The Journal of Spelean History

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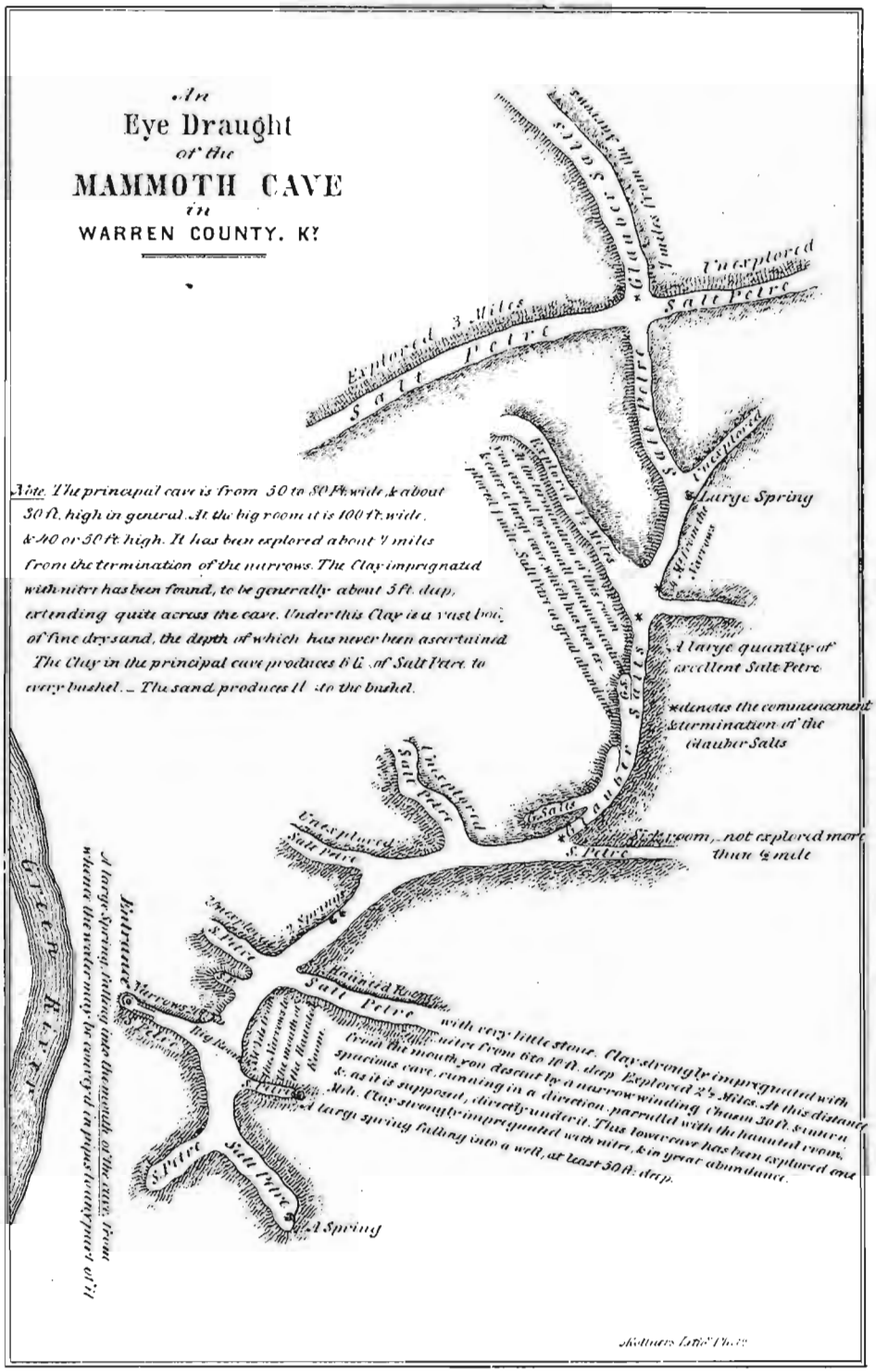

Vol. 1 No. 1 Winter Quarter 1968

ABOUT THE ASSOCIATION

The American Spelean History Association is newly chartered as a non-profit corporation for the study, dissemination and interpretation of spelean history and related purposes. The articles of incorporation, by-laws and business matters are to be found elsewhere in this issue. All persons of high ethical and moral character who are interested in these goals are cordially invited to become members.

ABOUT THE QUARTERLY

The Association anticipates the publication of the Journal of Spelean History on a quarterly basis. Pertinent articles or reprints will be welcomed. As a photo-offset process is in use, articles should be submitted in a form which can be photographed for direct use, i.e. single spaced, on 8½ x 11 paper and with adequate margins. Submissions of rough drafts for preliminary editing is strongly recommended. Line drawings are no problem; photographs require special handling and the editor should be contacted. Dark clear xerox copies of books, etc. reproduce well.

