth, water-worn gravel on top of that rock slide. And clay! You never saw such wet, sticky clay with the gravels.

It all came out of a flue, so I started up. In about 10 minutes and 30 feet I realized that I was definitely in a flue that went to the surface or nearly so. But I also realized that there was little liklihood of my going up. The rocks varied from the size of footballs to houses, and were all wedged together and covered with slimy mud. It would have been very difficult climbing, but beyond that I was afraid that one false kick would start a slide with us under it. I waited for the others and got their viewpoint, which was the same. So we vamoosed very carefully.

Hitting the stream again we compared notes. It seemed unanimous that as we had done all the major exploring from the inside that we could, home looked good. So we high-tailed for the entrance. It didn't take nearly as long to go out as it had to come in, and we didn't have to lose time getting lost on the waterfall as we had done three times in 300′ coming in. We were out in record time with no mishaps save that I made a wrong turning and had to go in the water literally up to my ears to get through the first curtain wall. We got to the entrance, changed clothes and piled in the car and went back to town. And were we glad to get back and get a good hot bath, another change of clothes and a hot supper inside of us. It was really a wonderful trip.

On the way back we talked to the owner of the cave property and found he, like all the other inhabitants of Clover Valley, was afraid to go in it. However, he promised to guide us to another cave near Mountain Lake and wait outside for us. This one has a 200′ sheer drop into it and no one has ever been in it and come out. Tradition has it that at least 3 people have fallen in it (not caving), and that we will find them at the bottom. We are planning. Don't know whether we will try it or not. But we will be careful. George Crabb

Blacksburg, Va. (1942)

SLUSSER'S CAVE NOTES

We have found out where the stream in Slusser's Cave comes out, and there is a cave at that end, too. We haven't been in that one yet, but we are planning to work it soon. We are going to take a transit with us and survey the top of the ground, also.

Last Sunday we went out to the cave 8:30 a.m. and got under ground at 9:40 a.m. The entrance is a small diamond about 5′ x 3′ and goes straight down 15′ to a room about 10′ in diameter and about 4′ high. The passage leads off to the east. This part of the passage is very rough, and the ceiling is only about 18″ high. Sixty feet from the entrance you come to the Trap, a water hole with about 8″ of head space above it and 6′ long. There is a shelf of rock around the edge. It is possible to get through the Trap dry, but it isn't probable on the first try. However, if you get wet here don't let it worry you, because you will sooner or later anyway.

After you get through the Trap, the passage goes down to the left. This part of the passage is small and rough and requires sliding on your stomach. Eighty feet from the Trap the passage narrows down to about 2′, but the ceiling is about 6′ high. From there on you can stand up and walk. About 900′ from the entrance is a small room about 8′ in diameter. A passage goes up to the right. We did not survey this passage, but I guess we went up it 1000′ to a dead end. We found some very white formations in this passage and brought some back for the Geology Department. We also found some iron formations in the form of short stalactites; they crumbled very easily and looked like plain rust.

The main passage continues down and to the SE until you get to the river. We chained down the river

400′ until the water got within 1′ of the ceiling. The river room gets small on each end, but is about 50′ high in the center. There is some evidence of other passages entering at higher levels. We really haven't started to exhaust the possibilities of this cave. We have not struck any water over 3′ deep yet. We have reason to believe this stream runs about 7 miles; and, as it runs about 1500 gallons per minute, we have hopes of getting all the way through.

Tony Watts,
Blacksburg, Va. (1942)

CORNWELL CAVE

Members of Society: James Beard, Edwin Gage, Pittsburgh, Pa.; Lohmna Thompson, Shy Matchett, Sam Allen, Steubenville, Ohio; Lila G. Miller, Mrs. Frances Snell, Wheeling, W. Va.; Alden Snell, Philadelphia, Pa.

Sunday, September 6, the Pittsburgh, Wheeling, and Steubenville groups met at the Auld Hotel in Washington, Pa., at 7 a.m.

Proceeded to Morgantown and on to Masontown, W. Va., near which the cave is located. In Masontown the crowd was joined by Mr. and Mrs. Snell who had driven in from Philadelphia.

When we inquired about Cornwell Cave to be explored, we were told it was easy to find, quite large and we would need some type of guide line so we would not get lost as that could easily happen, also that there might be need for rope ladder.

In Masontown we turned left about mid-town, headed east on W. Va. Route 7, drove to fork on road .9 mile, and turned right continuing to end of improved road. At the end of the improved road, we turned right and continued about 4 miles to a place called Herring, only a cross road and not marked. Kept straight ahead there, as directed. About .4 mile from Herring, at another fork in road, we turned left, continuing on a dirt road until another fork in road, a house standing on left, and also some mail boxes. Turned left here. A short distance more, then we opened a gate and then drove to first farm house. At this place we parked the cars and prepared for the jaunt to the cave.

As usual the farmer folks there thought we were crazy; but, being used to such after all these years of spelunking, we took no heed.

Were given very good directions as to how to find the cave. Having no sense of direction myself, I could not say in which direction we proceeded; but within 55 minutes after leaving the cars, we were at the entrance of Cornwell Cave. At the entrance we could look straight down about 100 feet into the Cheat River. Was a very hot day and the running water looked very refreshing.

