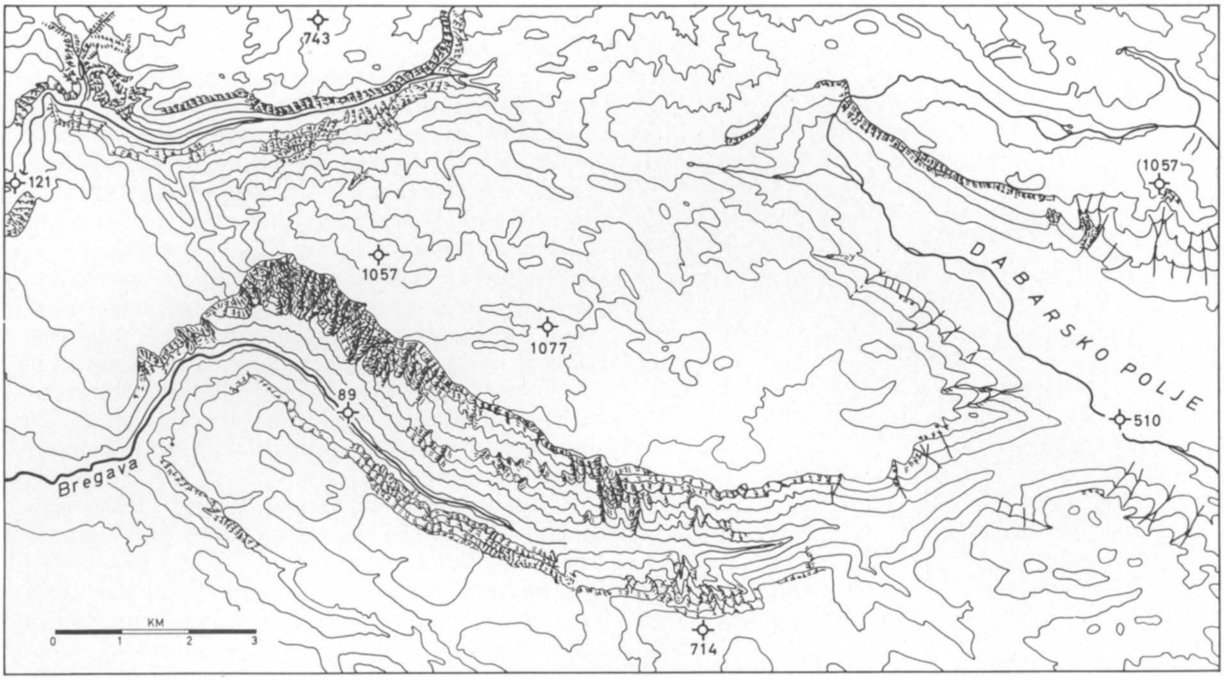

Fig. 2: Dry and deep canyon of Bregava River (Hercegovina) — Contour intervall 100 m. Although this is an old canyon (relative depth about 1000 m) its sides are very steep in spite of younger evolution of the slope. In the higher parts, during a period when the river flowed at surface, by means of differential erosion in the impermeable rocks Bregava River formed Dabarsko polje.

The eroded detritus must, therefore, have been evacuated underground. It is, consequently, a feature created in karst, i.e., in a region where during its creation, deeper fissure-circulation of water took place. Its ideally flat limestone bottom and the sudden transition into steep sides are further specific elements that disagree with the laws of river erosion.

Valley-like depressions as well as level ground in pure limestone cannot be explained with river erosion, which can only cut canyons into this rock. The other valley-like features must be accounted for by changes in the corrosion process in different climats and under corresponding ecologic conditions.

To conclude: Allogen rivers have only cut canyons in pure limestone, and this kind of valley is typical for them. More regular features of river erosion and slope washing appear in regions of mixed lithological composition and do not belong into typical karst scenery. Unusual features of surface levelling and differently moulded limestone slopes are remnants of a period when the climat favoured plane corrosion (Flächenkorrosion). We suggest to discontinue the use of the term "karst valley" because it was adopted at a time of insufficient knowledge and of a mistaken conception of land form development in limestone. Moreover, the term is also illogical.

DRY VALLEYS OF THE SOUTHERN PENNINES, ENGLAND

With 2 figures

GORDON T. WARWICK

Introduction

In the British Isles most attention has been paid to the dry valleys of the chalk of S.E.England, but they are equally important in areas underlain by limestones of Cambrian, Silurian, Devonian, Carboniferous, Permian and Jurassic age. In addition similar features are to be found on many porous sandstones and conglomerates such as Cannock Chase, Staffordshire and even on quartzites (Lickey Hills, Worcestershire) and Keuper Marl, though the latter are usually confined to valley heads and minor gulleys. In this paper the author wishes to discuss the nature of the dry valleys cut into the Carboniferous Limestone of the Southern Pennines, an area usually referred to as the Peak District, mainly in Derbyshire but partly in Staffordshire. The general account is illustrated by examples chosen mainly from the Dove-Mainfold and Lathkill systems.

