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LONGHORN CAVERN, A RECONNAISSANCE SURVEY*

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The recent opening of the Longhorn Cavern, twelve miles south of the town of Burnet, in the "Central Mineral Region" of Texas, as a state park, has given this fine cave known by local residents for almost a hundred years, state and national interest.

The Longhorn Cavern, located within a residual plateau, a fault block of Ellenberger limestone of Cambro-Ordovician age, is distinguished by the fact that it exhibits a wide variety of cave phenomena. The plateau block with an area of about sixteen square miles stands 550 feet above the valley of the Colorado River to the west. The plateau, locally known as Backbone Ridge, has a triangular shape. The entrance to the cavern lies near the center of the triangle. The larger rooms of the cave, grouped about the main entrance 75 feet below the surface, are of sufficient size to be utilized, respectively, as lobby and museum, cafe, ballroom and theater. This group is connected with the "Crystal Rooms," to the south and the "Lake Room" to the

* This survey covers only the main group of rooms now lighted and accessible to the public. The writer hopes to add to the map lateral branches as well as galleries on higher and lower levels. The map (Fig. 1) was made by Brunton compass traverse by H. M. Law, Mrs. H. M. Law, and Mr. and Mrs. Al Fuglistaler. The writer desires to thank Dr. Ellis W. Shuler for helpful suggestions and criticism and Dr. Edwin J. Foscue for redrawing the map and profile section. The geology of the area is well described in the Llano-Burnet folio No. 183, by Sidney Paige, United States Geological Survey.

north by narrow passageways that contain a chain of small rooms with ceilings 10 to 15 feet high. The cave has several small springs and standing pools, but no permanent streams. The area above the cave is covered with sinkholes which conduct all meteoric waters directly to the cavern channels.

The Central Mineral region is an area of intense faulting. Backbone Ridge is one of a series of residual plateaus, or fault blocks, which were cut across by pre-Cretaceous denudation. Following the stripping of the Cretaceous cover from this ancient peneplain, the superimposed Colorado River and its tributaries cut lowlands on the softer granite and schist blocks, leaving in relief blocks of Ellenberger and other limestones. The Ellenberger limestone, forming the plateau, exhibits extensive ground water metamorphism, as shown in the development of a sugary crystallization in the limestone and the filling of cavities and fractures with larger multicolored crystals. In local areas the spreading and mingling of bright colors along the margins of fine fractures produce a commercial marble of exceptional beauty, with a fairly high crushing strength. Chert exposed in the cavern walls appears in interbedded layers, varying from a few inches to several feet in thickness, and protrudes along the walls of all the rooms of the upper cave level.

The beds from which the principal channel ways have been dissolved are nodular and finely laminated. Beds of the more soluble and pervious limestone are separated by thick beds of dense, relatively insoluble, dolomitic limestone. The solution of the weaker, more soluble members has produced galleries on three levels. The harder, insoluble strata form the floor. In the entrance room and a few other large rooms solution has included the heavy intervening beds and produced rooms with exceptionally high ceilings.

Many of the rooms have circular domed ceilings so uniform in curvature as to appear artificial. The walls of these rooms are dense, thick beds, while the roofs are shaped from the beds of laminated, incoherent material, incapable of projecting far beyond the supporting medium.

