GEOLOGICAL FACTORS OF TIMPANOGOS CAVE

By Thomas A. Walker"

Timpanogos Cave is one of the outstanding examples of the limestone caverns that are commonly found throughout the world. It is located in American Fork Canyon, Utah, a country of broken rock strata, where there are numerous faults, foldings and twistings of the rock layers caused by the shrinking process of the earth's surface. In this readjustment of the earth's surface there were left in some places ragged wounds or fissures extending along the line of the faults, Timpanogos Cave being formed in one of these. According to estimates made by geologists, the Timpanogos Cave must be well over 100,000 years old.

The formations in the cave are composed of calcium carbonate in practically pure form. This has been carried into the cave and deposited by water seepage from the surface above. The water coming down through the limestone ledges dissolves the lime and reaches the cave saturated with that substance. Then a slow evaporation takes place, reducing the amount of water volume and the amount of lime which it can hold in solution, thus gradually making a deposit on the surfaces of the cave and walls. (*) Greater quantities of water collect in some places than in others, due to the irregularities in the rock surfaces, thus causing a greater deposit of lime where the largest volumes of water collect, starting the projections known as stalactites. As the water accumulates and drops from the ceiling to the tip of the stalactite, it deposits more of this lime solution where it hits the floor, thus forming a stalagmite.

These two types of formations are often found in pairs, the stalactite extending down from the ceiling and the stalagmite extending upward from the floor, the one directly under the other. When the building process has gone on long enough, these two formations meet and form what is called a pillar, extending from ceiling to floor.

It is probable, according to Dr. George P. Merrill of the United States National Museum, that the various forms of distortion and departure from the straight tubular forms of the stalactites are to be accounted for in several ways. An examination of these spectacular Medusa-like forms found in other caves by government geologists has revealed the fact that they occur not as dependents from the naked limestone of the cave roof, but as offshoots from a stalactitic crust which forms first, and varies

(* Escape of CO_2 from the water is undoubtedly the chief factor in lime deposition. C.C.P.)

from a mere film to several inches in thickness. They appear sometimes singly but commonly in groups ranging in size from 3 to 10 mm. in diameter. Close inspection has revealed that while in most cases these formations are tubular, the tube itself is of almost microscopic proportions, being as a rule less than one-half mm. in diameter.

So small is it that capillarity, and not gravity, is the controlling principle in giving the direction to the lime-carrying solution. A small spicule of calcite crystallizing on the extremity is as likely to point any other direction as downward; the direction of the next drop is controlled in part by the first, where the same process is repeated. Or, on the assumption that the stalactite increases in length by constant additions to the tube, on all sides, it is easy to imagine that the deposits take place more rapidly, for a time, on one side than another, perhaps partially closing the orifice or giving it a different direction. The essential fact is that to capillarity, and not to gravity, is due the peculiar vermicular formations.

Why at the outset the stalactite should begin to form through many small capillary tubes rather than through one large one, as is ordinarily the case, is not certain. It is possible, however, that this condition is influenced by the irregularity of the roof, and of the substance of which it is composed in the beginning.

The peculiar warty-like and distorted forms seem to be due likewise to the action of capillarity. In this case, however, the side excrescences are of secondary growth, the stalactite having first formed, in part at least, in the ordinary way. Through the closing of the tube at the lower extremity, the water either oozed through the wall or perhaps ran down over the outer side until some slight irregularity was met, it paused long enough for the necessary precipitation to take place. Such forms in brief are but "tricks of crystallization" due to capillarity.

Perhaps one of the most outstanding characteristics of this cave is the coloring that appears in the formations, ranging in tints from dark brown, buff and cream to pure white, with shades of green, blue, lavender and red blended here and there. The conclusion has been reached by W. D. Bonner, Professor of Chemistry at the University of Utah, that this coloring is due to the presence of iron. It is probable that the brown deposits such as the "Chocolate Fountain" owe their coloring to ferric iron, likely ferric oxide, and the greens are possibly due to ferrous carbonate. The other colors are due to combinations of this iron in varying amounts of each.

During recent years man has aided nature in this beautiful coloring by electric lighting systems which have been installed. Much of the delicate coloring has been emphasized and some very beautiful effects made by colored lights. Among the outstanding ones are The Great Heart of Timpanogos, The Jewel Box, and the Chocolate Fountain.