Various hypotheses have been put forward to explain the dry valleys of S.E.England. One of the most popular has been that of REID (1887) and BULL (1936, 1940), considering that they were produced during the colder periods of the Pleistocene when this area was subject to periglacial conditions, involving freezing of the ground and the melting of considerable amounts of snow. CHANDLER (1909) and FAGG (1923, 1954) stressed the importance of scarp retreat in lowering the water table of dip-slope valleys, whilst SPARKS and LEWIS (1957) advocated spring-head sapping as the formative agent for the dry valleys which bite into the chalk escarpment of the Chilterns near Pegsdon, Hertfordshire. Subsequent lowering of the water table having lowered the outlet of the spring, new saps are now proceeding into the dry valley floors. A similar origin has been suggested for Rake Bottom on the Hants-Sussex border by R. J. SMALL, (1958). Other writers suggest that the dry valley systems originated upon an impermeable cover which has now been eroded away and the cutting down of the major streams lowered the regional water table in the chalk and led to the progressive dessication of the valleys, a view supported by PINCHEMEL (1954). LINTON (1956) adopted a similar idea to explain the dry valleys of the Southern Pennines, and this mode of origin is favoured by the writer. For certain dry gorges such as the Cheddar Gorge, Somerset, hypotheses of cavern collapse have often been put forward, but with little detailed examination of the ground and of typical cave plans. TRUEMAN (1938) marshalled some of the counter arguments for an entirely subaerial origin for Cheddar Gorge. F. J. BENNET (1908) put forward the notion that some of the dry valleys in the calcareous sandstones of the Hythe Beds of Kent were due to solution and subsidence.

The Peak District

The heart of the area is a limestone plateau which rises abruptly in the south to a general height of 280—340 metres above sea-level. A long low swelling ridge rises up to 50 m. above the general level forming the divide between the Wye and Dove drainage systems. The northern part has rather greater relief and a somewhat greater altitude. The major rivers, shown on figure 1 have cut deep valleys into the plateau surface, though traces of wider valley floors are to be found marking stages in their progressive incision. These valleys are flanked by a series of dry tributary valleys. Flanking all but the southern side is an almost continuous rim of escarpments, interupted partially on the eastern side by the Derwent valley.

The central plateau is composed of Carboniferous limestones of Viséan age, for the most part well-bedded, pure limestones interbedded locally with contemporaneous lavas and tuffs and in parts of the south-east converted in places to dolomite. Nowhere is the base exposed and the limestones rest upon an old basement, presumed to consist of Pre-Cambrian rocks, which has been proved to lie 270 m below the middle of the Wye valley floor (COPE, 1949). A further 450 m. of limestone lie above the stratigraphic level of the bore-hole (WRAY, 1954). On the western edge of the block discrete masses of reef limestone are found which have weathered out into upstanding hills and westwards the limestones change to a basin facies with thinner limestones and a greater proportion of shale. Similar reef limestones flank the northern edge but basin facies are not exposed there. The old bioherms are traversed by major joints which are roughly parallel to the surface of the mass, and these are the commonest locations for caves. The limestones are overlain by Namurian shales and sandstones in an unconformable relationship, in the south-west they can be seen to be banked up against old landscape features with at least 150 m. of relief. Indications that the limestone surface over the plateau area was also irregular are given by the two outliers of shale shown on figure 1 which lie at the bottom of topographic depressions, surrounded by higher limestone hills. The cuestas surrounding the plateau are formed of coarse sandstones or grits, but in the south only shales seal off the limestone, succeeded in turn by Triassic deposits which only make direct contact with the limestone in the south-west.

The dominant structure of the limestone is a broad dome with an axis running NW-SE, but this is complicated on the east by a series of anticlines and synclines which pitch eastwards and produce the sinuous eastern outcrop of the limestone. In the south-west the structure ist more complicated and a series of folds and parallel faults swing from a NW-SE direction to the east of Dovedale into a N-S direction a long the Manifold Valley (PARKINSON, 1950, PRENTICE, 1951). Some of these folds were initiated in Lower Carboniferous times but the major earth movements occured in the main Variscan folding in Permo-Carboniferous times. There has been no further folding though some upwarping is presumed in connexion with the Alpine disturbances.