ABOUT THE COVER ILLUSTRATION

In the Filson Club History Quarterly, Burton Faust recently demonstrated that a different drafting of this map was in existence in 1811; it is therefore the earliest known use of the name Mammoth Cave. On June 11, 1811, Thomas Law asked E.L. DuPont for a copy of this map for Albert Gallatin. Gallatin then was visiting back and forth with Thomas Jefferson, so it is not surprising that the map later turned up in the 1853 edition of Jefferson's Notes on the State of Virginia. Also see colloquy section of this issue.

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IN MEMORIAM

Burton Sherwood Faust: August 5, 1898 - July 31, 1967

Member #237 of the National Speleological Society, Burton explored, studied and photographed caves for over 45 years. Through the years, his main interest in speleology focussed on the historical, procedural, chemical, archeological and cultural aspects of spelean saltpeter mining in the United States. Clearly the world's leading authority thereon, his many papers include The tools and equipment of the saltpetre miners (N.S.S. Bulletin 17: 8-18, 1955), Notes on the subterranean accumulation of saltpetre (presented at the 1950 meeting of the American Association for the Advancement of Science and reproduced in this issue as an illustration of then-current knowledge on this topic), History of the development of the chemical processes involved in the recovery of saltpetre from the earth of caves (presented at the 1965 meeting of the American Chemical Society) and The history of saltpetre mining in Mammoth Cave, Kentucky (a four part article published in the 1967 issues of the Filson Club Historical Quarterly). At the time of his death he was preparing a book on spelean saltpeter mining; it is understood that Wilda Faust is completing this, Burton's magnum opus.

Few of those of us who were privileged to know Burton were wholly familiar with his varied career. Born in Belle Plaine, Iowa, he graduated from Iowa State Teachers College and received his M.A. from the University of Virginia and also attended the University of Chicago. For twelve years he taught science and mathematics in Florida high schools and in summer at the University of Miami. He served as a marine in World War I and worked five years as master mechanic in public utilities construction and service. He spent 24 years as patent examiner of the United States Patent Office, retiring December 30, 1965.

Some of Burton's activities included service as NSS Administrative Vice-president for 8 years and as chairman of its Richmond and District of Columbia Grottos, its national convention chairman and also chairman of its old Program and Activities Committee. He actively promoted the N.S.S. Library and the International Salon of Speleological Photographic Arts and was a member of the Cave Research Foundation. Outside of speleology, he was a charter member of the Florida Academy of Sciences and served as its treasurer and member of its administrative council; also as chairman of the south Florida branch of the American Association for the Advancement of Science. He also was a member of the American Association of Historical Societies and a 32nd degree Mason.

One of Burton's outstanding, yet little-known achievements was his securing the manuscripts and photographs of the late Russell Trall Neville, "The Cave Man" of the 1920s. It is understood that they will be indexed and filed in the archives of the Cave Research Foundation. A sample from the Neville manuscripts is published in this issue as an illustration of this important historical material.

His loss is great.

NOTES ON THE SUBTERRANEAN ACCUMULATION OF SALTPETRE

By Burton Faust

From a vast fund of material it appears possible to draw some conclusions concerning the physics, chemistry and bacteriology involved in the formation of saltpetre in caves. There seem to be great differences of opinion between geologists, bacteriologists, agricultural chemists and others who, by profession or avocation, have a degree of interest in the problem. The statements and conclusions which follow comprise a partial discussion of the facts and opinions upon which those conclusions are based.

Only some of the theories and ideas that have been advanced will be discussed to a limited degree. The author will indicate points of weakness, and will promulgate a theory to explain the presence of nitrates in caves. It is recognized that this is a controversial subject and any one who attempts to interpret such facts as are known sometimes finds himself in a position similar to that of the astronomer who theorizes about the apparent canals on Mars. The mere fact that different ideas have been advanced to explain the same or similar deposits must be accepted as evidence that the subject is controversial.

Saltpetre is found in very widely distributed natural deposits. Among the earliest known deposits and those from which usable and commercial quantities were obtained are as follows: plains in Spain; chalk deposits near Eureux in France; the nitre caves of Ceylon; grottoes of Mont Hamberg, in Germany. The calcareous soil of Molfetta, Italy, Turkestan, Hungary, the Ukraine, and Podolia furnished Europe large amounts of the salt. It was obtained from the valley between Mount Sinai and Suez in Arabia. Persia and India both contributed this important material.

It appears self-evident from the above that the recovery and refining of saltpetre, the incident trading in and transportation of the product, as well as its utilization and consumption resulted in a large amount of activity in the commercial, military, and industrial world during the middle ages.

Our present concern is not with these phases of the problem or with the world wide distribution of saltpetre, but is directed to such deposits in caves, particularly those found in the Appalachian Region of this country.

Of the nitrate minerals only nitrocalcite is of present interest. This nitrocalcite, nitrate of lime, or calcium nitrate is often found in the form of white or grayish tufts, or masses, or as crystals interspersed with cave soil.

Some authors have stated that the accumulation of saltpetre in caverns is the result of the action of putrifying bacteria in the decomposition and oxidation of excreta and other animal by-products and remains.

