

## The Impact of Limestone Quarrying on the Mendip Hills

By

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### INTRODUCTION

The Mendip Hills in North Somerset are partly composed of Carboniferous Limestone, which is extensively quarried for various purposes. The rapid growth of the quarries is abhorrent to, and has caused conflict with, many sections of the community. This paper seeks to examine the problem from the viewpoints of the geologist, the lover of fine hill country, and the cave explorer, who has a special interest in limestone. A constructive approach, reconciling the various interests, is suggested.

In the accompanying map the geological data are drawn from Geological Survey publications, and data on quarry concessions and ownership from the maps of the Somerset County Council. The author visited all the quarries and mapped their extent in 1964 and 1965. Major caves and springs are defined as those with more than about 400 ft. of passage, and a mean flow of more than about 500,000 gallons daily, respectively.

### BRIEF HISTORY OF THE MENDIPS AND THEIR POSSIBLE FUTURE

The Mendips came into existence about 270 million years ago as a complicated anticlinal fold. Desert climates lasting many millions of years sculpted the fold into a jagged mountain range higher and steeper than the Mendips of today. Some 180 million years ago the sea encroached upon the range and gradually submerged it, burying it beneath Jurassic and Cretaceous sediments. Earth movements roughly 15 million years ago caused rejuvenation of the region, the sea began its final withdrawal, and the soft sedimentary rocks were gradually eroded away to uncover the tops of the hard-rock mountains. Late in the Tertiary period sea-level stood at about 750 ft. O.D. for several million years, and the hills were degraded to form the existing plateau. During the Pleistocene period beginning roughly 1 million years ago there was a continuous though intermittent lowering of sea-level, and the hills have slowly emerged as the soft rocks enveloping them have been worn away. Thus under the natural régime the Mendips have been increasing in height and grandeur for the last million years.

However, under the present man-imposed régime the future of the Mendips may be as brief as their history has been long. Limestone is being extracted from them at a rate that has increased from *c.* 1.2 million tons in 1947 to *c.* 3 million tons in 1965, and in evidence given at a Ministerial Enquiry into a proposed quarry on Bleadon Hill (Brown, 1965) it was estimated that annual production would reach 5 million tons by 1970. Modern industrial trends suggest that this rate of increase, 6 per cent per annum compound, will continue long beyond 1970.

A calculation by the author shows that the limestone reserves of the Mendips, as deduced from Ordnance Survey and Geological Survey maps, above an assumed working water-table, amount to *c.* 40,000 million tons. This figure includes areas of limestone covered by as much as 50 ft. of overburden. Removal of this quantity would plane off the limestone portion of the hills to slightly below the level of the surrounding lowlands.

Thus under present and expected conditions the limestone regions of the Mendips will have vanished after about 5000 years, a mere instant in geological time. It is, of course, risky to extrapolate present trends even to the end of the twentieth century, but the calculation is valuable in that it exposes the vulnerability of the hills.

### THE PRESENT SITUATION

Limestone quarrying became big business early in the present century, to meet suddenly expanding demands for road metal and concrete products. Previously, stone for building, road metal and lime burning had been won from scores of small pits that were usually worked intermittently to satisfy local needs.

Today there are 24 active quarries on Mendip, 7 west and 17 east of Wells, owned by a smaller number of companies. The concentration in eastern Mendip is mainly due to the great demand for hard stone in south-east England. The workings, and other abandoned ones, although very large and often very conspicuous, cover less than one-quarter of the area actually scheduled for quarrying. This scheduled area, some 2,300 acres, comprises 6.5 per cent of the *c.* 36,000 acres of Carboniferous Limestone outcrop, including limestone covered by as much as 50 ft. of overburden, in the Mendips.

The bulk of the scheduled area consists of permissions granted in the period 1946-48 by District Councils exercising planning powers under the Town and Country Planning Act, 1932. Many permissions are unconditional. Since 1948, when the Somerset County Council became the planning authority, concessions have been small and less easy to obtain, and the County Development Plan (First Review, 1964) states that "conditions have normally been imposed to safeguard amenity. . .". The County Council

