signs refer to it as "Burrow Mump". Whether it is a natural hill or an artificial one is not really known. But our cow "knows" more than she is willing to tell.

When her ancestor took the fabled trip over the moon, we may be certain that she looked back at the earth from her vantage point in space. In fact, we know this because the location of the continents was obviously impressed on her consciousness.

So impressed was the original "cow that jumped over the moon" that she left a record for all her descendants to appreciate. We can view the record even now impressed on the side of the cow that lives on Burrow Mump. You will note that this present day descendant has the MAP OF THE WORLD impressed in her side!

Note that North and South America are shown prominently for all to view. We can see Asia on the left, and Europe and Africa on the right. Everything seems to fit just the way that the cow-astronaut viewed the scene away back then . . . .

The critic will note that there is a peninsula of land jutting out from Africa toward the Azores. No such peninsula of land exists . . . well at least not any more. But dare we believe that when the cow has made her famous jump, this is what Atlantis looked like?

Such a cow hide as this would have been worth its weight in gold to the early explorers. Just think how Columbus would have valued it. Perhaps, St. Brendan had just such a hide on his boat when he travelled to the New World. Perfect security! Who would have believed that it was really a map of the world.

Capt. Cook could have used it too to visit the Hawaiian Islands, although more likely what is shown in the Pacific is the residue of the lost island of Mu. Or as the cow reports it, "Mooooo"!

(Editor's note.) I presume that this item was intended as a joke. Yet, really, is the proposal not about as believable as some of the evolutionary notions about how things which happened to ancestors have affected the descendants?

SOLUTION AND DEPOSITION OF CALCIUM CARBONATE IN A LABORATORY SITUATION III

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Previous work on the conditions necessary for the rapid growth of speleothem-like structures in the laboratory has been reported.[1,2] These results were discussed in relation to possible natural conditions. A tentative model for the formation of limestone caves and possible dripstone formation was proposed.[2] Certain phases of the continued experimental work are reported in this paper.

Amount of Water Available as a Factor in Limestone Cave Formation and Deposition of $CaCo_3$

It was suggested that the amount of water available during and after the Flood would be favorable to the rapid formation of caves in recently consolidated limestone.[3] This view has been strengthened by comments found in various technical articles. Ford[4] considers the volume of available groundwater as a factor in the development of limestone caves in the central Mendip region of England. Franke[5] states that the volume of stalagmite formation is governed by the supply of water. Gardner[6] claims that the rate at which dripstone forms is affected by the amount of seepage water.

In an excellent article on the formation of limestone caves, Thrailkill[7] states

> It will be noted that many of the processes thought to be of importance in cave excavation will operate most effectively *during floods.* (emphasis ours)

Acidity of Water in the Development of Limestone Caves

It was shown in earlier experiments how rapidly acidic solutions can dissolve limestone.[8] It is possible that the remaining Flood waters particularly where the water level was not very far above the ground (shallow-phreatic conditions)† would have been highly acidic due to the decomposition of organic material. This could have contributed to rapid cave formation in limestone. The action of acids on cave formation has been noted previously.[9,10] This may be why the shallow phreatic zone cave development theory is an important concept.[11,12] Thrailkill[13] feels that the dissolving power of water in the shallow phreatic zone is greater than that of water in the deep phreatic zone because it contains more CO_2.

Carbon Dioxide Content of Water

The previous section leads to a discussion of the amount of CO_2 in water which can dissolve and later precipitate $CaCO_3$. It was introduced in a previous report[14] and is included here simply to reinforce the hypothesis. Decaying organic material in Flood waters could provide a good supply of CO_2. Concentrations of CO_2 up to 100 times normal have been measured in humus.[15] The solution of this gas in water is considered

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†Pertaining to underground waters, especially those at or below the water table.

to be quite rapid.[16] The decay of organic material not only provides a supply of organic acids, but also CO_2. Both can dissolve limestone, but it appears that water with organic acids is not effective as CO_2-laden water alone in the precipitation of $CaCO_3$ in a cave.[17]