There is another phase of this problem that has a slightly different aspect to which attention is now directed. From about 1300 to 1700 a great share of the world's supply of saltpetre was obtained from rotting compost heaps. These artificial nitrate beds were made by a mixture of any and all kinds of organic waste material kept moistened with urine or water and maintained in an alkaline state by adding available limestone, plaster, or any other material of similar

basic nature. An excellent discussion of this method of obtaining saltpetre has been prepared by Leather.[1] A further consideration of this topic will be found in a resolution[2] passed by the Continental Congress July 28, 1775.

Certain writers go so far as to make the more or less broad and sweeping statements as follows:

> "There is no doubt that the nitrates in the caves originate in an exactly similar way. Caves or cavernous ledges are the natural refuge of all sorts of animal life, including insects, birds, reptiles, and many of the larger animals. In these recesses they leave not only excrementa but bits of their food, hair, bones, flesh, and even grains, mixed in a soil that is often light and porous, and may be filled with twigs and dried leaves. This is probably stirred by the coming and going of the cave denizens. Parts of these recesses are often damp with ground moisture or with wind blown storm water, or mist, and when damp, and at the same time warm, they are in an ideal condition to promote the activity of the nitrate-forming bacteria. Thus it is easy to account for the accumulation of saltpetre or nitrate salts in caves and in cavernous recesses of rock ledges."[3]

The superficial way many persons have of dismissing any serious discussion and taking for granted a preconceived idea of the manner in which the saltpetre deposits get into caves is illustrated by the following remarks which apparently are based on casual observation:

> "It is generally known that the earth in these caves contains the nitrates of lime, potash, and other salts. The numerous caves which have been found in the Cumberland Mountains and other parts of Tennessee, have been very productive of the nitrate of potash. In the investigation of the causes which have given origin to these salts, it may be recollected, that wild animals burrow in these caves; that when pursued by the hunter, they make them places of their retreat, and probably die there; that the aborigines have made them a place of burial; and that streams of water which flow through them in wet weather, carry with them not only great quantities of leaves but many other vegetable productions."[4]

While wild or predatory animals do use caves to a very limited extent, no amount of evidence has been found to substantiate the contention of wide use. It is believed the presence of animals in caves may be attributed to fear of enemies rather than seeking shelter. Animals, in general, prefer the burrow or small grotto type of shelter. Furthermore, no appreciable amount of evidence of the past or present peregrinations of animals in the vicinity of saltpetre bed deposits has been observed by the author.

Numerous cave burial places have been studied but there appears to be no correlation between such and the presence of saltpetre.

No instance is known to the author in which any cave stream, whether it had an underground or surface source, has or does flow through or immediately close to a saltpetre bed. There are several reasons for this fact. First there very probably would be no soil in which the saltpetre might lodge since a flowing stream would have wash-

ed such dirt, or, as some writers call it, the caput mortum, out of the cave or piled it in compact layers in some lower section of the cave. Second, the nitrate mineral compounds are so soluble that they would be carried, from any clay beds, completely out of the cave; this was the manner employed, under control, of extracting the calcium nitrate from the petre dirt. Third, all saltpetre deposits that have been observed, inspected, and studied by the author have been deep underground, a considerable distance from the surface and free of any evidence of running or percolating water for many years. Thus running water seems to have had a negligible part to play in the production or deposit of the saltpetre.[5]

Another known natural process of nitrogen fixation occurs when the nitrogen oxide base of nitric acid is formed in the air as a result of lightning discharges. Generally there is sufficient ammonia in the air or dissolved in rain to combine with all the nitric acid so formed. The ammonium nitrate which results eventually reaches the earth.

Another phase of this lightening discharge theory has been advanced by some authorities. It has been suggested that the nitrogen oxides formed by lightening discharges that are changed to nitric or nitrous acids and not neutralized by atmospheric-borne or rain-dissolved ammonia will act directly with limestone and thus form the calcium salts.

Another natural source of nitrates is the great quantities of ammonium salts in the immediate vicinity of an active volcano. For example, nearly all reports of the eruption of Paricutin in Mexico mention the great deposits of ammonium chloride found close to active fumeroles.

What appears to be one of the most plausible theories and one which is somewhat generally accepted by authorities is based on combined bacteriological and chemical processes. It has been discovered that certain kinds of bacteria not associated with plants have the property of being able to fix nitrogen.

An abstract from one of the earliest statements advancing this bacteriological theory is given below:[6]

> "Professor William B. Rogers remarked that from his observations in the caves of the Middle and Southern States, he was satisfied that the earthly deposit containing the nitrates, known in some places as Petre dirt, was chiefly derived from the overhanging and adjacent rocks, and not from sediment brought into the cave by existing or former streams. . . . As to the production of the nitrates with which the Petre dirt is more or less impregnated, Professor Rogers thought it could not, in any large degree, be referred to the excretions and other remains of animals occasionally found in these caves since the quantity of nitrogen required for this purpose far exceed such a means of supply. Besides this, the nitrates are found in the earthly mass while it is still adhering to the roof or walls and far removed from the organic matter supposed to be buried in the floor. Nor can we regard the nitrogen as chiefly derived from organic substances in the decomposing rocks. For in the case of some caves producing Petre dirt, the surrounding limestone contains

only a trace of such ingredients. We must, therefore, refer the formation of the nitric acid, and ultimately the nitrates, to mutual chemical reactions between the porus calcareous earth and the contiguous atmosphere."