To enter the cave one had to stoop, but almost immediately could stand in an upright position. There was evidence of many other people having been into the cave previously. Found the nest of a cave rat but nothing in it; however, a little later we saw a cave rat. The men stated it was a different type cave rat from any they had ever seen. We were able to get very close to it at one time, but before the photographer of the crowd could get the camera ready the rat was gone.

We were all agreed that some means of marking was very necessary as there were many passages. Seemed that each type of mark any one thought of had already been used by some other party of explorers, so finally Eddie Gage designed one of his very own.

We spent a good 3 hours in the cave. At no time did we negotiate any really hazardous areas. There was evidence of formations, but had all been broken off and carried away by souvenir hunters. There was only one small area of flowstone, and it not particularly spectacular or colorful. Cave was wet and muddy.

Monday, September 7, on to Davis, W. Va., and left Davis much earlier than the crowd usually gets away. Drove to Whitmar. At Whitmar crossed bridge at Emmet C. Thompson Store. Turned left to east and drove until came to first big white homestead to left. Sets back off road about 500 yards. This the home of Scott Hedrick. Mr. Hedrick informed us there was a good-sized cave on his farm and it had been several years since anyone had been very far into it but was quite large, and had formations in it. Our enthusiasm was soon squelched when Mr. Hedrick said about a month previous to our visit he had put the carcass of a cow down in the entrance. We felt that cave was out of the picture for at least a couple years. Mr. Hedrick said there were numerous Sink Holes all around that territory but residents didn't pay much attention to any of them so he didn't know of any that amounted to anything. Spoke of a large cave he remembered from childhood days near school which he attended. From location he gave us we assumed he meant School House Cave. He did direct us to what he thought might be a cave worth exploring.

His directions for finding cave were to continue on in same direction after leaving his farm until coming to fork of road then turn left on road that would take us to Job. Continued on this road until we came to a cow pasture on left and about 500 yards back in pasture an old grave yard. Not much left of this old grave yard as most grave markers had been knocked or fallen over. Could easily enough miss seeing this landmark.

I did not continue with the Spelunkers beyond the

grave yard so from here on it's Lohman Thompson's story as told to me.

"Some distance over the hill from grave yard we found a sink hole, with fence around, and an offensive odor. Entered about a 40 ft. drop on rapelling line. Were a few formations near entrance. Were no markings that would indicate anyone had ever been in this cave. After dropping a rapelling line, proceeded about 150 ft. to a chimney which would open up about 200 ft. Sam Allen was ahead then Beard, Gage and myself following. Could get no answer from Sam who seemed to have gotten quite a distance ahead. Rest of us felt there was no reason for going farther so waited and soon Sam returned. As far in as we've been, this cave is very hazardous, with falling rocks and only few formations. Not worth the risk to explore further."

Charles Matchett
Steubenville, O. (1942)

Letters from Our Files

To all intents and purposes, these letters are—as in newspapers and other magazines—"To the Editor." That is to say, they are the free expression of anyone who cares to write us, on any matter pertinent to the subject of speleology.

They do not necessarily reflect the policy of the Society; nor does the Society accept any responsibility for the truth or accuracy, necessarily, of the sentiments or statements expressed therein.

They are published—when *they are published—because they have been judged interesting enough to warrant the procedure, for one reason or another. They may even be deliberately designed as a hoax. (Remember Poe's "The Descent Into the Maelstrom"!)*

They promote good-neighborship, we believe, stimulate exchange of ideas, and serve the useful purpose of providing an outlet in print for those who are peculiarly inarticulate unless they are "writing to somebody."

FROM OUR MEN IN UNIFORM—
The "Distance" Does Make a Difference

Your BULLETIN just arrived and was read with much interest. Wish it were possible for me to attend some of the lectures and some of the cave trips, but distance prevents my doing so. I hope that when I return to the States I'll be able to take part in some of your trips, and help in the work which I found very interesting during my stay in Washington, D. C.

As far as I can find out, Australia has no caves—at least not in the region where I'm stationed. But, if we move, I may be able to visit some of them if any exist. Then I'll know something about their characteristics in this country.

Bruce H. Bennett,
APO 922, c/o P. M. San Francisco, Cal. (1942)

[*Ed.: Bruce, according to the papers, just got a medal in New Guinea—our first known member to distinguish himself in this war. Incidentally, Bruce, if you see this, let it remind you that your membership dues are "paid up" for the duration and six months thereafter.*]

Cave Tips from the Ranks

One of my men today happened to mention he lived in limestone country in Ohio, and I asked him if he knew of any caves thereabouts. Here is what he told me:

Seneca Caverns, Seneca County, Ohio, 4 mi. SW of Bellevue, Ohio. The town is presumed to be built over a big cave, possibly Seneca. He stated that wells there had a flowing of water when struck which could be heard roaring, that cesspools and sewerage were put down crevices, but that right in town, as far as he knew, no one had ever descended to the water; that at the outside, the cave is a large one; and that a rapid, underground river has been visited; and that the U. S. Engineers were so interested that they equipped some balls with radio so that when put in the water as they struck sides of rocks they gave off sounds which were picked up outside and were followed for several miles. He said that the engineers said they were going to have men remain in vicinity for a year to make soundings and tests. You might try to run this down by writing to the local Chamber of Commerce or mayor, or sheriff, or the Engineers of US. He said that at Castalia, Ohio, there is a pool of crystal clear cold water 50′ across, running over, full of immense trout; that people drop pennies and stones in it and can see them going down for 50 feet or more; that they have never been able to find the bottom. It is about 9 mi. from Seneca Caverns. Possibly there is some connection?

