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Spelunking in Central Pennsylvania

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The Central Pennsylvanian who is interested in adventure need not cast envious eyes on those unexplored frontiers of Alaska or the Amazon jungle for, practically in his own backyard, there are dozens of unexplored and undeveloped caverns that are capable of producing adventure galore. It may come as a surprise to those who associate cave exploration with a few hardy souls to learn that it is an avocation of many, including business and professional men and women of all ages. In fact, there is a society of cave explorers, the National Speleological Society, with members in more than thirty states and in many foreign countries, and with local societies or "grottoes" formed wherever there are enough members. Philadelphia has had a grotto for a number of years, and one was formed recently in Pittsburgh. A third Pennsylvania grotto may be organized in the near future at State College for the benefit of Central Pennsylvanians.

Speleology, the science of caves, was established only 150 years ago, but already it has many divisions and appeals to many people with diversified interests. Those who study caves for scientific purposes are called "speleologists." Those who explore caves for the fun of it and do not make any recorded observations are called "spelunkers." The more scientifically-minded may speak of their explorations as "caving," but the adventuresome hobbyist likes the term "spelunking" better.

As soon as one crawls through the entrance into a cavern, he is in an entirely different world from that he has just left. First, there is the absolute darkness that must be dispelled with light from a flashlight or carbide lamp. Then the "weather," which outside may vary from a stifling summer day to a chilling winter night, remains practically constant in the cave. The temperature, humidity, and amount of draft found in a particular cave does not vary to any extent, although there may be considerable variation in these conditions between different caves. Cavern temperatures usually range from 42° to 56° F, which is ideal for the exercising spelunker.

In some of Central Pennsylvania's caverns one may walk upright without getting either hands or clothes muddy, and without exerting much effort. This type, however, is the exception, and in many cases these caves have been commercialized. Normally one must crawl on hands and knees, or wiggle along flat on the stomach through narrow passages, or walk bent over like a chimpanzee in traversing caves. The floor may consist of sharp-edged rock, hard clay, wet "gooey" clay, or may even be submerged under water through which one must wade or swim. These are common conditions encountered in the average cave, but spelunkers all agree that these hardships are more than equalled by the thrill they get in finding places where man has never before set foot.

Fig. 1. Spelunking is a great sport.

Contrary to the fears of the uninitiated, limestone caves are comparatively safe, both from cave-ins and falls of roof material. As soon as a crack develops in the roof rock, it is quickly sealed by calcite cement deposited by the ground water seeping through the crack. If a cave has dissolved its way upward until the top is near the surface where there is a zone of fractured rock and soil, there is danger of a cave-in, and the experienced spelunker avoids those spots in caves where there is loose rock that has fallen from the roof.

Possibly the greatest danger in cave exploration is that of becoming lost. It is good practice always to carry a supply of at least two light sources such as flashlights and accessories, candles and matches, or carbide lamps. Also, a piece of chalk or some other marking device is essential for marking the path taken, with arrows pointing toward the entrance. Getting stuck in narrow places is another hazard, but there is usually another member of the party available to pull the stuck person back. Only the impetuous and foolhardy will attempt cave exploration by themselves. With a reasonable amount of attention paid to the hazards of clambering around caves, spelunking can be as safe as tennis or skating or any other surface sport.

Some knowledge of cave geology and, specifically, local geology is extremely useful in the search for new limestone caverns. These are typical features of areas where underground drainage is predominant, being formed by the movement of ground water through cracks in the rock strata below the level of the ground water table. Ground water is slightly acid and capable of dissolving limestone and dolomitic limestone, the former being more soluble. When the ground water table is lowered, the caves become dry or nearly so, which is the prevailing condition in most local caverns today. They are either dry or contain small, relatively sluggish streams that swell during rainy seasons, during which periods they deposit a considerable amount of clay in the caves.