Mr. John A. Myers[7] in speaking of the work Mr. S. Winogradsky has done states in part:

"Winogradsky has devoted a large amount of time and attention to the study of the nitrifying organisms which convert ammonia salts into nitrates. . . . He has succeeded in isolating and preparing a pure culture of a group of organisms, called by him 'Nitromonas', which he is disposed to consider rather as a group of bacteria than as a single species whose special function is the oxidation of ammonia. . . .He also found that the 'nitromonas' developed normally either in the light or in the darkness, and that they can assimilate the carbon from carbon dioxide in entire darkness. They are able, in entire darkness, to appropriate this carbon from carbonates or from carbon dioxide and cause it to combine with the nitrogen to form organic matter, without the aid of sun's rays. He believes that some sort of an amido compound is produced at the expense of the carbon dioxide and the ammonia. These chemical changes developed by the nitromonas, differ materially from those which occur with chlorophyl. In the action of chlorophyl, carbon dioxide is decomposed by the sun's rays, the oxygen liberated, and the carbon united with the hydrogen and the oxygen to form carbohydrates, but the investigations of Winogradsky indicate that the nitrobacteria, instead of decomposing the carbon dioxide and setting oxygen free, effects its union with ammonia and makes use of the oxygen of the air to oxidize the nigrogen to nitrous and nitric acids, the energy for this change being supplied to them from the oxidation which they bring about."

Another phase of this problem is discussed in a summary of additional studies by Winogradsky and Omeliansky and is reported as follows:[8]

"The activity of the nitrifying organism is retarded or even entirely stopped by the presence of small quantities of organic matter; the nitrous bacillis is more sensitive in this respect than the nitric. No doubt this retardation plays an important part in the transformations of the nitrogen in the soil. The denitrifying organisms convert nitrates into ammonia and then into free nitrogen, but they can act only in the presence of sufficient organic matter. So long as organic matter is present, the organic nitrogen is converted into ammonia, and nitrification cannot take place; but when the organic matter has disappeared, nitrification begins, and the denitrifying bacteria cannot destroy the nitrates produced. The nitric organism does not come into play until all the ammonia has been converted into nitrite; ammonia is fatal to the activity of the nitric bacillis."

In some of the studies[9] conducted by Mr. Wm. P. Headden some very startling conclusions are offered. The study will not be reviewed since it is easily obtainable.

An interesting sidelight on this bacteriological theory and more than a hint that early men of science suspected that some strange phenomenon was transpiring, is evident for Dr. Samuel Mitchell[10] reports in a discussion of saltpetre caves the following conclusions:

> "When the earth (from the caves) has been letched with the vegetable alkali (potash) and deprived of its acid, it is common for the men to replace it. For experience has taught them that if put back again into its former situation, it renews its salt-petrous quality in about three years. Being impregnated after lying that duration of time with another supply of acid, it is fit to be treated once more with wood ashes, for the purpose of forming a second portion of saltpetre. There seems to be no end to the possible repetition of these processes, of extracting and regenerating the acid ingredient of the salt."
>
> "Men of science may theorize and speculate on these remarkable facts. It seems difficult, in the present state of our knowledge, to explain how either the acid or the alkali should be spontaneously formed by synthesis, in those dark and rocky caverns. But before this can be done, we must acquire a knowledge both of the acid and alkali which constitute saltpetre, much more intimate and profound than the modern chemists possess."

The present day chemist, bacteriologist, physicist, engineer or other scientists are oftentimes prone to regard some of the early men of science as freaks, alchemists, astrologists of just plain charlatans. They seem to disregard the fact that many of those early scholars had just as high a degree of intelligence as the man of today. The only difference was in extent of background and a much lesser fund of knowledge and information from which to draw. Those men as illustrated in the above extract from Dr. Mitchell's writings must be given credit for keen powers of observation and the ability to so govern their procedures and conduct as to utilize the observed facts. While they might not have known why the saltpetre dirt would revive itself, they did utilize that property to their own advantage.

At one time the attempt was made to explain the production of nitrates in the soil on the basis of oxidation of organic matter. Whether the nitrates are thus produced; or produced by the action of nitrogen fixing bacteria in legumes as host plants; or by the tiny amounts resulting from the discharge of lightning, or by volcanic or mineral sources, there is a tendency for them to accumulate in the soil unless they are washed away by rain water. The accumulation of the nitrates in a cave thus became a mechanical problem. The mechanics of accumulation have been discussed in considerable extent by Ross,[11] Nichols,[12] and Hess[13] and will not be considered at present.

Since all nitrates are water soluble such accumulated material is bound to be found in percolating water. This property is well known and certain authorities[13] have advanced theories based on this fact to explain the occurrence of nitrates in caves. Now, if as advanced, the water as it percolates through the soil is intercepted by an open cavern, and the air movements within the cavern are such that the water transported minerals will be left behind, deposits will be accumulated on the cave floors and walls. On this basis it appears reasonable that nitrates should occur in all caves in which

the proper balance of humidity and air movement are maintained. Analysis, observation, and past history have shown a wide distribution of such deposits but the presence of saltpetre is not universal.