He said, also, that somewhere up in that part of the country, wherever there is a monument to Commodore Perry (I should know where it is, but don't), there is an island on which are three very interesting and beautiful caves.

Just thought you would like to have this information. I finished reading the last BULLETIN and find a few of the questions I asked you, answered there. I sure do get a big kick out of this little magazine. Apparently no caves right 'round here, but on convoy one day saw several signs of commercial caves South and SE of Columbus, Ohio, but didn't have time to investigate.

We have a number of men from various parts of W. Va. here, and I always ask them if they know of any caves. They have told me of some you know of already but, by asking, you occasionally find a new one.

So, I will keep up the good work even as busy as I am.

Capt. T. T. Perry, Ft. Benj. Harrison, Ind. (1943)
729th MP. Bn.,

A 6,000-Foot Deep Cave?

While reading the Oct. 30, 1943 *Science News Letter*, page 279, I ran across a proposal to dynamite a cave about 80 miles from Mexico City in order to close the entrance, the mayor of a nearby town feeling that his town was getting undesirable publicity from it. As it is estimated to be 6,000 feet deep, that would certainly be an unhappy thing to do from our point of view. The article says that it is to be explored first by geologists, so perhaps they would send you a report. You might give them some encouragement about keeping it open.

Recently got a letter from Will Thompson asking for the Society's address as he misses our cave trips more than almost any other thing. He is a flying lieutenant now, and has been for about 3 months.

The BULLETIN came and was fine. Have been trying to locate some California caves, but have found nothing but Hollywood dives so far in the year that I have been here. Will probably be going overseas in a few months, so may be able to get some foreign caves.

S/sgt. F. Silver,
Hq. & Hq. Det. 260 Ord. Bn., Arcadia, Cal. (1943)
Camp Santa Anita.

Nostalgia from Texas

The post war Society should really be a big success.

I've never ceased talking the Society up to anyone who in my opinion has anything to offer in the furtherance of the work.

Personally I wouldn't want to lose contact with the Society in any way even though I am not much use to it now.

I have talked to several of the boys in the Service who are from this area. As I can gather, there are some very interesting finds being made in caves in the canyons of the Big Bend country. It seems the Indians in years gone by have used these caves for burial purposes, and much of their lost arts can still be found in nearly perfect condition. I haven't been able to do much, however, but gather word-of-mouth stories on them.

I am sure a great deal of advantage to the Society could be gained if some member would write up the geological facts on the caves of Texas.

A trip into them would be a very interesting one, with wonderful opportunities for almost any "branch" of the Society.

Your card and the picture the other day reminded me of happier days. Those limestone canyons carry a feeling all their own. I guess "once a cave man always a cave man." I look forward to the day when we can all be together again.

I sure appreciate your cards as I get very few from the boys of the Society, but I know they are very busy back there on the home front.

I am glad to see you are still able to get in a few trips now and again. I'll bet a fellow really appreciates the beauties of a cave now that it is so hard to get to them.

I haven't been able to get to a single cave so far as we are very busy here getting in shape both mentally and physically for what may soon come. I never knew there was so much to learn in becoming what Uncle Sam thinks is a good soldier. Nevertheless it can't hurt me any, and so far has done me a considerable amout of good.

So—keep up the good work. I hope to be with you the moment we have finished this job we all have on our hands.

Edwin W. Gage,
Duncan Field, San Antonio, Tex. (1943)

One Furlough, One Cave

I finished my basic training last Saturday, so had a 3-day pass to go home on. While there I checked on the caves.

Report: Stephen's Cave had 3 in. to 2 ft. water, probably backed up for several days because outlet on north side was choked with ice. The cave at Linwell stone quarry has been sliced back some 20 feet along entire west side. The "Capitol Dome" has been broken up, was only a shell over red clay. The opening that was in the extreme north corner—way up—was sliced vertically and appeared to drop 20 feet, the last 5 feet being filled with red clay and rock. There was still water throughout so that extensive exploration is still out. Thompson does not have any caves on his own land, only "petrified rocks and animals," the usual lime and sandstone formations. His neighbor has a couple of sink holes.

John Showalter,
Fort George G. Meade, Md. (1943)

From Cave to Aerial Photography

I sincerely regret that I did not notify the Society of my entrance into the aerial photographic division of the Air Force in August of 1941. Since that time I have been actively engaged in aerial photographic work and have not had the opportunity to do very much caving.

My interest is concerned principally with the taking

of color and black and white photos of caves and cave formations; and, although there are few caves of any importance in Colorado, I have photographed several small local caves. The Cave of the Winds is located several miles from here in the village of Manitou, and I have explored a few small caves in the immediate vicinity.

I trust that I will be able to become an active member after the war, as I am extremely interested in photographing cave formations in color, an interest awakened by member John Meenehan's excellent color shots. Although shooting pictures from the air is a long way from cave photography, I hope that I will be able to return to the latter before very long.