With the lowering of the ground water table, nature begins to fill up the cave. Rain water seeping from the surface along joints in the overlying rock strata becomes saturated with soluble carbonate. When this water reaches the cave roof, some of it evaporates, depositing a small amount of

(Continued on page two)

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TRENDS AND OBJECTIVES

By Dean Edward Steidle

MAN AND NATURE

(Second of a series of five consecutive editorials entitled Humanistic Roots, Man and Nature, Man and Man, Man and Land, Man and Conservation.)

Thinking man has been concerned with his place and purpose in the universe since the time of the earliest Egyptian and Chinese philosophers. Ancient creeds, as well as modern religions and philosophies of life, are concerned with the same problem. While such considerations and concepts have been valuable, theoretical philosophizing and dogmatic concepts are inadequate for a satisfactory solution of world problems of today. The concepts of man and life and their ultimate purpose should be looked for in the relations of intelligent man to man and their relationship to the physical world.

The quintessence of Nature's accomplishment—man—is also the greatest disturber of Nature and the greatest enemy of his own kind. Yet while his spirit and mind defy and overcome natural limitations, his physical self is controlled by the same basic biochemical laws that govern any other form of living matter. This paradoxical duality of human voluntary and involuntary relations to Nature is the source of the perpetual conflict between mind and matter. Therefore, the higher the spiritual evolution and perfection of the individual's mind, the greater and deeper the conflicting elements in their expression; and conversely, the simpler the mind or the mental and spiritual heritage, the less is the individual concerned by the conflicting elements.

The power of Nature seemed absolute to primitive people and the awful inevitability of fate appeared to be far beyond the mere power of mortals. Primitive man, having accepted his fate, was happy in his way and did not attempt to change his destiny beyond the narrow limits imposed by the bleak and forbidding environment in which he lived. He worshipped Nature and attempted to placate the evil spirits by appropriate sacrifices, rather than by challenging their powers. However, since man possesses a brain that is capable of utilizing and directing natural resources and forces sufficiently to change his environment, he is consciously modifying Nature to a limited extent.

When our ancestors domesticated the sheep and realized that corn grows from a seed and can be planted and harvested, they became to a large extent independent of the feast and famine economy (mostly famine) under which they had lived for untold generations. When they invented the wheel and the sail, and discovered how to burn coal and oil and how to smelt metals from ores, they began to possess and apply power in amounts sufficiently large to disturb Nature's equilibrium. It must be realized that dynamic power is abundantly present in Nature and that, in order to modify Nature's equilibrium and even to reverse the course of apparently inexorable natural processes, it is necessary to apply relatively small amounts of directed energy. What is important is to apply these to the proper place and at the proper time. As Archimedes said, "Give me a lever and I shall lift the world."

There are many levers in Nature, and adequate pressure upon the smallest one lifts man to a place where he comes in possession of a bigger lever, and so on. This process of overcoming the influence of natural environment has been going on for thousands of years. The process has accelerated at such a rate during the past hundred years that, at the present time, humanity as a whole seems to be capable of developing enough technological improvements in machines and devices to shape a good portion of the universe according to his own mental pattern. What will this pattern be?

While humanity as a whole may be headed for the stars, technologically at least man as a single individual is still very much at the mercy of natural laws and of his own passions, and his personal fate cannot be weighed in the same balance as that of collective humanity as a whole. This diffe ence between the inevitable desti of one single person and the possib history of the entire race has produc a conflict which, at the present tim is deeper than ever and must be solv if humanity is to survive.

Man as an individual is inseparab from his fellow man, and his ow problems and welfare are integrat with the problems and welfare of th rest of the world.

Man is also an inseparable part Nature. Only in the combined stu of his relationship to his fellow m and his relationship to Nature will find himself.

It is the duty of all of our instit tions to prepare young people for th twofold task. The School of Miner Industries is playing its part by trai ing skilled scientists and technologis to discover and utilize Nature's mi eral resources, to improve mankind material lot, and to develop also r sponsible citizens ready to contribu constructively to humanity's spiritu welfare.