Some of the questions that must be answered satisfactorily before such an explanation can be accepted are as follows:

1. If the same water that dissolves the nitrates will concurrently dissolve limestone, why are there not nitrate-bearing stalactites, and why is there not nitrate-bearing flowstone found in saltpetre caves?
2. If the nitrates are brought into caves by percolating water how can one explain the fact that the distribution of saltpetre in the "petre dirt" appears substantially uniform in both areal extent and vertical depth?
3. If percolating water serves as a vehicle for nitrates how can one explain the fact that petre dirt was mined from passages and grottoes so filled as to prevent air circulation which is necessary for continued evaporation?
4. If ground water serves as a means of transport for surface produced nitrates how can one explain the fact that the author has never discovered or observed a petre-dirt bed that shows any evidence of water percolation through the cavern roof above the deposits? Such evidence of past water action as has been observed apparently took place before the petre-dirt beds were deposited.

Certain authorities have stuck to the theory of the decomposition of animal excreta and remains as a source of nitrates in the cave soil. In this instance also there are certain questions that must be answered satisfactorily before this theory can be accepted. For example:

1. If bat droppings have furnished the nitrogenous matter why is it that bat rookeries generally are highly localized in the caves and the "beasties" do not appear to roost in large numbers in all parts of the cave? It does not seem reasonable to assume bats have changed their roosting habits through the years.
2. If the bat-roosts are local arrangements, as appears to be the case, why are the saltpetre deposits spread so uniformly as analysis and past collecting experiences seem to indicate?
3. If bats and/or other animals were the source of cave nitrates how is the presence of nitrates in substantially closed passages and tightly packed grottoes, niches, cracks and crevices to be explained?
4. If animal by-products provide the source of the saltpetre how is the great paucity of animal remains such as bones, hair and skin in or about the beds to be explained?

Since the theory of the formation of cave nitrates from bat guano, the decomposition of animal remains, oxidation and neutralization, has been given wide circulation and is accepted so unquestionably by many writers it is proposed to briefly examine some of the arguments that have been advanced in its favor.

Some cave deposits have been worked for saltpetre at great distances from the surface entrances. For example, the tremendous deposits in The Hall of the Mountain King, in Sinnit Cave are over 1,200 feet from the entrance. While there probably is a shorter route as

the bat flies, the author has never been able to see any evidence that bats had at any time roosted in the immediate vicinity of the petre deposits. Reports indicate that Mammoth Cave was worked at a distance of over five miles from the mouth of the cave. Other instances might be cited of great distances from cave entrances to nitre deposits but the above are considered sufficient to make the point. Analysis and reports seem to substantiate the statements that the concentration of the nitrates is substantially uniform over the whole of the beds. The numbers of bats that have been observed at any great distance from the entrances of saltpetre caves have been comparatively small. However, that in itself does not necessarily imply anything of particular significance since bats could have migrated or changed their roosting places. Furthermore, it does not appear reasonable to assume that all the hair, toenails, bones and other stable remains would have become so completely disintegrated that much smaller amounts of organic remains are found than would reasonably be expected. Nichols[12] has an excellent discussion of this phase of the problem.

The nitrates are found in some instances in the earthy masses still clinging to the ceilings and walls of passageways that were originally, from all appearances, completely filled to the ceiling with the petre dirt. For example, certain passages in Breathing Cave and Clark's Cave and almost the entire intermediate level of passages below The Hall of the Mountain King in Sinnit Cave are instances the author has particularly studied and observed. The material clinging to the ceiling is far removed from any organic substance that might be in the soil underfoot. The author has seen many instances in old saltpetre diggings in which pockets, small grottoes, cracks, crevices, crannies, shelves and filled passage-ways have been scraped clean to recover petre dirt. It is considered safe to assume the early miners were not going to carry nonproducing dirt from the caves. It is not believed possible to explain such deposits by the bat-guano theory.

Another minor angle of this problem seems to be involved in the matter of the capacity of the bats to do the job with which they have been credited. The task of providing the vast amount of raw material from which the thousands of tons of saltpetre obtained has been recovered would have been a tremendous job for the bats. This seems to approach too closely to harboring the belief and expectation that the family pet dog could have built the Panama Canal by scratching for squirrels.

The author is of the opinion, however, that there is another method, to which too little attention has been given, that might account for a much greater volume of nitrate deposition than all the popular theories combined. This method is discussed below to a very limited extent.

As one reads the older literature, in which the procedures in mining, recovery, refining, and utilizing saltpetre are described, statements repeatedly appear describing the return of a leached soil to the caves where after a period of about three years it could again be treated and additional saltpetre recovered from the same soil. Craig[14] reports that such procedure was not unknown and suggests that dirt be carried into caves, spread, and left to become charged with nitrates.