S/Sgt. William H. Watkins,
Colorado Springs, Col. (1943)

Two Letters to Petrie

I suppose this* will surprise you as much as it did me when I was put on a ship headed for the U. S. A. Arthritis finally put me down. The climate is terrible for such things in Australia so I had to come back.

Unfortunately I didn't last long enough to get a chance to explore even one cave while I was there, although I had heard of caves within a few miles of where I was. I guess I'll just have to write it off the record and hope for better luck next time.

Meanwhile I guess you boys have been able to do a little exploring over here, even with conditions as they are. Jankowski has been to a couple in Tennessee lately. I am looking forward to trips again like the ones to Hell Hole and Wyandotte.

In a way, I sure am happy to be back. On the other hand, I wish I were able to be on the other side. I guess the old saying "you can't have your cake and eat it, too," holds good in my case pretty well.

Your Kentucky trip must have really been O.K. I sure would have liked to have been along with you boys.

I may at least be able to steal a march or so on the subject of cave science, however, as Jim Beard was out to see me recently and left the ELEMENTS OF GEOLOGY, by LeConte. I have so far found it very interesting. And I have been planning some new lines of action on cave photography, and an idea or so for exploring, also. With all the time I have on my hands, I have plenty of opportunity to brush up a little and make caving a lot more interesting than it was before.

Jim Beard tells me that he has a fairly good chance of our forming a Grotto in Pittsburgh. He has already interested among others two naturalists, a geologist, an entomologist, and several others. Jim and I sure have the bug, maybe we will be able to get results, also.

So, until I am able to be with you boys in person on your trips, I will be thinking of you always.

Ed. Gage

*Letterhead: Valley Forge General Hospital, Phoenixville, Pa. 9-2-43

AND OTHERS . . .

Prehistoric Men and Historic Caves

Received and enjoyed BULLETIN No. 5. A nice job. Morgan's "Index" to caves would appear to be a good start on one of the most important services the organization can render. Permit me to object to one of his introductory paragraphs. The author will find himself in severe disagreement with modern arthropologic literature when stating that "The oldest-known human remains are those found in a cave near Cro-Magnon in France"—what about *Pithecanthropus erectus, Sinanthropus pekinensis, Homo heidelbergensis, etc.?*, and "The oldest known remains of a white person was found at Neanderthal in Germany—Hence the Neanderthal man is generally assumed to be our oldest ancestor." My knowledge of the subject is very limited, however, it is a fact, brought out in most of the elementary textbooks, that whereas Neanderthal man was definitely more primitive in skeletal development and brain capacity, Cro-Magnon man equaled modern man in these respects, and is therefore probably closer to the direct line of descent than the former.

Morgan's list of caves is impressive. Let me add a few things. Under Virginia there are listed a New River Fault cave at Newport and a Spruce Run cave in Giles County. If the New River Fault cave is the same as that visited by you on one of your memorable trips to Blacksburg, the one overlooking the New River at Goodwins Ferry, I am convinced it is the same as the Spruce Run cave, from which numerous remains of Pleistocene fossils were described by Cope.

As for Wisconsin caves, Here is a clue which should be of much help to the Society. Years ago a fellow by name of Lange, student in Geology, wrote a senior thesis, which is on file at the Geology library at the University of Wisconsin, Madison, Wisconsin. The thesis deals with the caves of Wisconsin (largely in the Driftless Area in Southeastern Wisconsin), and includes rather detailed descriptions.

I notice only two caves listed for Wyoming. This state is one of great cave possibilities. There are numerous caves along the northeast flank of the Wind River Mts. The Madison limestone, of Mississippian age, flanks the Mt. side, and every stream coming off the Mts. develops underground passages—"sinks"—in this

formation. Many of these are rather inaccessible, but others may be reached by only a few miles of hiking. I have been to only a few of these places. One, on Meadow Creek, located between Bull Lake and Dinwoody Lake, is a cave with a fair-sized room littered with beautiful green calcite crystals. In the floor has been developed a deep vertical shaft, accessible only with ropes.

As for Europe: Many portions of the Alps are predominantly limestone regions, and contain many caves. Outstanding is particularly the Krain region of southern Austria, and the Karst of northern Jugoslavia (whence the term "Karst-topography," as applied to sinkhole topography).

The valley of Berchtesgarten in southeastern Bavaria is flanked on the northwest side by a mountain known as the Untersberg. In this mountain lies a rather well known cave featuring, among other things, a perennial deposit of ice. I am not sure whether this cave is accessible from Reichenhall or Berchtesgarten in Bavaria or from Salzburg in Austria.

Another cave I know of lies near the City of Wiesbaden in western Germany. It is known as the "Rauher Leichtweiss Hohle," after the highwayman Leichtweiss and his gang, who would commit a robbery, and, with the gendarmes on their trail, would suddenly disappear in a certain region of the forest. It is said that their hideout was discovered by a thin wisp of smoke issuing from a pile of rocks. The gang was subsequently smoked out of the cave and, as I recall, Leichtweiss was hung. The cave has been commercialized.

Alfred J. Fisher
Wichita, Kans. (1943)

First Tip on Dr. White Reprint

I have been busy with listing fossil animal bones in U. S. and West Indies Caves, but intended to write much sooner.