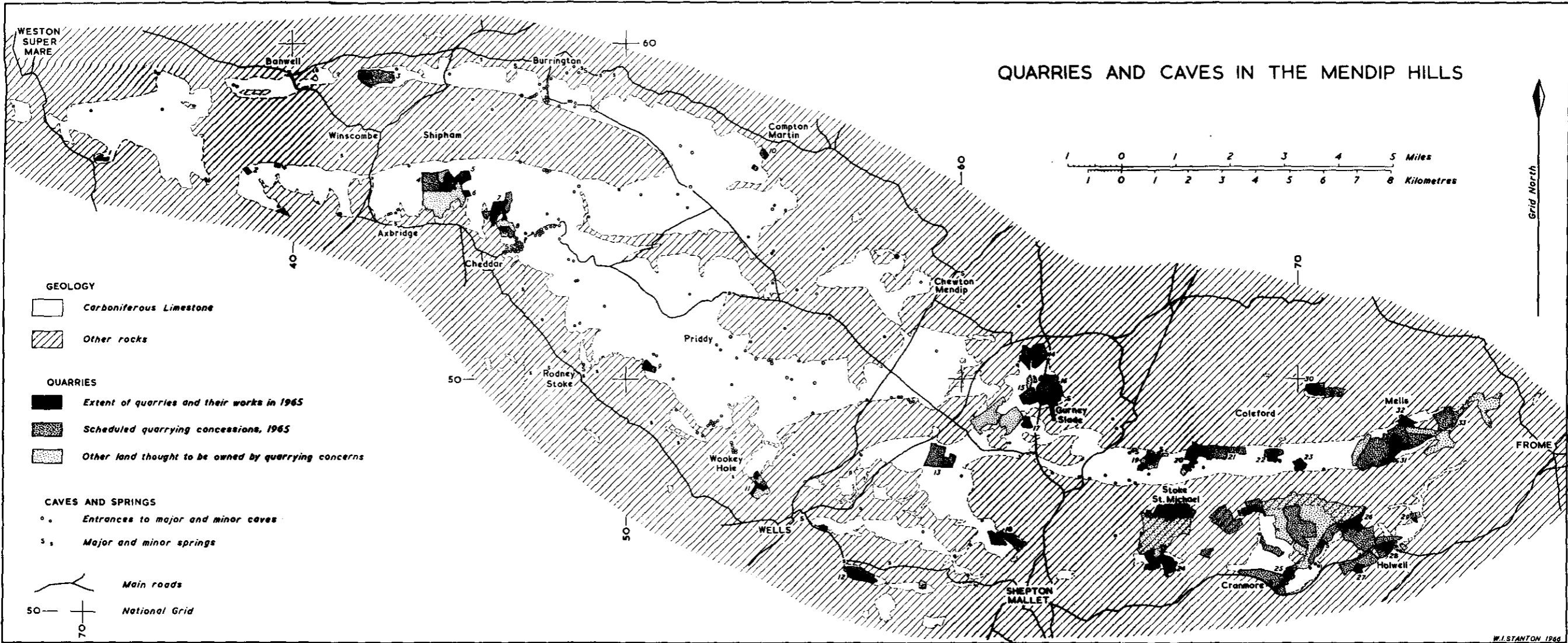
is sensitive to the fact that the Mendips are scheduled as an "Area of Great Landscape Value", an important asset in the county's second largest industry, the tourist trade. County Council policy, as stated at the Bleadon Hill enquiry, is to permit extensions to existing quarries "if local amenities are not further worsened", but generally to oppose the establishment of new workings. This policy was justified at the above enquiry by the broad statement that existing concessions contain adequate reserves for the next hundred years.

It is difficult to calculate limestone reserves in existing concessions without knowledge of the special conditions of individual sites. A rough but conservative estimate by the author suggests that reserves above the natural water-table, or down to a reasonable working depth where the water-table is very low, are in the region of 650 million tons. On the basis of the 6 per cent per annum compound increase in the rate of extraction already mentioned the life expectation of existing quarries is about 50 years. Hence there is no fundamental need for new concessions at the moment, apart, perhaps, from small extensions required for commercial convenience.

The ratio of land already quarried to total available land is *c.* 500 : 36,000 acres. If this is compared to the ratio of stone already extracted to total available stone (*c.* 70 : 40,000 million tons) a significant fact emerges. About 1.4 per cent of the land has been quarried but only 0.2 per cent of the stone has been won. Thus unless much more stone is extracted from deep levels large acreages will be exploited for disproportionately small rewards.