As stated above Winogradsky discovered that certain nitrifying organisms are capable of producing organic matter from the carbon dioxide, ammonia and water vapor in the air without the necessity of

having sunlight present. It was further discovered very early (circa 1860) that it was necessary to actually have soil present in order to produce the fixed nitrogen. Such reactions appear not to have been possible without the mysterious catalytic action of the soil.

The possibility that nitrogen fixing bacteria exist which have the ability to produce fixed nitrogen in the form of nitrates directly from inorganic elements and compounds is a question to which it appears very little attention has been given. Based on the observations and reports of early scientists, such as Dr. Mitchell, Wm. Barton Rogers[15] and studies such as those conducted at the Colorado Agricultural Experiment Station, to which reference is made above, it would appear that this method of fixing nitrogen must be considered very important. Of course, the main reason so little attention has been given to the deposits of cave saltpetre during recent years is probably due to the fact that the economic need of the product has not warranted the necessary expense involved. The fact that the action of these non-symbiotic nitrogen fixing bacteria are fairly well understood and that the circumstances under which they will live and function approximate very closely the ambient conditions in a cave make it necessary to consider this very pertinent source of nitre. The necessary conditions which seem to promote the growth and activity of these bacteria are found in every saltpetre cave the author has visited. These are: a uniform temperature, good air circulation, relatively low humidity, heavily alkalized loose and porous or semi-porous soil, and freedom from running, dripping or flowing water.

REFERENCES

[1]Leather et al, "The Indian Saltpetre Industry".
[2]"Several methods of making saltpetre recommended to the inhabitants of the United Colonies by their representatives in Congress."
[3]H. S. Gale, "Origin of Nitrates in Cliffs and Ledges", Min. and Sci. Press, Vol. 115, pages 676-678, Nov. 10, 1917.
[4]Kain, Am. J. of Sci., 1:65, 1819.
[5]Since the above was written information has come to the author that certain saltpetre caves such as Julian's and McFerrin's do have at the present time running water closely adjacent to the old workings. Wm. E. Davies has reported that he has inspected certain caves in which the saltpetre deposits are relatively close to the entrances. However, it appears safe to assume such deposits were not affected to any extent by outside rains, snow, or wind-blown water.
[6]Proceedings of Boston Society of Natural History, Vol. 5, page 334, 1856.
[7]Proc. Am. Chem. Soc., 21: 464 plus, 1899.
[8]Journal Soc. Chem. Ind., Sept. 20, 1900: 835
[9]Colorado Agri. Exp. Stat. Bull., 155, February 1910.
[10]Med. Rep. 9:86, 1806

[11]"Origin of Nitrate Deposits", Pop. Sci. Mo. 85: 134-145, Aug. 1914.
[12]"Nitrates in Cave Earths", Proc. Soc. Nat. Hist., Boston 5: 334, 1856.
[13]"Origin of Nitrates in Cavern Earths", Min. & Sci. Press, 115: 19, 1917.
[14]"Report on Nitrification", Smithsonian Institute Reports, 1861.
[15]Rogers, "A reprint on the Geology of the Virginias", 1884

NOTES ON EDMUND TURNER

From an unpublished manuscript (ca. 1926) by Russell Trall Neville in the Burton Faust collection.

Mr. Edmund Turner, some knew him as Edwin and some as Edward, and all as Ed Turner, was a civil engineer and a good one, well versed and knowing his stuff according to all local stories. He appeared in the Mammoth Cave country in poor health, alone, poor in worldly possessions, but in the few years spent thereabouts before his untimely passing as a result of his bodily afflictions, he came to be regarded as a first class 'Caver' and as a likeable man. He passed muster with people who quickly detect anything false in human make-up. It was not my privilege to ever meet or greet this explorer and gentleman. He won his chevrons as a master 'caver' from associates who themselves are not afraid of their shadows cast on rocky walls by the fitful flare of a lantern. It is with great regret that I here set down the fact that until too late, I did not know of Mr. Turner. But since his death I hear his name and something of this local fame about the Caves from friends on every hand.

He and Floyd Collins, the educated engineer and the poorly educated Kentuckian, explored further into the remote fastnesses of many of these caves than any other white man. Passage ways echoed to their footsteps never trod before except by sandaled feet of that mysterious race or tribe we now know simply as 'Cave-men'. Days and weeks they roamed these highways and byways shut off from sunlight, dependent upon their own uncanny powers of orientation for guidance, and a strong bond of friendship and admiration sprung up between them.

Mr. Turner made rather a complete scientific exploration and a survey of Old Salts Cavern, - a place I'll say something about when occasion arises. From his studies of the formation of this mighty hole, he arrived at some marvellous deductions.

We are told that he went to a man owning land at a distance of three or four miles from the nearest known point in Old Salts Cave, and told him that he had a cave under his rocky farm, and that he would locate it and break into it from the surface for a half interest in it.

An agreement was verbally made and, the cave discovered according to prediction. The subsequent breaking of faith whereby Mr. Turner was beaten out of his share of the property is a tale often repeated in the neighborhood. This story is not related to renew any bitterness, or to censure anyone, but simply as an evidence of the wonderful ability of this brave, sick explorer.