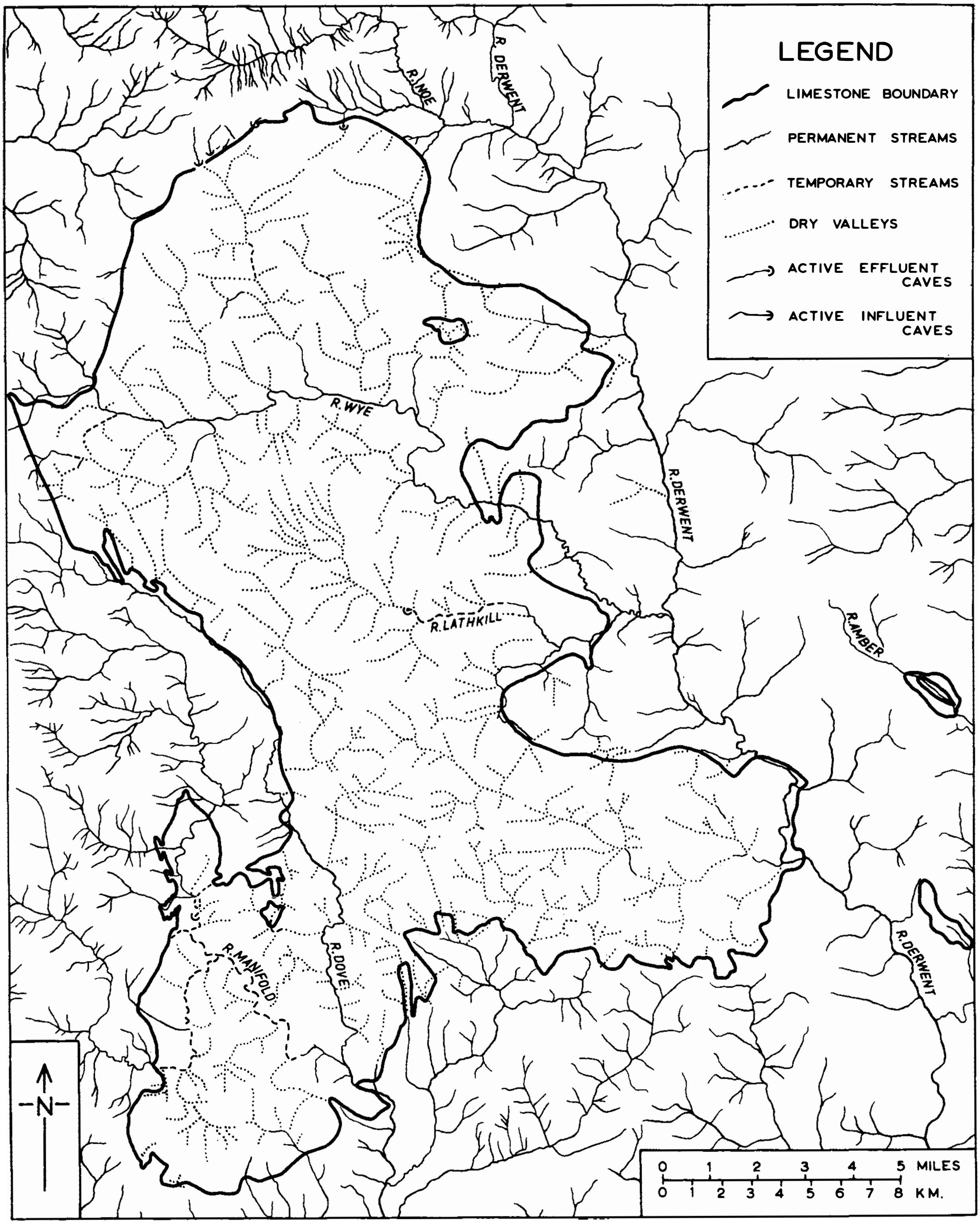

Fig. 1: Drainage system and dry valley network of the Peak District

The Dry Valley Systems

The relationship between the dry valleys and the limestone is clearly shown on figure 1, though a few small dry valleys do occur on the shales. They fall into two main categories, the first consisting of larger tributary valleys, usually on NW-SE lines which usually grade into the major valleys with little altitudenal discordance. The other group is formed of smaller tributaries with few branches which often hang above the main streams. The upper parts of both types of valleys are usually gently graded and in the case of the first group often consist of a wide "bowle", oval or circular in shape leading to a dry valley or gorge with steep, rocky walls and steeper gradient which may exhibit one or more dry knickpoints of varying grades of steepness. In a few cases water may still be flowing in the lower part of the valley, fed from a spring. Except for the northern flank of the Wye valley, most of the catchment areas of the major rivers and dry valley systems are very narrow and the tributary patterns simple. Many of the discordant junctions with the major streams show some valley development below the "hang", but they are very steep. In the tributary dry valleys bare rock walls sometimes occur below the lips of hanging tributaries suggesting spring head sapping or even waterfall scour in some cases. In general the valley sides and floors are covered by grass or occasional ash woodlands, but in the steeper-sided gorges free faces of bare rock occur footed by scree slopes in varying stages of being colonised by vegetation. Such bare cliffs, locally known as t o r s, are most frequent in the areas of reef limestone.

