“LiDAR re-lights the issue of mapping lime kilns in Scotland”

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LiDAR re-lights the issue of mapping lime kilns in Scotland
Paul Bishop

There have been several Sheetlines papers on the mapping of lime kilns in Scotland and I now return to this matter (I hope with the forbearance of readers not so interested in lime kilns).¹ This note is prompted by the recent addition to the National Library of Scotland Maps website of the capability to view a map series side-by-side with 0.5-1.0 m resolution LiDAR data. The LiDAR data have been processed to represent a digital terrain model (DTM), which is the ground surface with features such as trees and buildings removed. The removal of trees enables the visualisation of features on ground now covered by forestry, including lime kilns. Moreover, even in the absence of tree cover, the LiDAR data provide much higher resolution imagery than the usual freely available imagery, such as Google Earth Pro or Bing Maps (Aerial). In good conditions and with good imagery appropriately processed, these latter sometimes do enable subtle features such as lime clamp kilns to be identified but this capability can be hit-and-miss and in any event these aerial imagery packages provide nowhere near the precision and confidence in identifications that come with using the LiDAR data. Current LiDAR coverage of Great Britain is shown in figure 1 and further background on LiDAR is given on the NLS Maps website at https://maps.nls.uk/communities/lidar

Figure 1 (left) Current LiDAR coverage of Great Britain: Scottish Government, SEPA and Scottish Water data in Scotland; Environment Agency and Natural Resources Wales data in England and Wales. Note the larger data gaps in Scotland compared to the other two nations. (This and OS map extracts in this paper are published with the permission of the National Library of Scotland.)

I present here some examples to highlight the increased capabilities provided by the availability of the LiDAR data on the NLS website. Not the least of these capabilities is being able to use the dual cursor capabilities built into the NLS side-by-side viewer to make a side-by-side comparison of a location with its mapped representation on 6-inch and 25-inch second editions mapping. It is also then relatively simple to jump to the corresponding first edition mapping.

In a recent paper on the exclusive use of clamp kilns to burn lime in the west of Scotland, it was argued that the OS had mapped less than half the

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¹ Sheetlines 98, 19-31; 101, 42-47; 106, 32-33; 107, 20-22
The LiDAR data now show that I missed many in my fieldwork, especially in areas that I did not map in the field, and so the shortfall between OS mapping and the field data is even greater. I report this, not to draw attention to ‘failings’ on the part of the OS but to indicate an appropriate degree of confidence when using OS mapping for historical research. Some of the kilns that I missed in my local area are shown in figures 2 and 3.

Figure 2 LiDAR DTM of the area between Baldernock and Lennoxtown (Campsie Parish; modern East Dunbartonshire) with many clamp kilns (the side-by-side U-shaped depressions). The black arrowed examples are mapped on the OS first and second editions 25-inch mapping. The examples in a single red circle are mapped on the 25-inch first edition but not on the 25-inch second edition. The examples double-circled in red are mapped on neither the first nor second editions 25-inch mapping. The three unmapped clamp kilns at far right are under woodland trees and not visible on aerial imagery. The unmapped kilns at left comprise at least three (and probably more) clamp kilns. Note the circular pits, which are either mine shafts or ventilation shafts. The clarity of the clamp kilns is striking and the image can be viewed online even more clearly and enlarged at https://tinyurl.com/22zvyaj6. (The LiDAR data here and in other images in this paper are Crown copyright Scottish Government, SEPA, Fugro, and Scottish Water (2012-2020)).

A second example from the reference in fn 2 is also instructive. The structure at lower right in figure 3, which appears to be a run of six clamp kilns adjacent to a mine shaft, was unknown to me when writing that paper and there is no indication of it on either the first or second editions 25-inch mapping, except that both editions include at lower right the ‘Old Limestone Pit’ (which the LiDAR data now show is adjacent to the kilns). We noted in the paper referenced in fn 2 that the lime clamp kilns were most commonly located adjacent to a mine shaft and so the mapping of the ‘Old Limestone Pit’ at lower right in figure 3 should

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perhaps have alerted me to the possibility of the limekilns that are apparent in the LiDAR imagery.

Figure 3 Side-by-side view of (left) second edition 25-inch and (right) LiDAR DTM from the area adjacent to Glorat Lime Works, on the northern outskirts of Milton of Campsie (modern East Dunbartonshire). Note how the curving line of the former tramway into the mine entrance (‘Level’) at lower left in the map extract is clear in the LiDAR image. This area is under woodland and the tramway line is of course completely obscured by trees in aerial images, as is the crater-like shaft entrance at centre left in the LiDAR image. See https://tinyurl.com/r4t27cwb to view the LiDAR with better resolution and in greater detail.

