G.B. Cave, Blackdown, Mendip Hills.

GEOLOGICAL REPORT

By D. T. Donovan, B.Sc., F.G.S., and F. S. Wallis, D.Sc., Ph.D.

For some time past it has been fully realized by geologists that over much of Mendip, and especially in the Blackdown area, the most favourable conditions for the discovery of new cave systems occur at the junction of the Lower Limestone Shales (Cleistopora or K zone) and the massive Lower Limestones of the Zaphrentis (Z) zone. It was this underlying principle which led Messrs. F. J. Goddard and C. C. Barker to search the area South-east of Tyning's Farm, and in 1939 rewarded them with the discovery of a cave system of amazing size, complexity, and interest.

The G.B. Cave is situated on the Southern flank of Blackdown, about 700 yards E. 22° S. of Tyning's Farm at about 865 ft. above O.D. It lies to the South of the Roman Road from Charterhouse to Tyning's Farm, in a pitted and mine-scarred patch of ground known as Gruffy Field. The cave lies W.N.W. of Read's Grotto (*Proc. Spel. Soc.*, Vol. II, No. 1, 1922-23, pp. 74-75). The present entrance to the cave is a few yards to the West of an active swallet, the waters of which join the G.B. Cave system about 80 ft. below the surface of the ground.

Blackdown is the Westernmost écheloned periclinal uplift of the Mendip Hills and the geology of the area has been well described by Dr. F. B. A. Welch in *Proc. Bristol Naturalists' Society*, 4th Series, Vol. VII, 1932, pp. 388-396. The highest portion of Blackdown consists of Old Red Sandstone and the various members of the Carboniferous Limestone sequence are ranged around in roughly concentric fashion although this arrangement is interrupted by Triassic overlap on the West. As in the case of the other Mendip periclines, the Northern limb of the anticline dips much more steeply than the Southern, which at places shows evidence of over-thrusting.

The surface geology in the immediate vicinity of the G.B. Cave is relatively simple and the strata dip in a Southerly direction. The strike of the beds is approximately East and West and the entrance to the cave is very near the junction of the Carboniferous Shales and Limestones (K zone) to the North and the Lower Limestone (Zaphrentis zone) to the South. The shales form a relatively low-lying area between the Old Red Sandstone and the Lower Limestone.

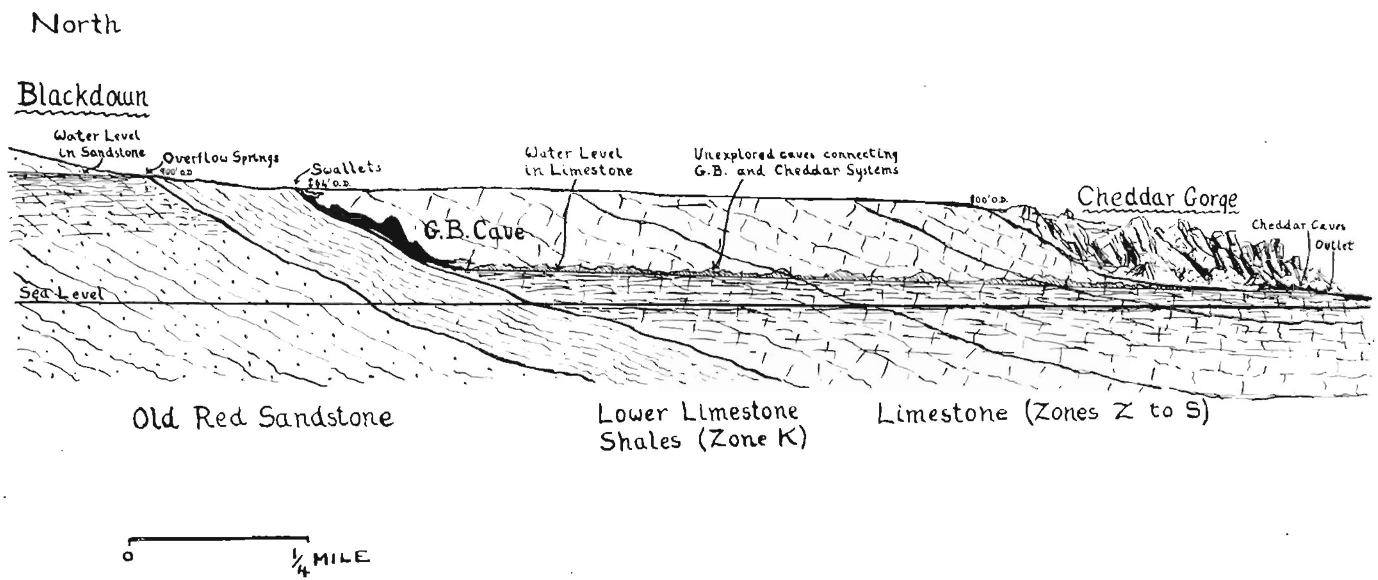

FIG. 3.—Section showing the site of G.B. Cave at the junction of the limestone shales and mountain limestone and its suggested connection with the Cheddar outflow.