Cave Humidity and Precipitation of $CaCO_3$

It has been suggested that stalactite growth is possible only in ventilated caves.[18] This means that speleothem growth is greatly retarded in areas of caves where the humidity is near 100%. Gardner[19] claimed in 1935 that in Mammoth Cave the development of dripstone was confined to the higher and drier portions of the cavern whereas only excavation was in process in the lower and damper levels. Subwater deposition is not common in any caves except so-called "crystal caves".[20]

An experiment was run to check this concept. Distilled water charged with CO_2 was allowed to run over Beekmantown dolomite. The water then dripped down strings which were completely enclosed in an airtight plastic container. Water was allowed to stand in the bottom of the plastic container. The disassembled experimental rig is shown in Figure 1. The empty solution box (plastic cube) can be seen on the top. Strings suspended from this box hang down in the plastic buckets that are taped together. Slits covered with transparent plastic material allow for observation of the strings during the experiment run. No moisture escapes from the apparatus as 100% humidity conditions are maintained. A heat lamp was directed through the large piece of plexiglass sheet at the bottom of the rig to encourage the precipitation of calcium carbonate.[21]

The test was run for 500 hours and 75 liters of water dripped down the strings. The strings were examined at the end of the test and found to be covered with a loose powdery, clay-like material. A total of 1.463 grams of deposit was found on 12 strings. There was no evidence of $CaCO_3$ precipitation. Thus it is felt that the precipitation of speleothems in very wet areas in unventilated caves is highly unlikely.

Presence of Ammonia and Precipitations of $CaCO_3$

Weeks[22] cited evidence to show that the decomposition of nitrogen-bearing substances, such as proteins, release ammonia or amines, increasing the pH of water which would favor the deposition of $CaCO_3$. It was decided to run an experiment to test this hypothesis. The same experimental rig shown in Figure 1 was used except that the heat lamp was removed.

Ammonia was admitted into the base of the apparatus. NH_3 was generated by dropping sodium hydroxide solution on ammonium fluoride powder. The rate of addition of the hydroxide was controlled to allow the slow release of ammonia into the string area of the experimental apparatus. A schematic diagram of the complete apparatus is shown in Figure 2.

Considerable experimental difficulty was experienced in this test. The strings were not securely attached to the solution box so that considerable water passed over the strings unnecessarily. Too much passage of water (similar to a continual fine stream) compared to the

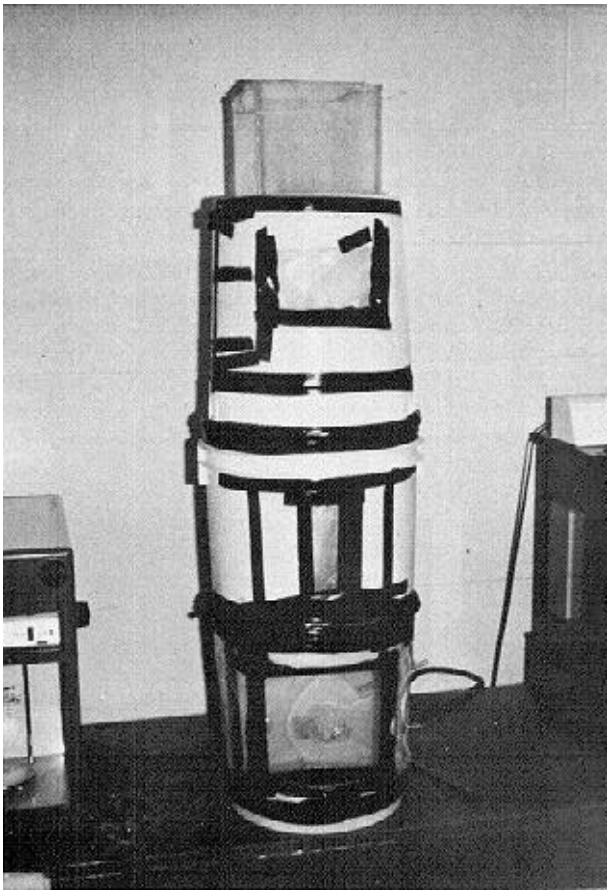

Figure 1. Apparatus used to ensure a wet environment around the precipitation area.