On the northern edge of the limestone small streams run off the impervious Namurian rocks into cave systems, some of which, like the Manifold Sink at Perryfoot, lie at the head of small blind valleys cut into the floor of dry valley systems. This cuts off allogenic supplies of water to the dry valleys, though in this area the water moves laterally to drain into the Noe system to the east. None of the dry valleys heads into a cave system, so that the cave collapse hypothesis is inapplicable here, though a few old spring heads occur e.g. Churn Hole off Deepdale, a right-bank tributary of the middle Wye. A few of the dry valleys contain dry effluent caves, but these are uncommon, Hob Hirst House in Deepdale is one example. The Lathkill (described below) commences at the flow from an active cave in the side of its valley, above this point the system is dry. At Castleton a dry valley hangs above the short gorge of Cavedale at the head of which lies the large mouth of Peak Cavern, once a powerful resurgence but now dry. The present cave stream passes through a flooded section to come into daylight below the main cave mouth. Here some roof fall may have assisted the formation of Cave Dale, but the sapping action of the present outflow must have been just as important. The stream rising here — Peakshole Water, flows in a wide valley cut in the shales but bordered on the southern side by a valley side of limestone seamed with short dry dales.

The River Lathkill System

Only half of the main valley is ever occupied by a flowing stream and the upper dry part consists of an elongated bowl centred upon the village of Monyash and leading into a dry gorge with steep rocky sides. Near the end of this gorge is a large cave — Lathkill Head Cave, where the river commences, but this stream gradually loses its water supply underground. This may be due in part to the driving of drainage levels known as s o u g h s (pronounced "suffs") which have permanently lowered the local water table to assist in mining operations. The last quarter of the valley is permanently occupied by water from a large rising in its bed and the nearby discharge from a sough. Although this stream is subject to considerable interference by weirs, it is possible to see a fairly extensive low cliff of bare limestone rising above the river on its right bank. Much higher cliffs are to be seen in parts of the nearby Wyedale.

Although many of the tributary valleys leading into the Monyash Bowl are steep, none of them hang above the main valley floor. This feature begins in the gorge section, e.g. Ricklow Dale and the un-named valley immediately south of Lathkill Head Cave on the left bank. This last has a bare wall below the lip of the valley. BARKE and SCOTT (1921) described a similar hanging valley leading into Cales Dale, the next rightbank tributary valley below Lathkill Head Cave. In the lower half of the valley most of the tributary valleys reach the main valley floor or only hang a few metres and this may be due to valley floor infilling which has been swept out of the Lathkill valley.

The gradient of the gorge above the cave steepens considerably up to the level of the floor of the Monyash Bowl. It is cluttered up by large blocks of limestone, whilst the steep sides are footed by coarse scree up to 10—20 cm. in length which is now becoming grassed over. Further down the valley where the slopes are less steep, patches of scree may be seen and where the grass has been disturbed much finer frost breccia, of 2—3 cm length is being distributed in stripes down the coarser material.

Immediately upstream from the main rising are small rimstone pools or gours of tufa, some of which are becoming grassed over. Further up the valley there is a much larger tufa dam nearly 2 m. high backed by silt through which the stream now flows, choked by vegetation. This again appears to be inactive. These forms appear to be connected with past discharges of nearby groundwater releasing carbon dioxide from solution and precipitating calcium carbonate.

The Manifold System

Some six stages in the rejuvenation of this river have been noted, though there are only four in the upper part of the valley due to complications introduced by an influent cave system which still takes all the river's flow in dry weather and whose dismembered remnants cut through at least two of the higher benches near Wetton Mill (WARWICK, 1955). Dry valleys are found on either side of the main valley with level stretches backed by dry knickpoints corresponding to the various past levels of the Manifold.