A philosophy of helping others help themselves — this is educatio and may be applied on an individua a community, a national, or an inte national scale. It is not charity; it lead to dignity, self-respect, and a feelin of constructive contribution to th welfare of all.

Spelunking

(Continued from page one)

calcite. When the water falls to th cave floor in droplets, more of it evap orates and more calcite is deposited The accumulation of these small quan tities of calcite on the roof and floo of a cave produces the beautiful "cave stone" or travertine features so ad mired by all. These features includ stalactites, or roof deposits resemblin icicles, stalagmites, or vertical pro jections from the floor, and a doze other types featured in commercia caves.

In searching for caves one shoul locate those rock formations that ar most soluble and, as previously indi cated, limestone formations are muc more soluble than dolomitic lime stones. In Central Pennsylvania th Stonehenge and Axeman limeston formations of the Ordovician syste are known to have sizeable solutio cavities, but so far no large caves hav been found in them. The Carlim, Blac River, and Trenton limestone beds the Ordovician system form a seri in which caves are quite abundan The Tonoloway limestone of the U per Silurian system and the Helde

berg limestone of the lower Devonian system also contain caves.

The approximate outcrop of the Carlim, Black River, and Trenton limestone series has been plotted on the accompanying six-quadrangle map of Central Pennsylvania. Much of the information used in plotting the map was extremely sketchy, and some of it was extrapolated from adjoining areas, so the map cannot be considered as completely accurate. However, it shows the general outcrop of this limestone series and the locations of known caves, with solid dots representing undeveloped caves, and circles representing commercial caves. Armed with this information, the speleologist, spelunker, or would-be spelunker may either visit the listed caves or concentrate his efforts on searching for new caves, many of which are probably awaiting the expenditure of effort on the part of a group of adventurous cave explorers. There is every reason to believe that new caves will be found, for in the past few months the writer has had little difficulty in finding a half dozen unreported caves.

Not all cave exploration is done for the sport of it, for the mineral scientist and engineer are finding valuable information in caves, and these scientifically-minded individuals form a substantial portion of the nation's speleological group. The geologist is interested in determining how, why and when a cave was formed, and how it ties into the erosional pattern of the area. The paleontologist has a good opportunity to study fossils that stand out in relief in the cave rock where the surrounding material has been dissolved away. The mineralogist studies the perfect crystals of calcite, quartz, and pyrite. The zoologist may study the fish, frogs, bats, or other forms of animal life that may be found in the caves. Entomologists may be interested in cave spiders and insects.

Caves may furnish information on groundwater resources that will be valuable to consulting engineers. The study of underground streams may indicate the level of the groundwater table, the variation in the table level in wet and dry seasons, and the general direction of water flow. The quantity of water flowing in underground streams may be important information affecting individual or community interests. Many Central Pennsylvania farmers utilize cave water, and some towns, such as Bellefonte, rely almost entirely on water from cavernous limestone formations.

The Federal Government is very much interested at the present time in caves as possible places of refuge for factories, personnel, and the stor-