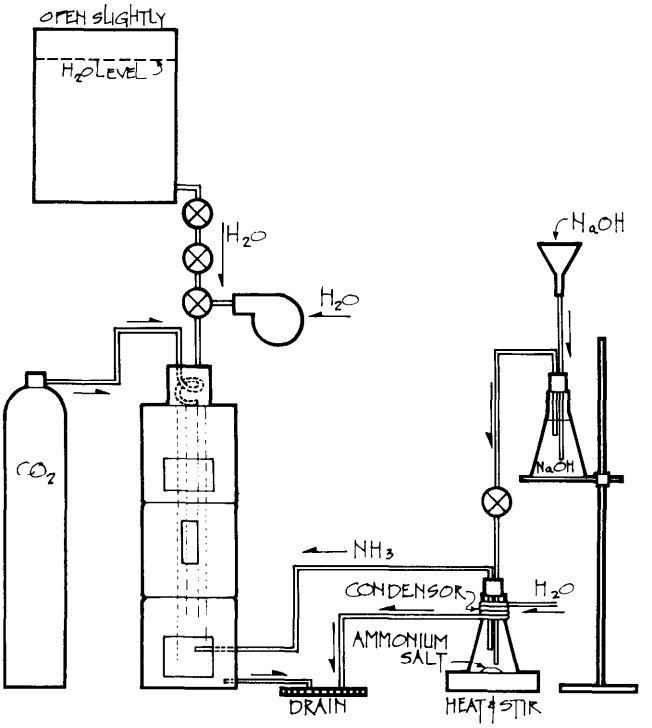

Figure 2. Schematic view of the apparatus used to provide the wet environment, and also the atmosphere of ammonia.

maintenance of a thin film of water on the depositing structure may have had an adverse effect on the growth of $CaCO_3$.[23]

1260 liters of water passed over the strings in 501.5 hours. Even under the excessively humid conditions some calcium carbonate did precipitate particularly on the upper part of some strings. The experimental results are tabulated in Table I. Thus it appears that even under very humid conditions, with ammonia present in the atmosphere, the precipitation and subsequent slow growth of dripstone may be possible.

Crystalline Form of Deposited $CaCO_3$

The crystal structure of the precipitated calcium carbonate from a previous experiment[24] was determined. The precipitation occurred from water at 45 °C to solid material at 50 °C. An x-ray diffraction analysis revealed that the deposit had the crystalline form of aragonite. It is known that the aragonite form of calcite does precipitate in warm water highly saturated with $CaCO_3$.[25] However it has been found that when calcite is ground dry in a mechanical mortar at room temperature it changes to aragonite.[26] Also Wallis claims that mixtures of calcite and aragonite can be deposited at temperatures between 30 and 90 °C.[27] Based on these uncertainties further x-ray diffraction analysis will be done.

Precipitation by Chemical Action

The deposit mentioned in the previous section could have been formed either by evaporation of the water or through chemical action by the loss of CO_2. If evaporation occurred, the deposit should contain both calcium and magnesium carbonate since the limestone in the solution box was dolomitic in nature. An EDTA titration analysis of the deposit revealed that all of the carbonate present (99.27%) was $CaCO_3$. Also a qualitative magnesium determination using p-nitrobenzene-azoresoricinol yielded negative results. Therefore it is concluded that the deposit formed by means of chemical precipitation and not by evaporation.

Discussion of Results

In the work mentined in this report and in previous experiments[28,29] it has been shown that under certain conditions in the laboratory rapid precipitation of $CaCO_3$ can be attained. If these conditions existed in the natural state, it is conceivable that speleothems could have developed rapidly in limestone caves.

