How old are limestone pavements?

Tom Lord. Winskill Farm Visitor Centre.

Such is the iconic status of limestone pavements in Craven's limestone landscape that is very easy to believe that we know everything about them. On field trips, on post cards, in textbooks and nearly everywhere we look we encounter limestone pavements. Malham and pavements are as synonymous as Blackpool and its tower. Limestone pavements are the most rigorously protected part of Craven's landscape, and their legal protection is actually enforced. Issues concerning their biodiversity are driving new management initiatives for Craven's limestone landscape. Inherently measurable, quantifiable, and ideally suited to performance indices, limestone pavements are resourced at a level unheard of by comparison with other key elements of Craven's limestone landscape such as caves and dolines. Yes we think we must know everything about them. Nothing could be further from the truth.

It is only very recently that we have a model for the formation of limestone pavement that reconciles geomorphology with structural geology so that theory at last marries actual observation, and just so explanations are replaced by an understanding of the significance of Carboniferous palaeokarstic features. Peter Vincent's(1) elegant reconciliation of palaeokarstic influences and glacial geomorphology emphasises the inherited aspects of much of Craven's limestone pavements. This in turn begs further questions, one of which I want to explore here. How old are limestone pavements?

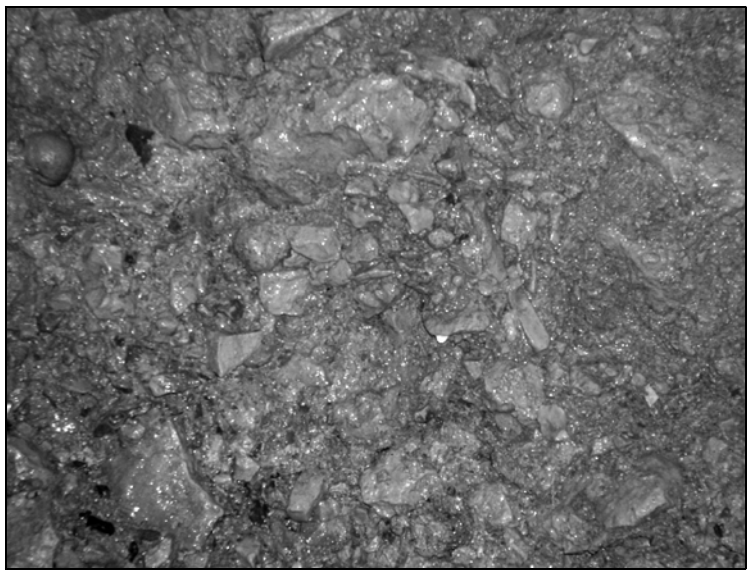

Plate 1. Pebbly sediment with rounded Lower Palaeozoic clasts, Kinsey Cave. This is overlain by Late Glacial bear bones AMS dated about 12,500 BC. Photo Tom Lord.

Clearly not all limestone pavements are the same age, and observation suggests that sub-soil processes are still actively forming limestone pavement today. But how old are the earliest pavements? Peter Vincent shows how variable are the effects of glacial scour, and that in certain instances the limestone bedrock is not removed the full depth of the open joints so that

some surfaces retain their open joints on deglaciation. If this is the case what might happen to any mantle of boulder clay or loess? Sometimes it would seem these deposits might be quickly flushed into open joints and shallow sub-surface conduits in the limestone where they might even reach the caves. In Kinsey Cave pebbly sediment with rounded Lower Palaeozoic clasts (Plate 1) was deposited beneath solution chimneys in the cave roof before the cave was occupied by brown bears, AMS dated as part of the Giggleswick Scar Project, and shown to have been using the cave around 12,500 BC. It suggests the sub-surface karstic drainage network had already formed and by inference some joints were already open in the limestone by first half of the Late Glacial Interstadial. Perhaps we should consider the possibility that some pavement was formed more or less at the time of deglaciation, and whatever boulder clay or loess was deposited on it was quickly flushed off before the formation of a protective and binding vegetation cover.

Plate 2. A large polished Neolithic stone axe made from Langdale tuff. Found in 1936 during limestone pavement extraction on the Over Close, Selside, and now part of the Ingleborough National Nature Reserve. Lord Cave Collection.

What other evidence might there be for the age of the oldest pavement? Some years ago Helen Goldie (2) noted the use of pieces of pavement in prehistoric stone structures in Craven. Clearly where pavement can be shown to be incorporated into dateable early structure, we have at least a minimum age for the pavement. The difficulty is determining the age of the feature. Following Raistrick (3) most workers have attributed an Iron Age date to the generally irregular lines of stones laid over limestone pavement. Careful inspection reveals the rows are sometimes deliberately sinuous, and occasionally include collapsed box like elements. The rows include detached pieces of pavement, and being laid across bare rock most workers, again following Raistrick, assume an agricultural function which of necessity must pre-date the emergence of the pavement surface. From here it is but a simple step to assume this is evidence for soil erosion and agricultural mal-practice. Actually all these assumptions are extremely tenuous. We simply don't know the age or ages of these features, let alone their function. Indeed it is much more likely that at least some are ritual and funerary in nature, and might represent a purely local development in response to specific beliefs connected with the pavement. Hopefully the work of Tim Taylor and others will bring some much needed clarity, now a matter of urgency as these stone lines are very vulnerable and greatly at risk with the

extension of public access onto most limestone pavements in Craven as a result of the CROW legislation.