Unlike the Lathkill the headwaters of the Manifold drain land underlain by impervious strata which provide permanent streams which exhibit considerable variations in their flow. At low water stage the river sinks at Wetton Mill in its bed soon after it encounters the first mass of reef limestone and the bed is dry from there unto the main resurgence at Ilam, a distance of c. 9 km. along the stream line. The profiles of the left bank tributaries have been drawn on figure 2, in which the vertical scale has been exaggerated five times. The contrast between the last tributary entirely on shales (Ecton Brook) and those cut into limestone is very marked. Many of them such as Redhurst Gorge hang precipitously above the valley side up to heights of 150 m. or more. In contrast the Black Meadow's Brook a little way upstream comes down to the general level of the Manifold Valley as it is fed from shale lands, but its stream normally disappears in its bed between 50—300 m. from the junction. Other valleys show progressive adaptation to the lower levels but all are now dry. Only the lowest of all has a large spring near the river backed by a low bluff above which the valley gradually slopes up to a steep valley head, probably marking a former spring head sap.

On the right bank the upper tributaries are all permanent, though the second one after the Manifold crosses into the limestone has a very steep fall down the valley side from an intermediate level. The reason why this does not sink is probably beacuse the limestone here is very shaley. Below Wetton Mill even the right bank tributaries are dry or intermittent. The former again show verying degrees of hang above the main valley. An exceptional dry valley is a feature more like an abandonned channel, which cuts into the erosion flat, c. 20 m. above river level, sub-parallel to the general valley direction and whose head has been cut off by undercutting of the river in relatively recent times. This is the only dry valley which does not have a counterpart at a higher level and which seems to have been initiated at a late stage.

The un-named valley above the Castern Valley of figure 2 has at its base a small, steep-sided fan composed of earthy material and coarse limestone blocks which is being actively eroded by the Manifold when it has water in its channel. The next right bank tributary downstream also has a fan

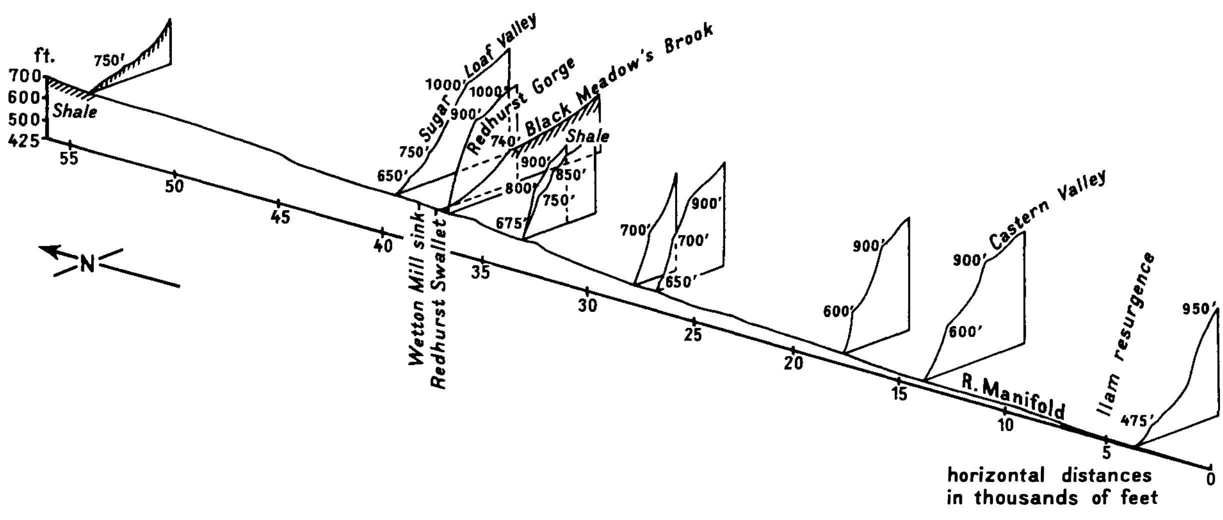

Fig. 2: Longitudinal profiles of the Lower Manifold and its left bank tributaries.
(The vertical scale is exaggerated five times that of the horizontal).

but that is much lower and flatter since the dry valley into which it heads grades more nearly to the Manifold. Such fans however are not common features.

In general the sides of both the main valley and the dry valleys are smooth and covered by vegetation, but tors are common in the reef limestones. In the upper Manifold valley just below where it enters the limestone, quarrying has exposed a large deposit of fine angular scree loosely cemented together on the undercut slope of a great incised meander. It has been suggested by PRENTICE and MORRIS (1959) that this deposit once filled the whole valley floor, inferring a drying up of the river at that period. The writer does not agree with this view of infilling, but some reduction in the valley floor space must be accepted. Similar material has been recovered from the nearby Elderbush Cave, associated with a cold fauna indicating that it is a frost breccia which is no longer being formed.