Even more striking is the number of clamp kilns revealed by the LiDAR at the Balgrochan lime burning site, ~2.5 km northwest of the Glorat Lime Works in figure 3. The LiDAR data indicate that there are something like 33 clamp kilns at this site (figure 4). None of these is mapped on the 25-inch first or second editions, the only hint from OS mapping of their possible presence being the second edition’s label of ‘Old Quarries’ for about 55,000 m² of disturbed ground. And Google Earth Pro is only slightly more helpful in that the bulk of the >30 clamp kilns on the site are not visible on the clearest imagery currently available via Google Earth Pro (from May 2009) (figure 5).

Figure 4 LiDAR imagery of the Balgrochan lime works with quarries and disturbed ground broadly from upper left to lower right, and U-shaped clamp kilns skirting the southwestern edges of that disturbed ground. The group of what appears to be ~11 small U-shaped kilns at lower right is particularly striking. See https://tinyurl.com/2ab2ku3e to view the LiDAR with better resolution and in greater detail.
Finally, we consider the Whit(e)field Quarry and kilns, where the OS labelled open-ended structures as ‘Limekilns’. There are in fact two quarry and clamp kiln sites at Whit(e)field, one to the west of the main road northeast from West Linton and one to the east of that road. Doug Mitchell and I have argued that these open-ended structures represent a different form of clamp kiln, suggesting that these kilns were open at each end, rather than at one end as in the usual U-shaped clamp kiln. Thus, the kiln consists of a pair of parallel lines of raised ground (the sides of the kiln), and banks of kilns consist of a series parallel lines of raised ground. It seems that these linear clamp kilns were used earlier and then superseded by two draw kilns. The representation of the clamp kilns at the West Whit(e)field site on OS 25-inch mapping and Google Earth Pro and by LiDAR data is shown in figure 6. The clearest image in Google Earth Pro reveals most of the linear clamp kilns (figure 6), and comparison of the OS mapping with the representations in Google Earth Pro and by LiDAR shows that the OS did not represent all of the linear kilns at this West Whit(e)field site.

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3 These two sites, either side of the road from West Linton, are explored individually below with OS 25-inch mapping and can be viewed together, with Bing aerial imagery, at https://tinyurl.com/8xu8p8jy.


5 Ibid.
Figure 6 OS 25-inch mapping (left), Google Earth Pro from December 2007 (middle) and LiDAR (right) of the West Whitenfield Quarry and limekilns, on the northwestern side of the road from West Linton, 2.4 km northeast of West Linton, North Lanarkshire. To view the LiDAR in more detail and to compare with the second edition 25-inch mapping, go to https://tinyurl.com/3bewytak.

Figure 7 OS 25-inch mapping (left), Google Earth Pro from December 2007 (middle) and LiDAR (right) of the East Whitenfield Quarry and limekilns on the eastern side of the road from West Linton, North Lanarkshire. To view the LiDAR in more detail and to compare with the second edition 25-inch mapping, go to https://tinyurl.com/7wajad6f.
OS 25-inch mapping does not represent any of the linear kilns at East Whit(e)field on the eastern side of the road from West Linton (figure 7, across the road from the area in figure 6). The Google Earth Pro image reveals several of the linear kilns but vegetation obscures many of them and the LiDAR image highlights the wealth of linear kiln remains. The sheer number of linear kilns at the site would not have been known without access to the LiDAR imagery. Such linear kilns in old quarries at Bents, about 2 km southeast of the Whitfield East site, have also been identified on Google Earth Pro from December 2007 and LiDAR. These linear kilns have so far not been found anywhere other than these three sites near West Linton and so it seems to have been a notably local practice.

As already noted, the purpose of this short piece is not to criticise the OS for omissions in its mapping. Rather the aim is to highlight the wealth of data that become available when the mapping is used in conjunction with Google Earth and LiDAR. The latter two are silent of course on what a particular feature is or represents. Thus, if OS surveyors chose to represent a feature or to label a broad land-use associated with a feature, then the OS mapping is indispensable for understanding that former land-use. It simply needs to be remembered that OS surveyors might not have recorded all the detail or all the examples of that former land-use.

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6 See https://tinyurl.com/5ymyctnk.