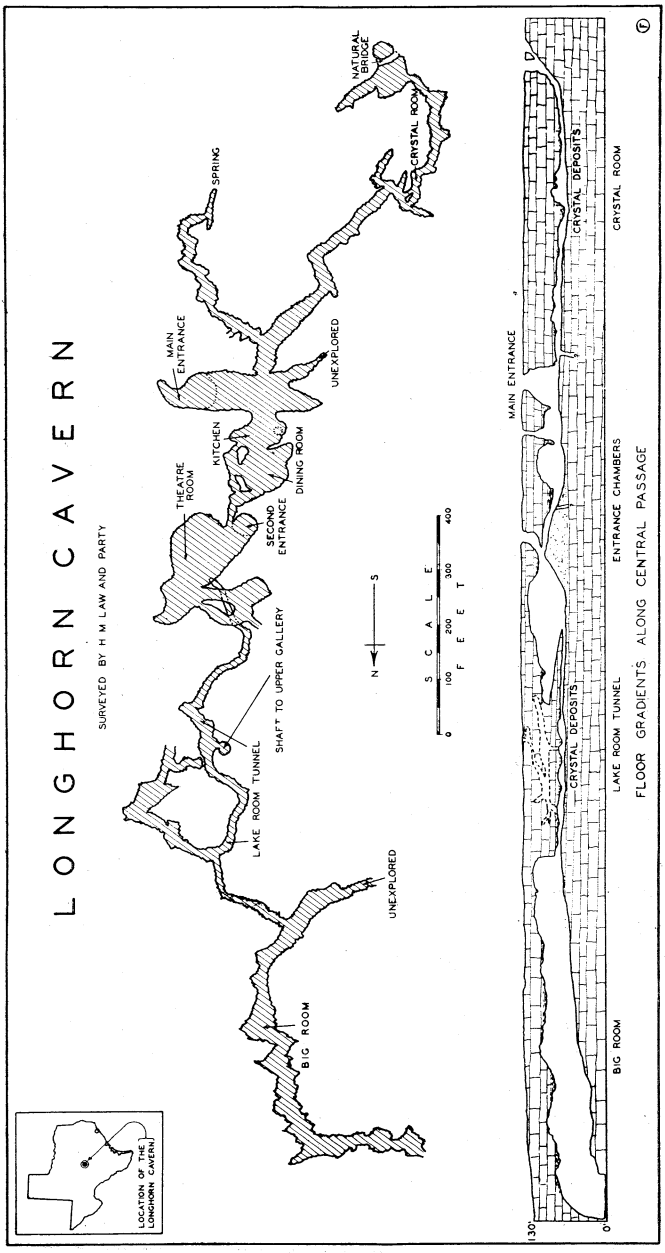
LONGHORN CAVERN
SURVEYED BY H M LAW AND PARTY
LOCATION OF THE LONGHORN CAVERN
BIG ROOM
UNEXPLORED
LAKE ROOM TUNNEL
SHAFT TO UPPER GALLERY
THEATRE ROOM
KITCHEN
SECOND ENTRANCE
DINING ROOM
MAIN ENTRANCE
SPRING
UNEXPLORED
NATURAL BRIDGE
CRYSTAL ROOM
N
S
SCALE
0 100 200 300 400
FEET
MAIN ENTRANCE
CRYSTAL DEPOSITS
CRYSTAL ROOM
BIG ROOM
LAKE ROOM TUNNEL
ENTRANCE CHAMBERS
CRYSTAL DEPOSITS
FLOOR GRADIENTS ALONG CENTRAL PASSAGE
130
0

Fig. 1

Origin of the Cavern

Following the rejuvenation of the Colorado River, which meandered widely over the ancient peneplain uncovered by stripping off the Cretaceous overburden, the river valley became sufficiently incised to furnish drainage for the present cavern territory. The process of drainage was too slow at first to permit the water table to sink far below the surface. Only after a long period of solution did the passageways open sufficiently to allow the lowering of the water table on the low divide of the plateau and the beginning of an appreciable movement of ground water toward its margins. At this early period the waters found egress through springs near the bottoms of the gradually deepening valleys of the Colorado River drainage system. Under hydrostatic pressure of an arching water table the diverging waters may have found little difficulty in reaching outlet springs by advancing through devious channels in the more soluble beds along joints, fractures, and fault planes which may have extended to considerable depths below the surface of the water table.

When adjacent valleys were sufficiently lowered to offer outlet springs at lower levels, the descent of meteoric waters through solution channels to the new and lower water table became too rapid for effective solution. Such vadose water as filtered its way through thick roofs entered the upper cavities laden with dissolved lime carbonate. Upon entrance into the air-filled chambers, it began to deposit dripstone and flowstone. In this cave the process must have been productive of a generous growth of stalactites and stalagmites, as is evidenced by the abundance of decayed fragments found upon the floors of the older upper rooms. In course of time the roofs covering these rooms were thinned so much by surface erosion that descending water reached the cavern ceilings only partially saturated; in fact, being still unsated, it began to devour the formations that had been formerly deposited with the result that many stalactites were either redissolved or cut loose from the ceiling by solution of their bases of attachment. Many fragments, a foot or more in