The Dove Valley System

The Dove maintains its course across the limestone without disappearing underground but all of its former tributaries from the limestone are streamless. Not only has this valley been subject to the usual multiple rejuvenation but it and its tributary valleys have been considerably modified by river capture (WARWICK, 1953). Capture is presumed to have been caused by spring-head recession from a tributary of the Manifold (which had achieved a lower level than the former tributary of the Dove, which has now been reversed). This capture apparently led to several high level valleys becoming dry. Small straightenings of meanders have also produced high level dry valleys, one near a farm called Dunge Bottom and the second occurring below Milldale (situated at the double kink in the limestone course of the Dove), but only forming a semi-circular alcove in the right hand side of the valley. At Milldale another steep-sided dry valley comes in from the west which leads up into a large bowl whose lowest point at Hopedale is still floored with shales. This leads to the conclusion that this feature is in large measure resuscitated from the old limestone shale unconformity. The higher parts of this bowl on the northside are also covered by a thin cover of shale, above which rise higher reef limestone hills. A small temporay stream off these shales sinks in a combined collapse doline and blind headed valley known locally as the Dumble Hole. A little further along the edge of the shale is a similar dry feature and another occurs near to Alstonfield. These minor valleys probably carried meltwater during the Last Glaciation. A thin covering of till lies on the shales, and this forms the edge of a sheet $^1/_2$—1 m. thick on the land to the north, but little till is to be found resting directly upon the limestone though occasional erratics have been found over the Hopedale Bowl and in lower Dovedale.

Discussion

A comparison between the dry valleys on the limestone and the permanent streams on the Namurian, especially to the west and north of the limestone, reveals a great similarity in the pattern and texture of the drainage lines. Both show dominant NW-SE trends, though this has been dismembered to some extent amongst the dry valleys due to capture. In both cases there are many headwater tributaries, simplifying downstream, though there are more first order tributaries on the Namurian rocks. This similarity lends support to the view that the drainage was inherited from an impervious cover.

The relationship between the hanging valleys and the successive stages of downcutting is a further indication of a progressive lowering of the water table. It is possible that variations in the height at which the "hang" occurs maybe related to former variations in the remaining shale cover of the headwaters of the tributaries, such as happens to-day in the case of the Manifold. When the highest incisions occurred there would be relatively little thickness of limestone exposed above the shale seal to the south of the mass which would maintain high water tables. As the major rivers cut down and the development of solutionally enlarged joints and bedding planes speeded water movements with consequent lowering of the water table gradients, more and more streams would find themselves above the ground water level. As the shale cover was removed this would mean that most of the precipitation would be absorbed directly with no run-off and so the valleys would become dry. The prime cause of this was the lowering of the level of the Dove and Manifold in the south-west and of the Wye and Noe in the north, these last two rivers being dependent upon the down-cutting of the Derwent. However this last valley is almost entirely cut into Namurian strata, except at Matlock in the south-east leaving intact the eastern seal of the limestone dome except where the Wye and Noe have breached it.

The dating of the various still-stands recorded in the Peak District landscape is very difficult, but most authorities agree that the higher levels are pre-Pleistocene but most probably post-date the disturbances following the Alpine earthmovements in Oligo-Miocene times. LINTON (1956) has summarized the available evidence to that date, suggesting a late-Cretaceous or Eocene date for the drainage pattern to be limned out on a Cretaceous cover. More recently pollen of Pliocene age have been reported from the fill of a large doline, cut in the plateau surface. This all supports the view that the earlier rejuvenations and accompanying valley desication occurred before the Pleistocene with its cold periods.

The lack of extensive cavern collapse rules that out as a possible source of dry valleys. Some evidence of spring head recession has been found and this caused the development of certain valleys such as the one below Ilam and there is some evidence of this occurring to-day at a lower level leaving the old valleys dry above the spring heads. Some of the steep rocky faces below hanging valleys may also have developed in this manner.