Water collecting in the permeable Old Red Sandstone rocks issues on the hillside as a series of strong overflow springs which come into action when the water-table within the sandstone aquifer rises to the level of the outcrop of the shales. Some of these springs are active only in the winter and spring.

The limestones in the Cleistopora zone are thin and subsidiary to the shales and so the formation as a whole is impervious to the surface streams from the overflow springs. When, however, the water reaches the massive limestones of the Zaphrentis zone it disappears underground through a series of swallets.

One of these small streams flows into Gruffy Field and disappears into a swallet. This underground stream course was investigated from 1920 onwards (*Proc. Spel. Soc.*, Vol. I, No. 2, 1920-21, p. 96, and No. 3, 1921-22, p. 151), but progress was soon barred by solid rock. In 1939 excavations were carried out some 100 yards to the West and access was obtained to a vast underground system of fissures and caves now known as the G.B. Cave.

The cave naturally offers an excellent opportunity for the examination of the rocks in which it has been formed. In descending the cave system the first beds met are the upper beds of the Cleistopora zone, consisting of thinly-bedded limestone and shales. The change to the massive crinoidal limestone of the Zaphrentis zone is abrupt and marked. Beds rich with brachiopods such as *Spirifer tornacensis, Chonetes* spp. corals, such as *Zaphrentis* spp., and crinids are fairly common near the base of the Zaphrentis zone, and many opportunities for collecting these occur in the course of a descent.

Of even more interest are the structural features encountered. Observations of the dip of the rocks at different points along the cave strikingly demonstrate that this varies widely between 60° and 15°. The average dip is about 30° in a Southerly direction.

Viewing the vertical projected section (*Fig.* 1) it is clear that the main configuration of the cave is primarily governed by the dip of the rocks. The chief departure from this regularity is caused by the numerous rock falls along the joint faces from the roof and the consequent enlargement of that portion. In this report the joint system of the rocks plays a leading part in determining the profile seen in section. It has also been determined that the cave system tends to follow the minor irregularities in the dip.

The effect of the jointing in the limestone is clearly seen in the plan of the cave (*Fig.* 1) and the orientation of the passages is a marked result of this feature.

The earliest stage in the formation of the cave was probably a network of narrow fissures resulting from the chemical action of water along planes of weakness in the limestone provided by joints and bedding planes. The fissures were, at this stage, completely water-filled. There was circulation of the water but no well defined underground streams. Such a network of fissures, since drained of its water, persists in the upper part of the cave, some forming the route from the first Grotto to the Boulder Chamber. That these passages have often been formed solely by the chemical action of water is shown by the manner in which the delicate silicified fossils, consequent on the different solubilities of

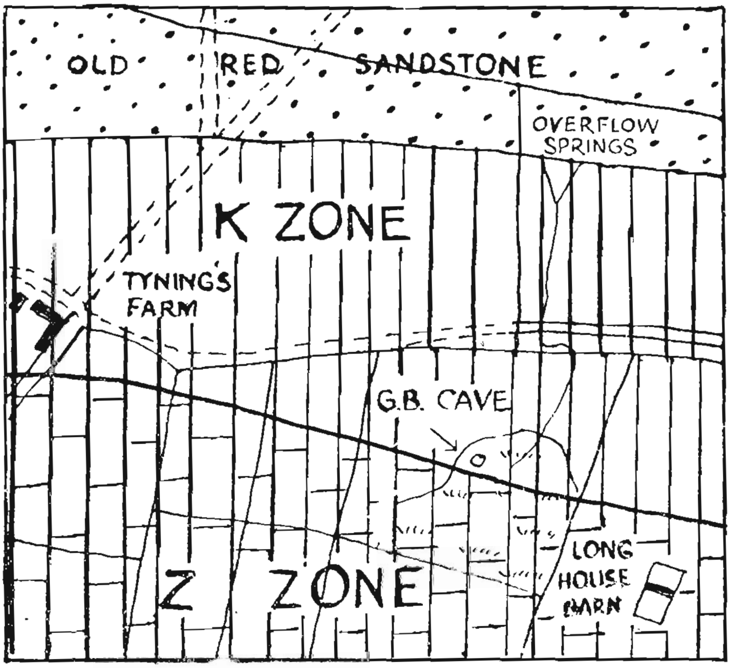

FIG. 4.—Geological sketch map showing the location of the cave in relation to the geological strata, and to Tyning's Farm.

limestone and silica, stand out prominently from the walls of the cave.