During the last 20 years there have been frequent disputes between quarry companies and other bodies. In 1949 and 1954 the citizens of Wells protested vigorously against the destruction of Milton and Dulcote Hills by the quarries numbered 11 and 12 (*Plate 10*), but the resulting public enquiries found that quarrying must continue. A fundamental difficulty, if planning permission is to be revoked, is that the owners of a concession must be properly compensated. A contrary situation can arise, for when an extension was granted to Bleadon Quarry (1) in 1957 the owners were unable to exploit it because of the risk of damage to private property nearby. The same owners were refused permission to start workings on the top of Bleadon Hill at a public enquiry in 1965. The reasons given were that an area of great landscape value would be injured, agricultural land would be lost and that the access road was unsuitable.

In 1961 a quarry company at Stoke St. Michael (20) applied for an extension and was granted 5 acres. Unknown to the planning authority the extension was directly over an underground stream in the Stoke Lane Slocker cave, which was scheduled as a Site of Special Scientific Interest, to be protected from undesirable development as far as possible. Protests from individuals and various bodies including the Nature Conservancy left the



**PLATE 10**

Based on Ordnance Survey and Geological Survey maps. Crown copyright reserved.

owners unmoved. But action by the Water Undertaking resulted in curtailment of quarrying operations in the interests of water supply. Instead the quarry company sought outlets in the opposite direction, and in 1965 were granted a 20-acre extension eastwards to connect their plant with another concession of 40 acres (21) already held by them.

In early 1966 negotiations were in train to reopen Webbington Quarry (2) on Crook's Peak. The County Council were, however, about to serve a closing order on the quarry, and other bodies were planning to oppose the threat to one of Mendip's finest hills.

In 1962 an attempt was made to reopen Cliff Quarry (10) at Compton Martin. To make the site economical an extension was requested, but the County Council refused to grant it on the grounds that the quarry would be detrimental to village amenities and injurious to an area of great landscape value, and that the access road was inadequate. The planning permission was revoked and liability for compensation exists.

### QUARRYING AND THE MENDIP CAVES AND SPRINGS

Carboniferous Limestone hills all over Britain provide recreation and adventure for the cave explorer, and the Mendips, being close to several great centres of population, are very popular. There are 43 members of the Council of Southern Caving Clubs, and they are only some of the clubs that cave in the Mendips. Individual clubs have as many as 300 members. Unfortunately there are only four Mendip caves longer than 1 mile,\* and the total length of known caves in the hills is less than 15 miles. They are therefore the most congested in the country, and new caves are almost desperately sought after.

From time to time quarries have broken into hitherto unknown caves which have thus for a while become accessible to the explorers. However, such caves are normally destroyed as the extraction of stone proceeds, and cavers have learned to receive news of a new cave in a quarry as a gloomy rather than a joyful event.

Fairy Cave Quarry (19) is, in the author's opinion, the classic example of a badly chosen quarry site. Opened in the hillside between St. Dunstan's Well, a large and complex spring supplying the Water Undertaking, and the swallets feeding it, the workings have broken into a whole series of underground passages, waterways and chambers. To date they have not diverted, blocked or polluted the streams feeding that part of the Well used for water supply, but the risk grows as the quarry extends. Ten separate caves totalling 1.1 miles of passage have been entered and in great part destroyed. The result has been operating difficulties and great loss of stone to the quarry

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\* Swildon's Hole (4.1 miles), St. Cuthbert's Swallet (2.5 miles), Stoke Lane Slocker (1.2 miles) and G.B. Cave (1.2 miles).

owners, and the brutal destruction of 7 per cent of the known Mendip caves including stalactite grottoes of exceptional loveliness. It has been said that these caves would never have been known had the quarry not revealed them, and therefore cavers should not grumble at their fate. The argument is invalid because a routine scientific examination of the nearby Fairy Cave would have shown where to dig through into the further systems, as would the geophysical studies that are becoming popular.

Certain other quarries and concessions are badly sited for similar reasons. The extension threatening Stoke Lane Slocker has already been described. A small concession close to Fairy Cave Quarry on the south-west will meet with problems similar to those of the main quarry. The southern working of Asham Quarry (26) is directly over the important Seven Springs which drain the swallets further west. Fortunately, the Springs do not supply any water undertaking. The same situation exists at Holwell Quarries (28). A connexion is known between a well in Dulcote Quarry (12) and the spring in Dulcote village (Balch, 1948, p. 125).