Let me congratulate the Society leaders on the excellence of BULLETIN No. 5. Mr. Fowler should know that the Dr. Chamberlin he lists, evidently from the separate I sent to you, has also published several other separates listing spiders from caves and embodied in his general taxonomic papers. Again, the librarian should be congratulated on the most useful bibliography I have ever seen. He should know of books I have just borrowed from a friend, one by Funkhouser and Webb, whom he names in another connection, in the Geological Survey Series of Kentucky, and another in the Geological Survey Series of Tennessee. I shall write you for him, by hand, or on a slip, the exact citation when I get back to the house.

Did either of you know that the late great Dr. David White published a mimeograph in 1926 making the best review of fossils found in U. S. caves for the National Research Council? It is out of print. It is so readable that I think our Society could well reprint it as a "voice from the grave," about 9 pages, double-spaced, letter-page typing, and may I suggest that I have footnotes of the most important discoveries since, to make it of general application? It might be better if the National Research Council would revise and reprint. Meantime, we have two sets of five type-written copies to send to my Committee and ask that they have it published in a local or state paper, and when I get further copies typed (slow work), I will send you a copy for you to pass on if it is worthwhile.

The list of caves in BULLETIN No. 5 is splendid, and I am asking the Washington office for nine, unless Morgan is having separates made. I do not want to deplete the number of BULLETINS which you need for distribution, but it will save us much typing time if we can cut up an issue to paste or staple into the catalogue being made here, the list of known caves for each state against which we then have to check the literature to find if any fossil bones were found in any of them. This catalogue has been arranged by my secretary with colored risers for bibliography, taxonomic series, and then Central, North, and South America, including West Indies. We shall not waste much time on Latin America, but because we have many scientific publications from Spanish America, we are doing that part of it on state time. Under the last three major heads are subordinate risers by State or Province, and under each of these political subdivisions, the caves are alphabetic by county. We may decide to make them alphabetic by cave names if that will conform better to the Morgan list for the Society.

We have so far dredged R. W. Stone's pamphlet of Pennsylvania Caves and written for the original papers he cites, where we could get them without paying for them; the same way for Funkhouser's Kentucky caves; and the same way to the American Museum for the paper by Brown on Conard Fissure fossils in Arkansas; for one California list and one Cope and Leidy list; one Florida list; National Museum for Gidley's Maryland list. The cave list just published is an immense help for going over our own Missouri literature. I have waited to start Missouri, and waited also on completing the Enon cave list of which we have some 100's of the bones, because the University won't send me what they published on it and the American Museum has not sent me what they published on it. BULLETIN No. 5 is going to be our major tool for a while and a great help.

The 22nd of this month we will legally pass under a new Commission of Resources and Development which will necessarily interfere for a while with the continuity of our effort. A. C. Burrill, Curator,
Missouri Resources Museum, Jefferson City, Mo. (1943)

Clay Perry Blows Hot and Cold

Recently have been getting ready to give an illustrated talk before the Western Hampden Historical Society, at Westfield, Mass. (Hampden County) at their request, and am glad to have the latest on the N.S.S. to talk about some. I have a collection of fine kodachromes of Luray and Howe caverns, plus a few taken by a Springfield man, now in the Navy, showing some eastern (New England) caves and hope to give them a good insight into spelunking, with color. I also have three or four of Lohman Thompson's slides showing NSS work in caves.

Now, as for some of the matter in Number Five BULLETIN: I got a shock out of that "partial list," of known caves in the world. What a mammoth subject to tackle! It was inevitable that there should be some big gaps and some mistakes, but evidently the compiler did not consult your library very closely in reference to eastern caves, notably my book, UNDERGROUND NEW ENGLAND, with its quite complete index of caves. He mentions five in Massachusetts; there are almost two pages, double column, in my index. He places "Hudson's Brook" cave in Adams; it is in North Adams, and is best known as the Natural Bridge Cave. He does not have *any* caves in Connecticut; I have over 35 listed. He places one Vermont Cave under Texas! I have a page of Vermont caves. Three caves in Maine; I have over 30. None in Rhode Island; I have four, and there are more. He has five in New York; I have a dozen, in eastern N. Y. alone.

I do not wish to seem hypercritical, but this would have been so easy to get right, by consulting one book alone, that it puzzles me. I would not recommend listing every cave on my lists in this partial world list, of course, as some are insignificant—but a perusal of the book text, itself, would have enabled Mr. Morgan to pick out some "important" ones which his list does not have. A lot of them. Such as Twin Lakes Cave at Taconic, Conn., as you know, our longest and most beautiful in New England, and Crystal Pool Cave, Egremont, Berkshire Co., Mass., next in beauty if not equal. And so on. Over 40 caves in Berkshire Co. alone.

Doubtless this partial listing will inspire a flood of corrections and additions from all corners. I hope so. It will make a big book in itself if ever completed—and with the war on, European caves of recent discovery will be difficult or impossible to locate by a long shot.

Now, to try to be more constructive, I have found some new cave references, lately, as follows: THE STORY OF WUNNEEE-NEETUNAH, by Mathias Spiess, Meador Pub. Co. Boston, 1934. (The Squaw Cave, Bolton Notch, Conn. Excellent folklore.) "The Mystery of Hutter's Cave," by Samuel W. Taylor, in *Esquire*, Nov. 1943. (Fiction—but good cave stuff.)