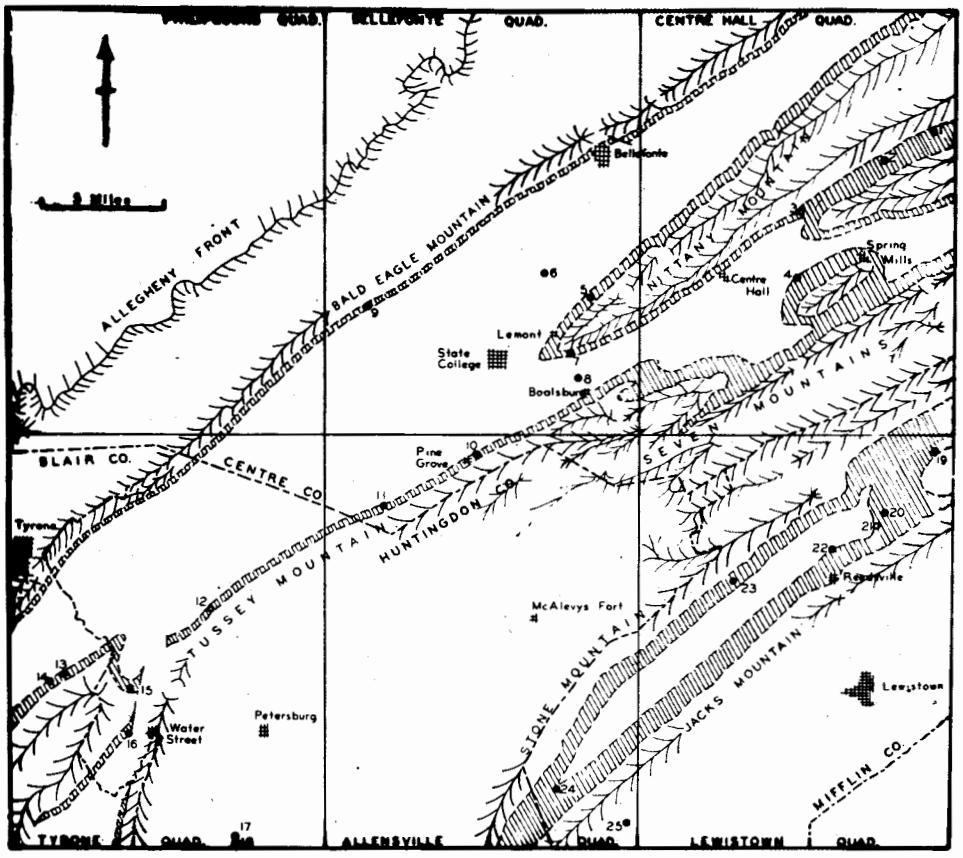

Fig. 2. Map showing location of caves in Central Pennsylvania.

CENTRAL PENNSYLVANIA CAVE INFORMATION

1. Madisonburg Cave.
2. Veiled Lady Cave—was commercialized, but flood waters destroyed the concrete walks and lights several years ago, and it has not been reopened. It has a single long passage with some cave formations.
3. Penn's Cave—commercial.
4. Brukerhoff Cave.
5. Rockview Cavern—a small but interesting cave with some stalactites and stalagmites. The entrance is a vertical opening 25 feet deep. It is the nearest dry cave to State College.
6. "The Rock" Caves—small caves in dolomitic limestone that are reported to open up into a long cavern.
7. Oak Hall Cave—an all-water cavern under the Oak Hall limestone quarry. It is essentially a long passage with a few beautiful chambers on a higher dry level.
8. Boalsburg Cave—a small cave which shows a remarkable development of right angular passages along joints, forming a labyrinth.
9. Buffalo Run Cave—the opening is a large sinkhole located behind the Buffalo Run school. At present this opening is clogged with mud, but legend indicates the cave is quite large.
10. Pine Grove Mills Cave—the entrance is covered by loose rock.
11. Miller Cave—a small but interesting cave that starts in a sinkhole and proceeds downward to an underground stream.
12. Historic Indian Cave—commercial.
13. Arch Spring Cave—located at the end of a sinkhole behind large natural bridge. The spelunker must wade in water through the first room, which has large and beautiful travertine features. To proceed beyond this room, one must dive and swim at least 20 feet under water.
14. Ty-toona Cave—commercial. This is the old "Arch Spring" cave opened to the public in July, 1947.
15. Kooken's Cave—the deepest cavern in Central Pennsylvania, requiring ropes and mountain climbing skill to gain entrance. It is a half mile long and composed of two levels, an upper dry passage and a lower passage carrying a stream. The cave is quite muddy but has some large and beautiful travertine features.
16. Tipperary Cave—a moderate size wet-and-dry cave which shows interesting remnants of a higher water level.
17. Lincoln Caverns, formerly called William Penn Caves—commercial.
18. Hall Cave—in Keyser limestone formation.
19. Aitkin Cave—possibly the finest non-commercialized cave in Central Pennsylvania. It is dry, has large passages of fairyland beauty, and is inhabited by an enormous number of bats which have been studied extensively by Cornell University.
20. Cave near Naginey—not to be confused with the old Naginey Cave made famous by Edgar Allan Poe.
21. Alexander Caverns—commercial.
22. Reedsville Cave—reported to be very deep and difficult to explore.
23. Barrville Cave—small but interesting.
24. Allensville Cave.
25. Rupert Cave.