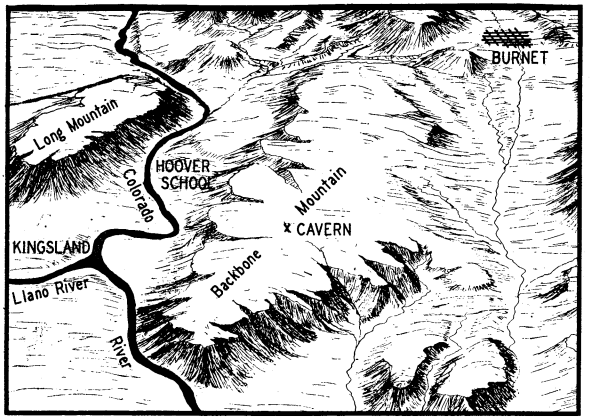

Fig. 2. Ideal view of Backbone Mountain and the areas adjoining the Longhorn Cavern.

diameter, found in the debris of the floor, are badly decayed and honeycombed with re-solution. At present only a few pendant forms are to be found in the upper and larger rooms of the cave, but fragments are abundant on the floors.

Work of Running Water

A feature of this cave, not always present on so large a scale, is the work of running water. A large part of the cavern, including the "Big Room", "Lake Room", and the entrance chamber connections, forms a typical dendritic drainage pattern below the surface. The "Big Room" occupies the bed of the main stream, which has been so deepened as to become a winding, subterranean canyon with tributary branches entering as a surface stream. Where there are two galleries connected by shafts and occupying different levels, the connecting shafts show all the phenomena of differential solution, but only slight effects from running water. The bed of the main stream in the "Big Room" is fifteen or twenty feet wide, incised in a floor that was at one time about twice as wide. The new stream bed, from three to ten feet below the old one, forms terraces several feet wide on one or both sides of the present channel.

Rounded boulders and gravels indicate that at times the stream has been a torrent. All the attendant phenomena of running water are to be found, including cataracts in shelving strata, falls, pools, and potholes. The gradient of the stream increases rapidly as it approaches the lower end of the Big Room, drops over low cataracts, then over a ten-foot fall into a pool; and about thirty feet farther drops something like five or six feet into another pool and disappears under the end wall.

If the successive galleries had been developed by respective base levels, the grading of each gallery floor by running water would be expected. The process would have filled all low places with sediments up to the level of the spillway for each segment of the cave. There is no evidence of extensive grading or stream erosion on the floors of any, except the lowest gallery level.

The Crystal Rooms

To the average visitor the most spectacular feature of the cave is its crystal rooms. They are veritable jewel caskets. These rooms, five in number, although not large, are lined with a thick coating of calcite crystals in variegated colors, often measuring four to six inches along their rhombic edges. Adjoining crystals may be of brilliant contrasting colors. Dogtooth forms in bright colors are often found, penetrating larger transparent ones.

A study of the profile section (Fig. 1) shows that the crystal rooms lie at the lowest section of a siphon-like tunnel; they are low points below the level of the spillways for the segments. They are in part even today collecting basins. The crystals along the wall are apparently the result of crystallization from standing pools of saturated waters.

The upper parts of the crystal rooms are mostly free from the crystal coating. The fact, however, that slabs of crystals are found embedded in the floor debris of these areas, indicates that the entire ceiling may have been coated at one time, but since the limestone walls were more soluble the crystals have weathered loose, and have fallen

down where the walls are either overhanging or very soluble. In places the limestone has been dissolved away from the crystal sheets, leaving them standing out three or four inches from the present walls.

The Life Content of the Cave

In the pools of the stream in the Big Room numerous yellow-white crayfish dash about as if frightened by the advent of light. They appear to have normal eyes and some are still unblanched. They may be immigrants into the cave from streams into which the cave empties. Other arthropods (white crickets, daddy-long-legs, millipeds, spiders, and beetles) and numerous worms are found throughout the cave. Small pools of stagnant water, near the lower ends of shafts connected with surface sinks, were thick with decaying insects; mute caution to all who would drink water issuing from limestone fissures. Bats are so numerous in some parts as to necessitate their removal before the rooms can be opened to the public.

In the drifts and bars of the stream, as well as the debris of the floors at points not affected by running water, are numerous bones of bison, bear, and possibly camel, as well as those of many modern forms.

Numerous flints, arrow and spear heads, crude tools, bits of charcoal, and reported beds of ashes and charcoal indicate that the cave has been at times a temporary harbor for human beings. If it were inhabited for any length of time by a race using fires, the walls have lost all traces of the ancient smoke stains through scaling and weathering.

Two human skeletons have been found. One is said to have been beneath a large boulder in the center of the big entrance chamber and the other on a ledge farther back in the cave. They have not so far been investigated by any reliable authority on anthropology.