In a perusal of the Cave Fauna list, I find that, probably through my own neglect, you do not have listed an article of mine published in *Nature*, some time ago, "Ten Thousand Banded Bats," a story of Donald R. Griffin's early work. (Several of his brochures and articles are listed, however.) And there is a chapter in my book about Griffin, describing his work: Appendix, p. 234-241.

The BULLETIN, altogether, is an astonishing production, monumental compared to early editions, and allow me to congratulate all who had part in compiling it and publishing it. I believe Leo Lincoln has sent you a report on our last trip. I enclose a news clip which hardly tells the true tale—as usual.

I shall try to do some real organizing on my Folklore Committee and work, during the winter. I have been extremely busy, lately, working on stories and articles for *Esquire, Colliers*, etc. (not caves, yet, but maybe sometime).

Note your use of the little article "Cave of the Dead Cow." I never have heard from Bachand, since. Perhaps he's in service. Must now write to the *Outdoors Unlimited* editor.

I had a nice letter recently from Robert E. Morgan about his cave list, etc., and he says he had not even seen my book when he compiled it but has since.

I wanted to tell you, also, that I'm doing some cave advertising these days. I gave an illustrated talk before 50 of the 100 members of the Western Hampden County (Mass.) Historical Society at Westfield, using my series of kodachrome slides, some of them by Lohman Thomson, showing Society groups at work, others of New England, Luray, and Howe; and I am to give a public lecture at the Berkshire Museum with the same slides, the announced subject "On the Trail of the Glawackus-Cave Crawling in Color." In each case I tell about the work of the Society.

At Westfield a charming young woman rushed up and said, "I'm Jack Butler's wife and have been in every cave you described." Butler is a member of the N. E. Grotto, now in the service in Porto Rico (not many Butler, just addressed to Westfield, asking her if she

caves but some, she said). I suggest a line to Mrs. might want to "jine" up herself, or at any rate to ask Jack, in letters to him, to report on any Porto Rican caves.

I think I shall have an article on caves in *Travel* sometime next year. They've asked me to submit photos and sketch. I have plenty pix, I guess. They want a personal story of New England cave work.

Letter from Howe Caverns says they are getting only about 5 percent of their former visitors, now.

Here's a funny one. "The Cave Man," Neville, gave a lecture in Westfield last week, and told his audience he couldn't use or wouldn't use kodachromes because they just wouldn't show colors, so he has his slides hand colored—then I come along and show 'em some brilliant kodachromes of caves! Clay Perry,

Pittsfield, Mass. (1943)

Leading Up to the "Glossary"

Your recent letter concerning the proposed glossary of speleological terms has interested me very much, as I have long felt that one was needed. However, I wonder if the compilation of such a glossary would not, at this time, be somewhat premature? It seems to me that many serious problems must be debated, a great many puzzling questions answered, and several preliminary decisions made, before any speleological glossary can pretend to be of any value.

If speleology is to become a "science" in practice as well as in name, it must direct its efforts toward more exactness. Like so many other new sciences, speleology has developed from amateur dabbling and haphazard adventuring resulting from natural human curiosity. The result is that the greatest contributions to cave lore as we know it today have come from a miscellaneous assortment of casual adventurers, tourists, and thrill-seekers. Much of the background of speleology is legend, rumor, and fancy. The older records of cave exploration are in the greatest part exaggerations mixed with flights of imagination. Even some of the more recent reports from amateur cave hunters are couched in very unscientific terms, based on geological ignorance, and replete with faulty observations. This is not intended to malign such reportings, for they are the real spice and flavor of caving. But the results of "spelunking" should not be confused with the findings of "scientific" speleology.

It appears to me that the first order of business for us is a general house-cleaning. We must rid our science of all the useless debris it has accumulated in its casual past. We must decide what our science is, and what it means to accomplish. Have we yet defined just what is a cave and what is not? When we speak of "ice caves" do we mean caves formed of ice (as in glaciers), caves which are rock-formed but containing ice, caves which have periodic freezes and ice-formations, or just caves which have icy temperatures? Are lava tubes to be considered true caves? Is the vent of an extinct geyser a cave? Does the name "stalactite" include lava and ice formations, or is it to be limited to limestone? By marine caves do we mean caves on shore-lines developed by wave action, inland caves formed by prehistoric tidal action, or caves formed under water on the ocean floor? And so on, ad infinitum.

Practically all of the cave terms used at present are ambiguous. The establishment of a glossary, merely as such, would serve no purpose, unless the definitions were scientifically sound and in accordance with some universally recognized system of classification.

It is my opinion that before we can achieve a glossary of terms, we must arrange our science according to a system of classification, such as is used in other sciences. We must arrange speleological phenomena in some kind of order, and then define our terms in relation to it. For instance, the word "grasshopper" is the layman's vague term for the more specific scientific name expressed in relation to this particular insect's class, order, genus, and species. So, too, any speleological term, unless it fits into the general order of relationships adopted, will remain vague and doubtful in meaning. It follows logically, then, that the establishment of the general system of classification must preceed, and not follow, the definition of more specific terms.