But Mr. Turner was somewhat more fortunate in another similar undertaking, for he discovered too, the wonderfully interesting Cave now called Dossey's Dome. We have already journeyed down to the banks of Green River below the entrance to Mammoth Cave. It's just a short half mile as the crow flies,

but rather further, counting the up goings and the down goings necessary on the part of human kind.

There we find a little leaky ferry scow, swinging idly on the further shore, a scant hundred yards of deep, green, cold water intervening. Hailing the ferryman, perhaps somewhat in the manner we shall one day hail Charon when the time comes for him to carry us across the Styx, a gaunt, typical Kentuckian responds. Ike Meredith, whose home perches on the steep side of the Knob forming the further shore of Green River, pulls his wet cable from the River bottom, and approaches the muddy landing where we await him.

Safely across, we find that a very rough road separates his house from the River brink, and learn that this is the road from Munfordville, and is travelled by the rural mail carrier who serves the community. Ike is custodian of the key which admits the occasional visitor to Dossey's Domes. Up a steep path from the roadway, through hugh ledges of rock and with boulders all about, we come at last after just a short climb, to a wooden barred door, padlocked and secure against trespass. Through one of the openings between the bars, a pipe carries a constant stream of ice cold water to a convenient place for family use.

Dossey's Domes is not a large cave, as caves go, but consists rather of a series of very beautiful domes and pits. The Wooden steps and platforms making this cave easily traversed, are the work of Mr. Turner. No better engineering or more skilful work is seen in any cave with which we are familiar. This cave is very wet and muddy and somewhat disagreeable to the casual tourist on that account.

Away up near what must be the ultimate roof of the topmost level, a small concrete basin has been fashioned in a niche in the rocks, and this is filled to overflowing from a waterfall trickling down the rocks. This is the source of the water pipe we saw when first we entered the Cave.

There are some very beautiful onyx formations in this Cave. Domes are roofed with curiously fluted curtains of stalactite character. Rooms are draped with rocky curtains and portieres of the same substance. In places there are black onyx columns and pillars, and pendant pagodas, if you can conceive of such a contrivance, of great beauty. It seems hardly fair to call these interesting formations stalactites and stalagmites, because they have pursued a post-graduate course as it were, in acquiring beauty and are surely the aristocrats amongst their humbler relatives.

At one time Dossey's Domes was open for public inspection, but now few people visit it, and it is little known outside the neighborhood.

Ed Turner left a monument no human hands can rival. He discovered for the world at least two beautiful Caverns and one of them is still clearly identified in a happy association with his memory.

REPRINT SECTION

Editor's note - it is expected that this section will be longer and more diverse in future issues; contributions of significant items will be welcome. The following short items were selected in accord with the theme of this special issue.

Imlay, G. 1792. A topographical description of the western territory of North America. London, printed for J. Debrett. p. 122:

"Sulphur is found in several places in abundance (in Kentucky); and nitre is made from earth which is collected from caves and other places to which the wet has not penetrated. The making of this salt, in this country, is so common, that many of the settlers manufacture their own gunpowder. This earth is discovered in greater plenty on the waters of Green river, than it is in any other part of Kentucky. But, perhaps still farther southward, it will be found in greater plenty. However, it is so common in every part of the country that it might be made a considerable article for exploration."

* * *

(introductory note: the following item describing the Le Sueur Mississippi River expedition of 1700 - 1702 has the semblance of a direct extract from Le Sueur's journal. Unfortunately, this journal has not been located - if it exists. Further, it should be noted that even if Le Sueur did record the presence of saltpeter in these small Minnesota caves in September, 1700 - which would be the earliest known record of spelean saltpeter in the United States - this might have been a misidentification of some other efflorescent salt. A little local research might be of great value here.

La Harpe, Bernard de Journal historique de l'etablissement des Francais a la Louisiane. Nouvelle-Orleans. A.L. Boimare etc. 1831. 412 p. also Microcard 1951.

p.48 ...and to the northwest of Lake Pepin, à widening of the Mississippi River, (Wisconson ?) a second prairie of two leagues long and wide; in the vicinity there are a chain of mountains, which a good two hundred foot in height and more than half league in length, will find pleasant caves where nearby bears seek retirement for the winter; there many of these caves will be no longer than forty feet in depth, and about three and four feet in height; some of them are hard to enter and all contain the saltpetre.

COLLOQUY

Patty Jo Watson (1026 Metro Circle, Palo Alto, Calif.) is seeking the date of the collapse of the north entrance of Salts Cave, Ky., in which Pike Chapman was killed. Even indirect references would be appreciated.

Harold Meloy (P.O. Box 454, Shelbyville, Indiana) is seeking the identity of the correspondant who supplied Ebenezer Merian with much information on Mammoth Cave in 1841 -43.

Bill Halliday (1117 36th Ave., E., Seattle, Wash.) would like to know if the cover illustration appears also in the 1828 edition of Jefferson's Notes. It is not in the 1801 edition.

Harold Meloy also would like information on Valentine Simons, first owner of Mammoth Cave.

This is YOUR section; use it as you will.