Second only to Fairy Cave Quarry in unsuitable location is Chelm's Combe Quarry (8, not working at present) and the concession belonging to Batt's Combe Quarry (7) adjoining it on the south east. The quarry is close to the complex of springs at Cheddar, the largest in Mendip and a major source for the Water Undertaking. As at Fairy Cave it is cutting into the hillside between the springs and their feeder swallets to the north, and is sure to intersect a complicated passage system above the underground streams. Already two caves with 400 ft. of passages have been exposed. A possible connexion between the area and the springs was established in 1962 when, a few hours after loud nocturnal underground rumblings were heard below a house roughly half-way between the springs and the quarry, the water began to flow very muddy and continued thus for several days. There had been no heavy rainfall. It may be inferred that there was a major collapse of rocks and mud into the underground streamway, conceivably triggered by the heavy blasting that regularly takes place in Batt's Combe Quarry.

At least 16 Mendip quarries other than Fairy Cave Quarry are known to have broken into caves in the past. Most of these were blocked by quarry debris, but at Chelm's Combe (8), Dulcote (12) and Windsor Hill (18) they proved to be several hundred feet long. Some caves contained important Pleistocene animal remains, notably at the Underwood or Milton Hill Quarry (11) where bones of hippopotamus and *Elephas antiquus* were found in an old swallet (Balch, 1936). This is one of the very rare sites at which a fauna of the Last Interglacial occurred. A cave in Whatley Quarry (21) yielded remains of mammoth (Donovan, 1954a). Bleadon Quarry (1) had fissures containing a rich late Pleistocene fauna, as did the old quarry at Uphill near Weston-super-Mare.

The frequent visits of cavers and archaeologists to these various sites have often interfered with commercial operations and embarrassed quarry managers, who have been known to conceal or even destroy new occurrences. Unique archaeological deposits and scientifically interesting caves may thus have been lost. The managers' point of view is both understandable and regrettable, and it is difficult to see how such a basic conflict of interests can be resolved.

### QUARRYING AND THE MENDIP LANDSCAPE

For obvious reasons it is easier and cheaper to quarry horizontally into a hillside than downwards into a hole in the ground. This is why certain workings in West and Central Mendip are flagrant eyesores visible from 20 miles away, and why so few of the attractive wooded valleys in East Mendip remain unspoiled. Until recently the damage was obvious and the continuing threat was that of a proliferation of great unsightly scars on the natural scene, an affront to a multitude of country lovers. Now, however, it has become evident that a big quarry is capable of removing an entire hill, covering the stump with top-soil and restoring it to agricultural use. This is a more subtle threat to the countryside which is harder to counter by down-to-earth argument. Perhaps the fairest comment is that everyone feels the inspiration of high places, so that when a hill is gone we are all, irreversibly, a little poorer.

In the Western Mendips, between Weston-super-Mare and Cheddar, the landscape is a striking one of hill ranges dotted with limestone crags rising steeply from an almost level plain. This is the region most popular among tourists, not least because many of the hills are unfenced land with few restrictions on walking and picnicking. There are only 5 active quarries, but they are all large and visible from great distances in many directions.

The Sandford Quarry (3) is large already and, almost incredibly, is destined to remove more than half of the attractive hill after which it is named. The skyline including the summit will be lowered by as much as 100 ft., and the hill left a hollow shell. Three of the other quarries are clustered in Shipham Gorge, a combe which with pits, tips, kilns and grimy industrial buildings is now one of the ugliest sights in Somerset. In the Callow Rock Quarry (4) machinery and spoil project above the slightly lowered skyline at 800 ft. O.D. and can be seen from as far away as Glastonbury. Unlike the two nearby quarries Callow Rock has a very large concession and will eventually eat out the heart of Callow Hill. The face of Batt's Combe Quarry (7) is 500 yd. wide and extends almost the full height of the 800-ft. escarpment. The gigantic scar, dwarfing Cheddar Gorge, is obvious from the Polden Hills 20 miles away.

The steep-sided plateau of Central Mendip between Cheddar and Shepton Mallet is remarkably unspoiled. The southern slopes rise impressively from the plain and are marred only by the Westbury Quarry (9), which at present is not very obvious but will become much more so as it extends eastwards. The northern escarpment is only marked by a few smallish abandoned workings, thanks to the closure of the Cliff Quarry at Compton Martin (10). Of the two large quarries near Wells, much disliked by the citizens, (11) is fairly well concealed but (12) has removed the greater part of Dulcote Hill, a high rocky ridge that used to be a prominent feature of the city's environs. Now, as H. E. Balch foresaw many years ago, the hill resembles nothing so much as a "hollow tooth". When the two big concessions on the crest of the Mendips north-east of Wells (13) come to be worked there will probably be a large visible face and some lowering of the skyline.