Some considerable debate and discussion must similarly precede the establishment of the general outline, too, as there is much opportunity of choice. For example, when we set out to divide caves into divisions, we can choose from among many possibilities: (1) divide by type of rock in which cave is formed, i.e., limestone, lava, sandstone, etc.; (2) divide by method of formation, i.e., solution, wave action, lava-formed, etc.; (3) divide by physical structure, i. e. tunnel, fissure, maze, shaft, etc.; (4) divide by size, i.e., length, depth, chamber size, etc.; (5) divide by interior appearance, i.e., the Mammoth Cave (large chambered), the Carlsbad Cavern (formation-filled), the Modoc Lava Beds (conventional lava tube), etc.; and there are doubtless other possibilities.

Once we have decided upon this general division, we are then in a position to invent sub-divisions, and compartments within sub-divisions. When we have fitted any particular cave into its proper classification, we are then able to define its more specific phenomena without the danger of contradicting our definitions of

phenomena in other caves. We can then begin to rid ourselves of such unscientific nomenclature as dripstone, flowstone, ice cave, wind cave, sea cave, etc. etc.

Your proposal to prepare a glossary of terms is nevertheless deserving of applause from every speleologist and "spelunker," as it reminds us all of the great need for it, and may stimulate someone to give serious attention to outlining the structure of our science. On the other hand, unless considerable care is exercised, such a list might also serve to perpetuate many of the myths and ill-chosen names which so encumber us.

I would appreciate learning the results of your inquiries from the field concerning the definitions you listed in your form-letter. Perhaps, armed with that information, a few of us could get our heads together and evolve a system of classification and definition.

Erwin W. Bischoff
Oakland, Cal. (1942)

Your letter answering the form letter and list sent to all members of the Society is discouraging and yet at the same time encouraging. In one paragraph you state that such a compilation is premature and a tremendous task. In another paragraph you state that it is deserving of applause. Mrs. Muma and I fully realize the tremendous scope of such an undertaking and the probable tidal wave of criticism that will follow its publication. We are, nevertheless, intent upon considering and compiling a tentative glossary. Mr. Stephenson, at the last Board Meeting, commented to the effect that the first glossary, in any science, must be considered tentative and should be revised after time and study have proven the terminology.

Your letter, however, is of great interest to us as we too have felt that the terminology of speleology has not only been incorrect in many cases, inadequate in others, but also often garbled. The general house cleaning that you mentioned must necessarily take place after the first list has been published. We are of course contacting and communicating with specialists in the field of geology and biology for the terms used in those fields as well as in speleology. As for common terms or so-called unscientific terms, we honestly feel that in order to satisfy the "spelunkers" these terms should be retained in a working glossary. In this case, however, it is necessary that such terms be standardized and limited in definition.

So much in defense of our glossary. Now I would like to consider a standardization of caves and terminology dealing directly with caves. Your proposed taxonomy of caves may in itself be standardized to fit any scientific classification. In so doing, a division by the type of rock can easily become the class, the division by method of formation becomes the order, and the division by physical structure becomes the family. I would, however, rearrange methods of division 4 and 5 in your letter to make the division by interior appearance the genus and the division by size the species. Other possible divisions would of course constitute other taxonomic classifications. I feel, however, that the methods of division that you have mentioned and that have been analyzed above are not only adequate but entirely satisfactory. As you probably know, caves have already been given a class, i.e., limestone, sandstone, etc. The further classification of these caves can therefore easily be determined. I do not feel, however, that any terminology need be proposed to cover this so called classification. It becomes evident that any report on any cave should include all of the divisions, i.e., the cave is a limestone cave, formed by solution, is the tunnel type, formations scarce and of small size (350 feet). I would like very much to have your opinions and any suggestions on this type of arrangement.

M. H. Muma
College Park, Md. (1943)

I have read the Bischoff letter and Muma's reply. I commend the worship by Bischoff of science but I find myself in quite continuous disagreement with him in this matter of relation to caves. If we follow his plan, it will be to defeat the whole idea and we will get nowhere. His idea is to do the thing right and not do it till it is right. This means that it will never be done. If it were done, it would be wrong anyway. Later workers would marvel at our assurance but not have much respect for our judgment.

Recently I gave Mr. Muma a hastily written idea of my idea of a glossary. The idea back of my letter to him was that I was for the glossary but we should frankly acknowledge that due to lack of knowledge, lack of perspective, lack of correlation of ideas from different sources and a lot of other lacks, we should consider this tentative and subject to revision—something to shoot at.

Let's have the glossary. Let's do a lot of other things. I am proposing to the V.P.I. Grotto that each member write something about each cave trip. It may be speleology; it may be psychology. Let it be something—preferably something simple. Let this be read at meetings and let it be preserved in typewritten form where it will be a permanent record for the amusement or enlightenment of later comers.

R. J. Holden,
V.P.I. Blacksburg, Va. (1943)

PRIVILEGES and ADVANTAGES of MEMBERSHIP
in the
NATIONAL SPELEOLOGICAL SOCIETY

Every Member Receives:

A Membership Identification Card, which secures privileges in many societies and libraries, special courtesies at many commercial caves, and the cooperation of many owners of undeveloped caves both at home and abroad.

The BULLETIN, the only publication in the United States devoted exclusively to Speleology.

A Newsletter periodically, designed to keep members informed of the activities and happenings of the Society.