It has been noted previously by scientists who are not creationists that present rates of stalactite and stalagmite growth in limestone cannot be used to assume ages for these structures. Franke[30] states

> If an attempt is to be made to date stalagmites it is important that the results obtained should be reliable, and it is always necessary to estimate the magnitude of any simplifications made in formulating the theory. As has been shown in this paper an approximation to the rate of growth can be attempted in the case of simple candle-shaped stalagmites where near constant conditions of growth can be assumed. Indiscriminate application of the growth theory, however, is likely to yield false results. In each individual case it is essential to assess whether growth did in fact occur under ideal conditions. Theories of stalagmite formation in their present form cannot therefore be adapted to routine measurements of age or growth rates.

Gardner[31] writes

> In some cases, stalactites and stalagmites in the top most levels of a cavern may approximate the age of the cavern itself, having been produced in a stage of its youth; others are younger. Their beginnings may spread over nearly all periods of the cavern's history. In many instances they are still growing, and new ones are being formed as the years advance. Hence they are not dependable in determining the age of a cavern. The rate at which dripstone forms is a variable factor, due to changing circumstances; it depends on the amount of seepage water, the quantity of carbonate in solution and the rate of its precipitation. It is a common practice to attempt to fix the age of dripstone by the rate at which it forms, but this is plainly a valueless calculation. It invariably results in fixing the age of a stalactite or stalagmite in proportion to its size; the largest will be the oldest and the smallest the youngest. For example, in Carlsbad Cavern at the present time, the management maintains a large sign on an immense stalagmite, stating that it is estimated to have an age of 60 million years. Guides give the information that the calculation is based on the rate of so many cubic inches per year at which such dripstone formed. The writer believes that such signs should be removed by the National Park Service as being misleading to the public.

Thus neither creationists nor uniformitarianists should use laboratory or field information on dripstone to claim an age for them. However as creationists we can point to various conditions under which these structure can grow rapidly.

The growth of dripstone on portland cement structures must be handled with care.[32] In an excellent creationist study[33] Helmick, Rohde, and Ross pointed out that the aging process in limestone will affects its solubility in water. This in turn will affect the deposition of $CaCO_3$ structures. What are the solution properties of "young" limestone? A creationist study on the formation of this material is desperately needed.

Table 1. Deposition of $CaCO_3$ from a solution of water and carbon dioxide at 25 °C. Test time 501.5 hours, 1260 liters of water passing through the apparatus.

String	*Mass of Deposited $CaCO_3$ (grams)*	*Rate of Deposition (grams of $CaCO_3$ per year per liter of water)*
1	0.0292	
2	0.3730	
3	0.2427	
4	0.3391	
5	0.0344	
Total deposition	1.0184	0.0141

It should be noted that "aged" limestone has been used in this study. Under proper conditions the growth of laboratory dripstone from this material is quite rapid. Many instances can be noted for the quick growth of dripstone on portland cement objects[34,35] which may have similar chemical properties as "young" limestone. Therefore it appears that predictions of fast-growing dripstone based on creationist model is a valid theory.

Future Work

Work will continue on conditions favorable to the rapid growth of laboratory dripstone. It is desirable to test the effect of changing pressure, but difficulties dealing with the experimental apparatus have been experienced. Hopefully these can be overcome, and some experimental information can be obtained. It is hoped that other variables can be tested as well.

Acknowledgments

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NOTICES OF BOOKS

Foundations of Electricity and Magnetism, by Thomas C. Barnes, Third Edition, 1977. Published by the author at 2115 N. Kansas, El Paso, Texas 79902. xi + 413 pages. While we have not often reviewed textbooks on Physics, this one is mentioned because of its special features. They are: Dr. Barnes' work on the Earth's decreasing magnetic field; and the work by him and Pemper on electrodynamics, elementary particles, and an alternative to the theory of relativity. These things have been discussed in articles in the *Quarterly*.

For the rest, the book gives an adequate treatment of electricity and magnetism, and would be quite suitable as a text.