The greatest difficulty in assessing the part played by Pleistocene climatic changes is the scattered nature of the evidence regarding former glaciations. There is fairly widespread agreement that the region was heavily glacierized during the Antepenultimate (Mindel) Glacial and erratics from this district are found widely scattered over the Trend valley and East Midlands, but a growing suspicion that much of the area was free from ice during the Penultimate and Last Glacials apart from a stream of ice passing up the Goyt valley and thence down the Wye. Support for this view is lent by the general absence of bare limestone solutional forms (karren) and the cover of stoneless silt-loam 100—150 cm. thick on the gentler sloping ground discovered by PIGOTT (1962) which contains wind-borne material derived from the Namurian rocks and only a thin basal layer of mineral matter from the solution of the limestone (c. 1 cm. thick) PIGOTT has also found evidence for festooning in the lower parts of this cover. LINTON (1949) argued on morphological grounds that the area was an unglaciated enclave during a least the Last Glaciation. For these reasons one must look for evidence of modification of the dry valleys during these periglacial periods. In 1947 after 2 months of hard frost and thick snow cover (1—2 metres), meltwater flowed on the surface of many of the dry valleys but quickly died away. Presumably such condition would be of more frequent occurrence during the colder Pleistocene phases. However the limited amount of material associated with such events indicates that it was not important. The fans of the Manifold Valley have already been cited. It is possible that even the main rivers would cease to flow in winter and that frost action was strong upon any faces of limestone exposed by the killing off of the vegetation and the stripping of much of the regolith by solifluction action. The fine scree bears witness to these events both in the river and the dry valleys, and can be correlated with similar deposits in cave mouths. It is likely that as condition began to ameliorate that there would be increased snow-fall and higher spring temperatures producing more meltwater than previously and that scouring of the valley floors might take place in some of the lower valleys. However PIGOTT has found his deposits undisturbed in some of the high-level dry valley floors. Small, abandoned blind valleys such as those near Gateham and Alstonfield may also date from a snowier period.

The general effect of post-Mindel periglacial periods on the dry valleys appears to have been one of minor modification of already existing features.

Conclusion

In view of the evidence cited above the author is convinced that the majority of the dry valleys in the Peak District were evolved from a complex pattern initiated on overlying impervious rocks and that intermittent rejuvenation of the main valleys has led to the progressive elimination of the tributary valleys. This was due to rapid adjustment of the water table to the level of the Dove, Lathkill, Manifold, Noe and Wye rivers, below the level of the floors of the tributary valleys. This was probably helped by the short and therefore steep gradients of the side valleys, many of which were left hanging.It is thought that much of this adjustment occurred before the Pleistocene Period and that periglacial conditions of the later Pleistocene glacial phases only caused minor modifications to these valleys. It is difficult to assess the effect of glaciation by an ice-sheet, though again it would appear to have been slight.

Acknowledgements

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Birmingham, 17. Dec. 1963

References

BARKE, F. and A. SCOTT. 1921. An Unusual Case of Hanging Valley. *Trans. N. Staffs. Field Club,* 55, 51—53.

BENNET, F. J., 1908. Solution-Subsidence Valleys and Swallow - Holes within the Hythe Beds Area of West Malling and Maidstone. *Geographical Journal,* 32, 277—288.

BULL, A. J., 1936. Studies in the Geomorphology of the South Downs (Eastbourne to the Arun Gap). *Proc. Geologists' Assocn.,* 47, 99—129.

—, 1940. Cold Conditions and Land Forms in the South Downs. *Proc. Geologists' Assocn.*, 51. 63—71.
CHANDLER, R. H., 1909. Some Dry Chalk Valley Features. *Geol. Mag.*, Decade V, 6, 538—539.
COPE, F. W., 1949. Report of Boring in Wood Dale. *Abstract of Proc. Geological Society of London,* 1446, 24.
FAGG, C. C., 1923. The Recession of the Chalk Escarpment. *Proc. Croydon Natural History & Scientific Soc.*, 9, 93—112.
—, 1954. The Coombes and Embayments of the Chalk Escarpment. *Ibid.* 12. 117—131.
LINTON, D. L., 1949. Unglaciated Areas in Scandinavia and Great Britain. *Irish Geography,* 2, 25—33.
—, 1956. Geomorphology, Chapter 2 of *Sheffield and Its Region* (Editor, D. L. Linton). British Association Handbook.
PARKINSON, D. L., 1950. The Stratigraphy of the Dovedale Area, Derbyshire and Staffordshire, *Quarterly J. Geological Society of London,* 105 (for 1949), 265—294.
PIGOTT, C. D., 1962. Soil formation and development on the Carboniferous Limestone of Derbyshire, I. Parent Materials. *J. of Ecology,* 50, 145—156.
PINCHEMEL, PH., 1954. *Les Plaines de Craie.* Paris.
PRENTICE, J. E., 1951. The Carboniferous Limestone of the Manifold Valley Region, North Staffordshire. *Quarterly J. Geological Society of London,* 106 (for 1950), 171—209.
PRENTICE, J. E. and P. G. MORRIS, 1959. Cemented Screes in the Manifold Valley, North Staffordshire. *East Midland Geographer,* 11, 16—19.
REID, C., 1887. On the Origin of Dry Chalk Valleys. *Quarterly J. Geological Society of London,* 43, 364—373.
SMALL, R. J., 1958. The Origin of Rake Bottom, Butser Hill. *Proc. Hampshire Field Club,* 21, 22—30.
SPARKS, B. W. and W. V. LEWIS, 1957. Escarpment Dry Valleys near Pegsdon, Hertfordshire. *Proc. Geologists' Assocn.*, 68, 16—38.
TRUEMAN, A. E., 1938. Erosion Levels in the Bristol District and their relation to the Development of the Scenery. *Proc. Bristol Naturalists' Soc.* 4th series, 8, 402—428.
WARWICK, G. T., 1953. The Geomorphology of the Dove-Manifold Region. Unpublished Ph. D. Thesis, University of Birmingham.
—, 1955. Polycyclic Swallow Holes in the Manifold Valley, Staffordshire. Actes du 1er Congrès Internat. de Spéléologie. 2, 59—68.