Finds of spectacular stone objects made in the 1930s during limestone pavement removal for garden rockery stone hint at the possible significance of limestone pavement in early cosmologies. These include a large polished Langdale Stone Axe (Plate 2) from the Over Close Selside, and an unusual perforated ground stone axe from above Arco Quarry (Plate 3).

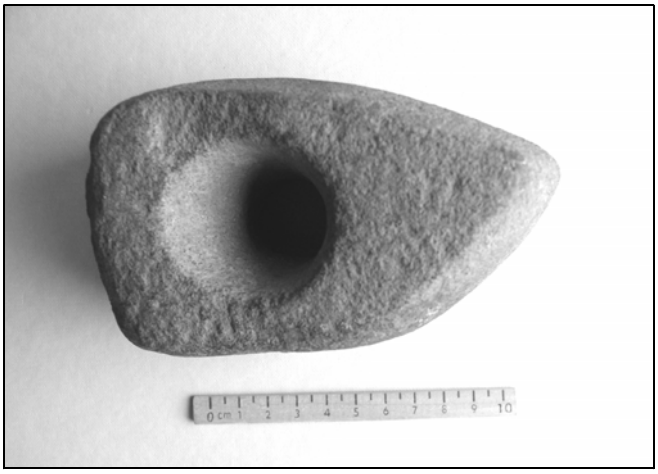

Plate3. An unusual perforated and ground stone axe found in limestone pavement above Arco Quarry, Horton-in-Ribblesdale. Dating of these objects is problematic, sometime from the Late Neolithic to Early Bronze Age is the most likely. Lord Cave Collection.

It is difficult to dismiss these prestigious stone objects as casual losses, and finds of Langdale polished stone axes have been reported from pavement in Cumbria. If we accept limestone pavement as foci for ritual deposition of special objects from the Neolithic, then the pavement must have already formed by that time.

More indirect evidence for dating limestone pavement formation is the deliberate use of cobble size, sandstone erratics, usually with a high quartz content, in the many stone cairns on the limestone pavement on the east side of Ingleborough overlooking Ribblesdale. One such cairn, later destroyed by quarrying at Horton, produced a Late Neolithic or Early Bronze Age pottery vessel known as an all over cord beaker (Lord Cave Collection). The sandstone erratics may originate from boulder clay, but where did the makers of the cairns get them? We don't know, and we can only speculate at present. One possibility must be that they represent the coarser fraction of a boulder clay mantle that had already largely disappeared by the Late Neolithic, and the cairn makers collected them from the surface of limestone pavement.

Much larger cairns often incorporates substantial pieces of limestone pavement. Few cairns in Craven have been excavated to an acceptable standard, and sadly all too often we are left trying to make some sense of damaged cairns quarried for walling stone in the eighteenth and nineteenth centuries. Especially tragic is the case of the Giant's Graves at the head of Penyghent Gill. This appears to been a substantial chambered tomb and according to current

orthodoxy one of the few Neolithic monuments in Craven (4). The upright stone slabs poking through the turf today which might have formed compartments within the tomb, if it is indeed a tomb, are pieces of limestone pavement set on edge. A large prehistoric cairn of unknown date, the Apron Full of Stones, on Giggleswick Scar, when it eventually fell prey to a local antiquarian in 1784 was found to contain 'a coffer made of great stones, some of them over six feet long and 3 feet wide' (5). The 'coffer' is depicted in a contemporary illustration published in the Gentleman's Magazine (Plate 4) Quite remarkably much of the cairn and parts of the so-called coffer still survive. By now it should come as no surprise that the 'coffer made of great stones' was made from large pieces of limestone pavement.

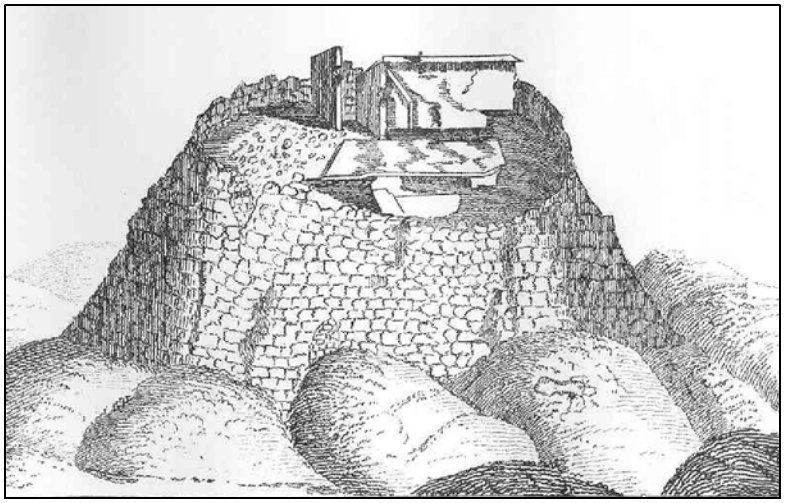

Plate 4. The Apron full of stones, a large prehistoric stone cairn on Giggleswick Scar illustrated in the Gentleman's Magazine in 1784. The 'coffer made of great stones, some of them over 6 feet long and three feet wide is clearly visible. Some of the 'coffer' stones survive today and they are pieces of limestone pavement.