age of supplies in the event of an atomic war. The suitability of a cave for such purposes can be determined only by a detailed survey, and the National Speleological Society is now urging its members to survey and map the caves they explore, or at least take notes on pertinent information. A few of Central Pennsylvania's caverns have been mapped, but there is still much essential information to be obtained. From present knowledge it appears that some local caverns could house small industries, while the remainder could provide refuge for at least half of the local population.

Those persons interested in caving, either as a science or for the sport of it, may write to the National Speleological Society, 510 Star Building, Washington, D.C., and secure detailed information. As a recreation that combines vigorous exercise, educational interest, and high adventure, the writer recommends it without reserve.

ELECTRON MICROSCOPE DISPLAY

An exhibit entitled "Electron Microscopy" is on display in the rotunda of the M.I. building. It consists of photographs taken with the electron microscope in the high magnification laboratory of the School. The pictures show magnification ranging from 10,000 to 43,000 diameters of clay particles, smoke, the surface of etched steel, and the internal structure of a bacteria cell.

This type of microscope is the most powerful tool yet developed for making minute objects visible to man. It bridges the gap between X-ray diffraction and the light microscope, and is the greatest advancement enabling man to probe deeper into his studies of the unseen world.

A magnification equal to that shown in the photographs would make the head of a pin appear as large as the entire M.I. building.

The exhibit is one of a series of scientific and technical subjects planned by Dean Steidle. The present display was furnished by Dr. T. F. Bates who is in charge of the high magnification laboratory.

DEPARTMENTAL NEWS

Professor Oscar F. Spencer, Supervisor, Petroleum and Natural Gas Extension, has completed recently a revision of the extension textbook, Petroleum Refining, Volume II, which was written by the former supervisor, Dr. M. M. Stephens, and published in 1941. This second edition, which represents approximately 50 per cent revision of the original book, embodies discussions of the most modern petroleum refining practices. It will be available for distribution about February 20.

The Division of Geography was honored recently at the annual meetings of the American Society for Professional Geographers, held in Charlottesville, Virginia, by having two members selected for official positions. Dr. E. Willard Miller, Chief of the Division, who has served as secretary for the past three years, was elected president of the society for 1948. Professor George F. Deasy was re-elected treasurer of the society. Professor Miller presented a paper on "Some Aspects of the Mineral Position of Eight Principal Industrial Nations." Professor Deasy presented a paper on "Topographic Regions of Manchuria."

Dr. Frank M. Swartz, Chief, Division of Geology, attended the meetings of the Geological Society of America and the Paleontological Society h at Ottawa, December 28-31, 1947. served as co-chairman of the sess on micropaleontology, and was elected treasurer of the Paleontolo cal Society.

Dr. Harold J. Read, Division of M allurgy, presented a paper on mic hardness measurements and their plication to electroplated deposits the Tenth Annual Educational S sion, Grand Rapids, Michigan, Bra of the American Electroplaters' ciety on January 24, 1948.

Dr. Hans Neuberger, Chief, Di sion of Meteorology, was recently pointed by the Army-Navy-NRC sion Committee to serve as a memb of the newly formed subcommittee Visibility and Atmospheric Optics. was appointed also to serve as tec nical editor of "Weatherwise," t new bimonthly magazine of the Am teur Weathermen of America.