BEDECKTER KARST IN DER UdSSR

N. A. GWOZDECKIJ

Weit verbreitet ist die Auffassung L. SAWITZKIS (1909), der den Karst in zwei Typen einteilt: den „Mittelmeerkarst" und den „Mitteleuropäischen Karst" oder den „nackten" und „bedeckten" Karst. Die Begründung dafür wurde im Einfluß des Mittelmeer- und Mitteleuropäischen Klimas gesehen. In der russischen Literatur fand diese Einteilung eine sehr große Verbreitung, (KRUBER, 1915, S. 278; SCHÜKIN, 1933, S. 341—342). Der bedeckte Karst jedoch ist eine Folge der Besonderheiten nicht nur des Klimas, sondern auch der geologischen Struktur.

Unter dem bedeckten Karst soll im wesentlichen ein solcher Karst verstanden werden, bei dem wasserlösliches Karstgestein von unlöslichen geologischen Formationen geschützt wird, die genetisch nicht an die Karstdecke gebunden sind, also sandigtonige Meeresablagerungen, Moränen, fluvioglaziale Ablagerungen, alluviale Terrassen und anderes mehr. Im Gebiet des bedeckten Karstes fehlen oberflächliche Auslaugungsformen, jedoch spielt die Bildung von Trichtern und Wannen eine große Rolle. Die Hohlformen im Untergrund wurden auf mechanischem Wege mit dem lehmig-sandigen Material der Deckschicht aufgefüllt, (GWOZDECKIJ, 1954, Kap. IV, SOKOLOW, 1962, Kap. III). Wo sich unter unlöslichen Schichten Gips befindet, entstehen gleichfalls recht häufig Einsturzformen, die sehr typisch für den bedeckten Gipskarst sind.

Die Verbreitung des bedeckten Karstes ist in der UdSSR sehr groß. Beispiele dafür ergeben sich u. a. in Verbindung verkarsteter Schichten mit unlöslichen Deckschichten von Meeresablagerungen. Ausgedehnte Gebiete liegen im Süden und Südwesten von Kislowodsk im Nordkaukasus, wo auf Strukturterrassen und flachen Talböden Hohlformen des bedeckten Karst mit lockerem Material erfüllt über Kreidekalken entstehen, (GWOZDECKIJ, 1962, S. 143, 1958, S. 133 und 141). Gipskarst mit ihn bedeckenden Meeresablagerungen beobachtet man in der Umgebung des Baskuntschaker Sees in der Kaspischen Niederung, (GWOZDECKIJ, 1953, 1954, S. 245—246). Auch in der Russischen Ebene ist der bedeckte Karst sehr weit verbreitet, wo die Kalke, Dolomiten und Gipse oft von Moränen, fluvioglazialen und alluvialen Ablagerungen überdeckt sind (GWOZDECKIJ, 1954, S. 234—235; JAKUSCHOWA, (1949). Im östlichen Sibirien, in Priangarie, kommt typisch ausgeprägter bedeckter Karst auf den alluvialen Angaro-Terrassen, über kambrischen Dolomitensockeln vor, (GWOZDECKIJ, 1952, 1954). Gipskarst mit Moränenbedeckung finden wir auch im gebirgigen Teil Mittelasiens, so im Gebirge „Peter I." und am Fuße des „Saalaiskij-Gebirges" in seinem östlichen Teil (GWOZDECKIJ, 1957, 1960; TESAUIK, 1958, S. 216). Im Gebirge „Peter I." gibt es typisch ausgeprägte Vorkommen des bedeckten Kalkkarstes mit durchlässigen Trichtern, auf alluvialen Terrassen und Schwemmland sowie ausgebildete Talböden.

Vom bedeckten Karst sind die Fälle zu unterscheiden, in denen das lösliche Gestein nicht von einer nichtlöslichen, geologischen Formation bedeckt ist, sondern von einer autochthonen Boden-