In East Mendip the relief is much lower and the hills less striking than further west, though the countryside is very pleasant. As a result the majority of the limestone quarries there are relatively unobtrusive and few can be seen from any distance. In some cases the planning authorities have ordered that green belts shall be left between workings and adjoining main roads. It is unfortunate that the deep, narrow, wooded valleys typical of the region are ideal starting-points for quarrying, and most have been or will be badly damaged. A fine example remains in Ashwick Grove, east of Oakhill, and it is to be hoped that this site will stay unspoiled.

#### CONSTRUCTIVE VERSUS DESTRUCTIVE QUARRYING— A POLICY FOR MENDIP

Most of the existing Mendip quarries may be defined as *destructive quarries*. By driving horizontally into hillsides they injure the natural scene and destroy places of public recreation such as hills and caves. The workings at Sandford, Batt's Combe and Dulcote are prime examples. When finally abandoned, they usually form prominent wounds that will not heal in the foreseeable future. Destructive quarrying is the easiest and cheapest way of extracting stone.

*Constructive quarries* may be defined as holes sunk downwards into the ground. Their damage to the natural scene is minimal and they do not destroy hills or, if properly sited, caves. When abandoned they can serve a useful purpose as rubbish tips, ultimately allowing complete restoration of the original landscape. The cost of raising the stone, and, in some cases, pumping out the water, make this method of quarrying slightly more expensive than the other, but it has already been used successfully in large workings at Leigh-on-Mendip (22), Waterlip (24) and Vobster (30).



Stone may also be obtained by mining, a method already practised in Derbyshire and North Wales. Mining resembles constructive quarrying in its effect on amenity. It is sometimes the only economical way to obtain limestone with special properties, e.g., very pure limestone.

In regional planning it may be advisable to allow a particular area to be totally destroyed by quarrying in order to prevent a multiplicity of quarries over the whole region.

In formulating a long-term policy for the Mendip quarries the basic facts are the following:

1. Existing concessions contain reserves of limestone sufficient for the next 50 years at the estimated progressively increasing rate of extraction.
2. The conflict between quarrying and amenity is much greater in the Western and Central Mendips than it is in the Eastern Mendips.

It is difficult, in view of these facts, to justify the granting of any new concessions or extensions in West and Central Mendip, where all the quarries are destructive and all have many years' reserves. The wisdom of restarting work at the Chelm's Combe Quarry with its nearby concession should be carefully examined. If necessary, the owners might be offered a compensatory extension to one of their workings in East Mendip.

In East Mendip about one-quarter of the total limestone outcrop is already scheduled for quarrying so that the whole region is sure to become seriously damaged, the more so as it supports other large quarries in volcanic rock. East Mendip is closest to the great markets for stone, and the low relief diminishes the conflict between quarrying and amenity. If one part of Mendip should be sacrificed to save the remainder, this eastern part would seem to be the best choice. However, the limestone reserves in existing concessions are adequate until the early decades of the twenty-first century, so that there is no urgent need for new concessions. If extensions are granted for commercial convenience the Stoke St. Michael-Oakhill area should be avoided as caves are known to be well developed there and the underground streams supply water undertakings. Constructive quarrying is feasible in many concessions and should be encouraged, especially towards the extreme east where much limestone is concealed below a thin overburden of younger rocks.

The estimates of limestone reserves quoted in this paper have been calculated for conventional quarrying, i.e., down to the level of the water-table. In East Mendip where the water-table is high the conventional reserves are small in relation to the large area of the concessions, but enormous extra tonnages of limestone will become available if the workings are extended below this critical level. In the region east of Shepton Mallet quarrying of existing concessions to a depth of only 120 ft. below the water-table would

provide roughly 500 million extra tons of stone, nearly as much as present-day conventional reserves. This depth has already been passed at Vobster and approached at Waterlip, and is clearly practical at small extra cost in virtually all the concessions. Sub-water-table working could be the last word in constructive quarrying, protecting the Mendips for at least a further century and ultimately enriching the natural scene with vast reservoirs and attractive boating lakes, positive assets to the countryside.

### CONCLUSION

Limestone quarrying is an essential modern industry, and stone must clearly be extracted from the Mendips in increasing quantities for many years to come. In this paper the author has tried to show that good planning and responsible management can minimize damage to the Hills and perhaps tide them over until some time when new conditions drastically reduce the demand for limestone.

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