BOOK EXCHANGE

Tom Meador has an extra 1956 Speleodigest for trading and needs the 1957 and 1958 issues; also Bailey's Aminal Life of Carlsbad Caverns. New address: Box 3216, San Angelo, Texas.

Charles R. Pease, Jr. (907 E. 9th St., Tucson, Ariz. til June 1, then 7 Cadwell Rd., Bloomfield, Conn.) has for trading: Caves and Cave Diving, Caves of Adventure, The Darkness under the Earth, 1000 metres down, The Caves Beyond and Caves Studies #1-11. He wants 1958 Speleodigest, NSS Bulletins 1-7, early NSS News and quite a few books.

Bill Halliday has for trading Helen Randolph's Mammoth Cave and the cave region of Kentucky, Nicholson & Jim White's Jim White's own story, several Casterets, Kunsky's Homes of Primeval Man, Clay Perry's Underground empire. Also other books and many grotto publications, and all spelean National Geographics through 1924. Wanted: Nicholson's booklet on Carlsbad, many grotto publications, many books, NSS Bulletin 2.

John Bridge (206 W. 18th Ave., Columbus, Ohio) has for trading Subterreanean Climbers, 1000 meters down, three Casterets, Hovey 1912 and some mountain books. He wants Cave men new and old, Darkness under the earth.

What about you?

IMPORTANT ANNOUNCEMENT

For the first time, the 1968 N.S.S. Convention will have a section on spelean history. Papers are now being solicited. If you can present a paper or have one read in absentia, please notify Dwight Weaver, Box 272, Osage Beach, Mo.

There will be a formal meeting of the Association during the Convention. Remember that it will be held in August, not June.

ASSOCIATION BUSINESS

The American Spelean History Association was chartered by the state of Washington January 3, 1968 after a formal organizational meeting held December 28, 1967 under Washington state law. Acting president and editor is William R. Halliday, acting secretary-treasurer is Jerome Frahm. The writer (W.R.H.) is not willing to continue as president after the August meeting under any circumstances. The Board of Trustees will be elected just before the August meeting; Tom Meador, Harold Meloy and the above temporary officers have agreed to serve until that time.

It is anticipated that the trustees will serve also as the editorial board, and that most or all association business can be conducted by mail. One question which probably should be decided at the August meeting is whether the Association should apply for sectional status in the N.S.S.

Initial dues of the Association are $5 (regular) or $6 (family); annual subscription is $4.00.

Articles of incorporation of the Association are as follows:

I. The name of the corporation shall be the American Spelean History Association. The parliamentary authority for this corporation shall be Roberts' Rules of Order.

II. The principal place of business of the corporation shall be 1117 36th Avenue East, Seattle, Washington.

III. The term of existence of this corporation shall be perpetual.

IV. The corporation shall not have capital stock. The private property of the members of this corporation shall not be liable for the debts of the corporation.

V. The purposes for which this corporation is formed are as follows:

The advancement of the study, dissemination and interpretation of spelean history and all related purposes permitted under the above Title and Chapter (printed on the form - W.R.H.)

VI. Upon dissolution of the corporation the assets shall be distributed to the National Speleological Foundation in accordance with Section 501 (c) (3) of the Internal Revenue Code. This corporation shall not conduct any activities not permitted to be conducted by an organization exempted under the above code.

By-laws of the American Spelean History Association

I. The government of this association shall be by a board of trustees which shall have full power to conduct and supervise all business of the association, appoint officers for the association and perform all other functions incident to proper conduct of the association.

a. Initially the board of trustees shall consist of the acting president and acting secretary-treasurer. Upon chartering of the association they shall promptly appoint two additional acting trustees who shall serve until the first annual meeting. Thereafter trustees shall be elected annually by mail vote of the membership, except that the board may fill vacancies resulting from death, resignation or other causes.

b. The board of trustees shall consist of not less than four and not more than six regular members of the association. Only one person of a group or family membership shall be eligible for election to the board of trustees.

c. The board of trustees shall apoint such officers as it deems proper and such officers shall perform the usual duties of the offices to which they have been appointed, subject to these by-laws.

d. The board of trustees shall establish membership dues and subscription rates.

e. The board of trustees may issue formal endorsements of books pertaining to spelean history and reprints of literary or photographic works pertaining to speleology. All such endorsements shall be conditional on the reprinter's pre-publication possession of any copyright releases which may be necessary.

II. Regular and special meetings of the Association shall be held at such time and places as may be determined by the board of trustees.

III. Membership in this association shall be open to qualified persons who are interested in the study, dissemination and interpretation of spelean history and who have complied with conditions of membership determined by the board of trustees. The board of trustees may reject any application for membership without stating any reason for such action.

IV. The association shall issue such publications as are determined by the board of trustees. The board of trustees may appoint an editorial board.

V. The association may acquire real and personal property for use by and on behalf of the membership. It may maintain a library for use by members.

VI. Membership in this association may be terminated by (1) non-payment of dues or (2) by action of the board of trustees after due notice to the member.

VII. These by-laws may be amended by a 2/3 vote of the membership or by a 2/3 vote of the membership present at a regular meeting after one month's due notice.