Every Member Has the Privilege of:

Attending the Annual Meeting of the Society and voting for members of the Board of Governors.

Attending all lectures and educational meetings of the Society.

Attending meetings held by any Grotto of the Society.

Wearing and displaying the Society's insignia.

Access to the Society's Library of books and pamphlets on caves and related subjects, by mail or visitation.

Access to the Society's photographic collection.

Access for research purposes to published and unpublished records and maps of the Society.

Attending field trips sponsored by the Society.

Use of special Society-owned equipment.

Purchasing personal cave equipment advantageously through the agency of the Society.

Using National Headquarters as a temporary mailing address when visiting Washington.

Receiving advertising literature for distribution for promotional purposes.

Proposing and endorsing applications for membership in the Society. .

Using the Society as a medium for publication of original work in Speleology and related subjects.

Every Member Has the Advantage of:

Educational opportunities resulting from pooling of speleological information and experience.

Opportunity for furtherance of individual research through the cooperation of the personnel and facilities of the Society.

The fellowship of those interested in Speleology and the opportunity of contact with outstanding specialists in Speleology and related subjects.

The distinction and endorsement which comes from membership in a nationally recognized Society.

LIFE MEMBERSHIPS

At the meeting of the Board of Governors on June 19, 1943, the By-Laws of the Society were amended to provide for Life Membership in the Society. It is contemplated that eventually the fee for life membership will be an amount not in excess of $100, dependent somewhat upon the amount of the fee for Annual (also termed Active or Regular) membership. However, to encourage our members taking out this new class of membership, and in recognition of the fact that our present comparatively small membership is bearing the burden of getting the Society permanently established, the low fee of $25 was set for those who took out Life Membership in 1943. The wording of the new By-Laws is:

> "Life Membership carries the privilege of exemption from payment of annual dues. . . . . The fee for Life Membership shall be $25 if paid in 1943, and shall be increased $10 each year thereafter provided the fee shall not exceed $100. Members in the Armed Services during the year 1943 may take advantage of the 1943 rate up to and including a period of six months following their release from such Service."

It was further directed that at least one half of all life membership fees be placed in the Reserve Fund.

It is urged that all members who can possibly do so take advantage of this new provision of the By-Laws and take out Life Membership. This will help the Society build up an urgently needed Reserve Fund, and provide funds to improve the quality of our Bulletin.

BULLETIN NUMBER SIX

Contents

Notice to Contributors

This BULLETIN, issued intermittently, is the official organ of the National Speleological Society. In it are published original notes, letters, articles, and papers pertinent to speleology. Unless the sender indicates otherwise, all letters directed to officers of the Society or which are referred to them, may be presumed to be for publication in whole or in part, at the discretion of the Editor. No payment is made for materials published.

The editors do not assume responsibility for the ideas expressed by authors.

Contributions should be submitted to the Editor, but may be sent through other officers of the Society. Contributors are requested to consult the latest issues of the BULLETIN for guidance to style of title, subheads, footnotes, tables, bibliography, legends for illustrations, etc. All text submitted should be original—not carbon—copy, typewritten double-spaced on white paper, one side only, and carry the author's complete name and address.

The Editor cannot undertake to correct other than obvious, minor errors in copy submitted, and reserves the right to return otherwise approved manuscript and illustrations to the author for revision if not in proper, finished form for the printer. If the author so desires, the Editor will prepare the materials and charge the author for the cost of the work ($2.50 per 1000 words). When the amount of tabular and illustrative material is judged to be excessive or unusually expensive, authors may be requested to pay the excess costs. Usually, illustrations in excess of the equivalent (in cost) of one full-page halftone are to be paid for by the author.

Original drawings—not photographs of drawings—should accompany the copy; and, if intended for line or halftone reproduction, should be in *black* ink on white or blue-white paper or bristol board only. Photographs should be glossy prints securely mounted with colorless paste or rubber cement only. More expensive forms of illustration will be at the author's expense.

All illustrations should be submitted with complete legends, typewritten, attached. Drawings should be marked with the author's name; and photographs should be credited.

In order to facilitate prompt publication, one proof will generally be sent to authors in or near Washington. While the editors will exercise due care to see that copy is followed, alterations made in proof by the author may be charged to him at prevailing rates.

Inquiry to the Society regarding exchange of its publications for those of other societies should be directed to the Librarian.

Requests for back numbers of the BULLETIN should be directed to the Corresponding Secretary.

Reprints will be furnished in accordance with the schedule of prices below. Authors wishing reprints should request the number and type desired in advance of printing, communicating directly with the Editor in this matter, and enclosing Money Order for exact amount with their request. Others desiring reprints should request them from the Editor, also, within two weeks after publication of any issue.

COST OF REPRINTS OF ARTICLES IN *B. N. S. S.*

	50	100	150	200	250	Additional 100's @
4 pages	$2.00	$2.50	$ 3.00	$ 3.50	$ 4.00	$1.00
8 pages	3.25	4.00	4.75	5.50	6.25	1.50
12 pages	5.20	6.40	7.60	8.80	10.00	2.40
16 pages	5.45	6.75	8.05	9.35	10.65	2.60
20 pages	7.25	8.70	10.25	11.75	13.25	3.00
Extra costs for covers	2.00	2.75	3.50	4.25	5.00	1.50