A recent program of AMS radiocarbon dating of human remains from caves, to be further amplified by the Giggleswick Scar Project, has shown that caves in the western part of Craven were used for the deposition of human remains in the Early Neolithic, about 4,000BC to 3,600BC (archived in the Lord Cave Collection). Forensic work by Stephany Leech has revealed that the individuals placed in the caves at this time often display unusual pathology. Stephany has also found unusual pathology on the skeleton of a woman discovered during limestone pavement extraction on the Over Close, now part of the Ingleborough National Nature Reserve, Selside in 1936. It may be a tenuous link, but this woman too might be Early Neolithic. The skeleton was found in a shallow grike covered by a substantial limestone capstone. A contemporary photograph clearly shows the capstone is a large piece of limestone pavement (Plate 4). Unfortunately the feature was destroyed by limestone pavement extraction and the capstone transported to the Royal Gardens at Windsor Castle (pers com the finder of the skeleton, the late Mr Tommy Braithwaite of Ingleton). However, the woman's skeleton survives, and an AMS date would provide a minimum age for limestone pavement formation at this locality. Here at last then potential for a scientific answer to the question how old is limestone pavement? If the woman's skeleton were indeed Early Neolithic then it would be evidence for the formation of limestone pavement on the Ingleborough NNR prior to the arrival of the first farming communities. Rounding up the usual suspects, the National Park informs us that pavement formed as a result of woodland clearance instigated by early farmers

(6). If there were areas of pavement before the Neolithic then farming practices alone cannot explain how Craven's limestone pavement formed.

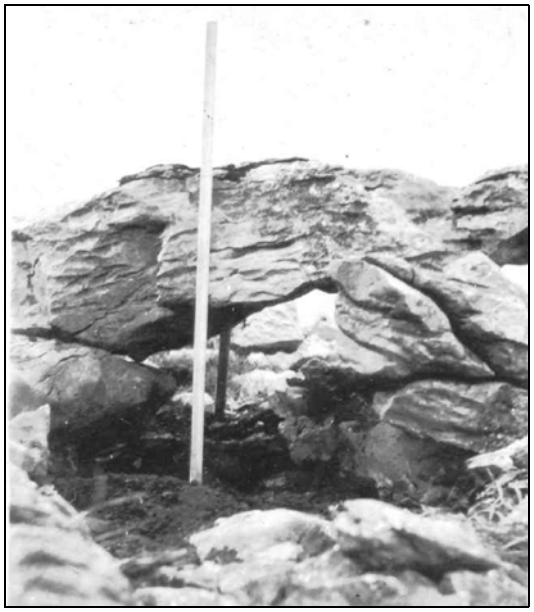

Plate 4. A photograph showing the shallow grike and substantial limestone capstone beneath which the skeleton of a woman was discovered on the Over Pasture, Selside, in 1936. Shortly afterwards the feature was destroyed by limestone pavement extraction. The large polished Neolithic Langdale stone axe, Plate I, was also found in the vicinity. The capstone is clearly a large piece of limestone pavement. Photo Lord Cave Coll.

Finally to think the unthinkable, might some of Craven's limestone pavement have formed due to activities by those arch-exponents of setting fire to vegetation, the hunter-gatherers of the Mesolithic? Pine seems to be a consistent and distinctive component in post-glacial fossil pollen spectra from Craven. One reason might be that pine had a liking for loessic soils over limestone bedrock. Pine was also perhaps the only canopy tree in post-glacial woodland that was remotely combustible standing. If deliberate fire setting to facilitate hunting by Mesolithic people selectively targeted areas of pine and its under storey. This could have accelerated the erosion of shallow loessic soils, leading to limestone pavement formation in the Mesolithic. Who knows? We don't.

References

1. Vincent, P. 2004. Polygenetic origin of Limestone Pavements in Northern England. Zeitschrift für Geomorphologie 49, pp 108-116.

2. Goldie, H.S. 1986. Human influence on landforms: the case of limestone pavements. In Paterson, K. & Sweeting, M.M. New Directions in Karst pp 515-539. Norwich, Geo Books.

3. Raistrick, A. & Holmes, P.F. 1962. Archaeology of Malham Moor. Field Studies 1, No. 4, pp 73-100.

4. Feather, S. W. & Manby, T.G. 1970. Prehistoric chambered tombs of the Pennines. Yorks. Archaeol. J. 42, 396-7

5. Brayshaw, T. & Robinson, R.M. 1932 A History of the Ancient parish of Giggleswick. London, Halton & Co.

6. Thom, T. No Date. Limestone Pavement. Nature in the Dales, Habitat Information Series 1, Yorkshire Dales National Park Authority.