As the level of saturation in the rocks fell to its present position the network emptied of its water. This was due in some measure to the enlargement of the channels permitting easier escapes for the water and possibly also to a change in some external controlling factor, such as sea-level. The drainage water of the area could now flow freely through the system, and certain channels were selected and enlarged by the water. At this stage the mechanical erosion of the rocks by running water was more important than solution in enlarging the caves. Such action is exemplified on a small scale by the Boulder Chamber and succeeding passages, and *par excellence*, by the Main Gorge itself.

That the subsequent history of the cave is not straightforward is suggested by the fact that deposits of pebbles, sand, and stalagmite were at one time laid down in the Gorge, and have since been largely removed by erosion, though sufficient traces remain to indicate their former extent and thickness. These deposits have not yet been studied in sufficient detail for any definite conclusions to be reached.

G.B. Cave lies within the area drained by the subterranean stream which has its outflow at Cheddar. This area extends Northwards and Eastwards from Cheddar as far as the subaerial watershed of Blackdown and North Hill. Its boundaries to the West and South-east are less easily determined, but probably lie in the regions of Shipham Gorge and Priddy respectively. This estimate of the drainage area, about 16 square miles in extent, agrees closely with that given by Mr. H. E. Balch in *Netherworld of Mendip*, 1907, p. 17.

water was more important than solution in enlarging the caves. Such action is exemplified on a small scale by the Boulder Chamber and succeeding passages, and *par excellence*, by the Main Gorge itself.

That the subsequent history of the cave is not straightforward is suggested by the fact that deposits of pebbles, sand, and stalagmite were at one time laid down in the Gorge, and have since been largely removed by erosion, though sufficient traces remain to indicate their former extent and thickness. These deposits have not yet been studied in sufficient detail for any definite conclusions to be reached.

G.B. Cave lies within the area drained by the subterranean stream which has its outflow at Cheddar. This area extends Northwards and Eastwards from Cheddar as far as the subaerial watershed of Blackdown and North Hill. Its boundaries to the West and South-east are less easily determined, but probably lie in the regions of Shipham Gorge and Priddy respectively. This estimate of the drainage area, about 16 square miles in extent, agrees closely with that given by Mr. H. E. Balch in *Netherworld of Mendip*, 1907, p. 17.

The Stalactites of G.B. Cave.

By D. Donovan, B.Sc., F.G.S.

G.B. Cave is adorned with stalactite growths in great profusion, and is especially remarkable for the abundance of those otherwise rare "erratic" forms, or helictites. The deposits may be dealt with under the two familiar divisions: Stalactites (including Helictites) and Stalagmites.

STALACTITES

These have commonly been formed by the deposition of concentric layers of calcium carbonate around a central core. This core is usually a "straw" stalactite, a thin-walled cylinder, of diameter about 5 mm., which is composed of crystallographically continuous calcite, the axis of the crystal lying along the length of the straw. The central channel of the straw has often been more or less filled with calcite at the same time as exterior enlargement was taking place. In broken specimens the core may then be seen as a circular area of clear calcite. In some cases, the core is formed of aragonite, the other crystalline form of calcium carbonate, in a fibrous condition, the fibres being elongated along the length of the stalactite. These are also fed by a central channel, but the walls are initially thicker than in the calcite straws. In some cases the stalactite has no definite core.

In all cases where there has been subsequent enlargement of a straw, this takes the form of cylindrical layers, or lenticular bands, of calcite, in a fibrous or granular condition, and aragonite, in a fibrous condition (see diagrams, *Fig.* 5). The presence of aragonite is an unusual feature in Mendip stalactites. The bands of aragonite are quite sharply defined, indicating that both calcite and aragonite are primary.

As already mentioned, this cave is noteworthy for the abundance of helictites. These small, irregular branches commonly arise from the sides, or around the bases of ordinary stalactites. They also grow on the surface of the stalagmite sheets which often cover the walls of the cave, but not on walls of bare rock. Close examination shows them to be circular in cross-section, except where they have suffered subsequent enlargement, with a minute, almost capillary, channel running down the centre. They are all composed of aragonite. Every stage of the transition between stalactites and helictites may be found.