THE 'ENGLISH QUARRY', BENNACHIE:
An estimate of the quantities of granite extracted and exported from the English Quarry, Bennachie during the early 19th Century

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Introduction

The following note considers an estimation of the quantities of granite extracted and exported from the English Quarry, Bennachie, during the early 19th Century.

The English Quarry is a small granite quarry on the southern face of the Bennachie massif below Garbet Tap and Quarry Hill. It is adjacent to the present Gordon Way public footpath. The National Grid Reference for it is NJ 6735 2160. On the Ordnance Survey maps it is referred to as Pitgaveny. The material of the quarry is a coarse porphyritic granite with conspicuous phenocrysts of feldspar which vary from 1cm up to about 5cm. The location of the quarry so far into the hills is curious but it may have been opened here on the first natural outcrop of granite. Elsewhere on Bennachie the granite is generally completely covered at lower levels by glacial drift. During the early 19th century the understanding of geology may have been insufficient for the quarry men to predict that the granite extended throughout the hill below the drift.

The quarry is referred to by McConnachie in his book on Bennachie where he says that it was called the English Quarry because it was worked by an English company and that the blocks were exported for the building of the Sheerness docks. There are also references to blocks being used in the Thames Embankment. The quarry was worked during the early part of the 19th century. McConnachie implies that it stopped working in about 1820. He actually says, "it is upwards of seventy years since the quarry ceased to be worked" and his book was first published in 1890.

It would appear that the quarry was worked by prying the granite apart along the original fractures and joints. No signs of working with tools were seen on the rear face of the quarry, except for one drilled shot hole (see below). Once

extracted the blocks may have been faced by cutting rows of triangular holes about 5cm apart and a similar depth as described by Anderson (1794, 29). Squared-off wedges were driven into these. Hammering them in in turn until the rock split along the line. There is at least one block that has been split this way (See Photo. 1).

Photograph 1: Cut block showing chiselled holes. (A Wainwright)

However, rotary drilling has been used in the quarry. Two vertically drilled shot holes were seen as well as one block cut with a line of small drilled holes (see Photo. 2). One shot hole in the back face is interesting as it is triangular in section with rounded corners (Photo. 3). The front face has been blown off and about a meter of hole is exposed. The other one is in the wall of the road out of the quarry to the west. This one is round and not as deep. No drilled blocks were seen in the spoil heaps and it is possible that these are all related to a later period of extraction.

The transport of the blocks to London would have been by horse to Port Elphinstone, about 12kms distant. Then on the Aberdeenshire Canal for 26kms to Aberdeen and finally to London by ship. The first

Photograph 2. Block on quarry floor cut with row of drilled holes. (A Wainwright)

Photograph 3. Shot hole drilled in quarry face, made with triangular section. (A Wainwright)

part of this trip would have been the hardest. On the hill, the road from the quarry that can still be seen down to Woodend of Braco is well-graded but often steep. Therefore, transport would probably have had to have been by sledge, known locally as a 'puddok sledge'. From Woodend of Braco in the Hervie valley the journey would have been by horse cart over local roads which, according to the Old Statistical Accounts, were at this time (1799) built by statutory labour and often of very poor quality. The New Statistical Account written in 1835 implies that the roads had improved.

The canal first opened briefly in 1805 and was then in regular use from 1806 until it was closed and replaced by the railway in 1854. This would provide an earliest date for the start of quarrying for other than local use. This suggests the quarry was probably in use for no more than fourteen years. However, it is possible that the quarry was briefly worked at a later date by John Fyffe who subsequently set up the Kemnay Quarry in about 1830 (www.kintore.org.uk).

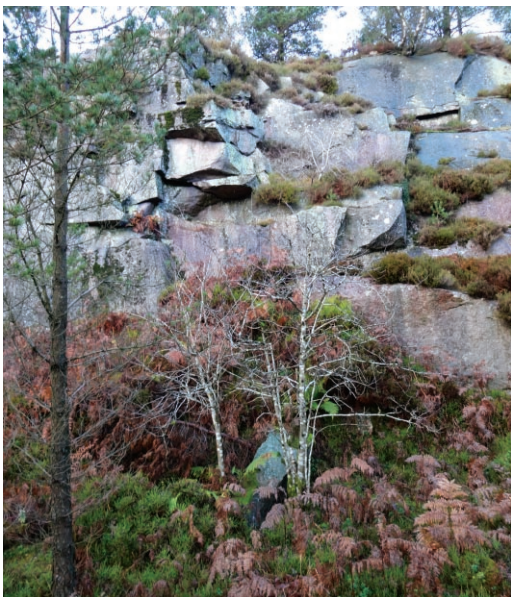
Photograph 4. Quarry floor looking west. The entrance from that side can be seen with the hillside cut back. (A Wainwright)

Photograph 5. Possible road from the west side of the quarry down towards Tilliefoure. (A Wainwright)

There is some evidence of a road from the quarry westwards, possibly extending down the hill towards the River Don at Tilliefoure. The quarry floor has been extended to the west (Photo. 4) where the granite has been removed from the north side. Here there are signs that at least one shot hole was drilled. Then further down the hill are some flat areas where the surface rocks appear to have been removed as if to make a roadway (Photo. 5). The first edition of the Ordnance Survey 1" map of about 1866 shows the road to the east crossing the Clackie Burn at Heather Brig and then roughly following the route of the present forestry road to Woodend of Braco, but it shows nothing to the west. It

is therefore no more than speculation that they took the blocks down the hill on sledges to the Don and then by a raft of some description to Port Elphinstone.

The Sheerness Naval Dockyard was originally built under the orders of Samuel Pepys in the 17th century, but was completely rebuilt in the early years of the 19th century. The site was levelled and new construction began in December 1813. The docks took ten years to complete and were opened in 1823. This fits in nicely with the dates for the English Quarry.



Photograph 6. North face of the quarry showing tree density impairing measurements. (A Wainwright)

A casual observation of the quarry might raise the question of whether enough material could have been extracted to build any major structures. This could only be answered by some form of analysis. As the quarry comprises a fairly simple form, volumetric estimates based on a few simple measurements was considered potentially revealing. And, although these calculations were hindered by the number of trees on the quarry floor interfering with sight lines (Photo. 6), the proposed analysis was able to be achieved.

Method

The equipment used was limited to a Brunton compass-clinometer for taking azimuths and inclinations and a 100m tape. A base line was measured across the flat area in front of the mouth of the quarry and from this triangulations were made to the NW and NE top corners. This enabled the relative locations and elevations to be established. Both linear measurements and inclinations gave similar results. Inclinations were also taken on both sides of the quarry and the azimuth of the contours of the hillside to east and west were made by eye. Contours for the original hillside and the top of the undisturbed granite were constructed from the raw measurements. Standard volumetric calculations then enabled estimates to be made of the volume of granite extracted (see Figure 1).

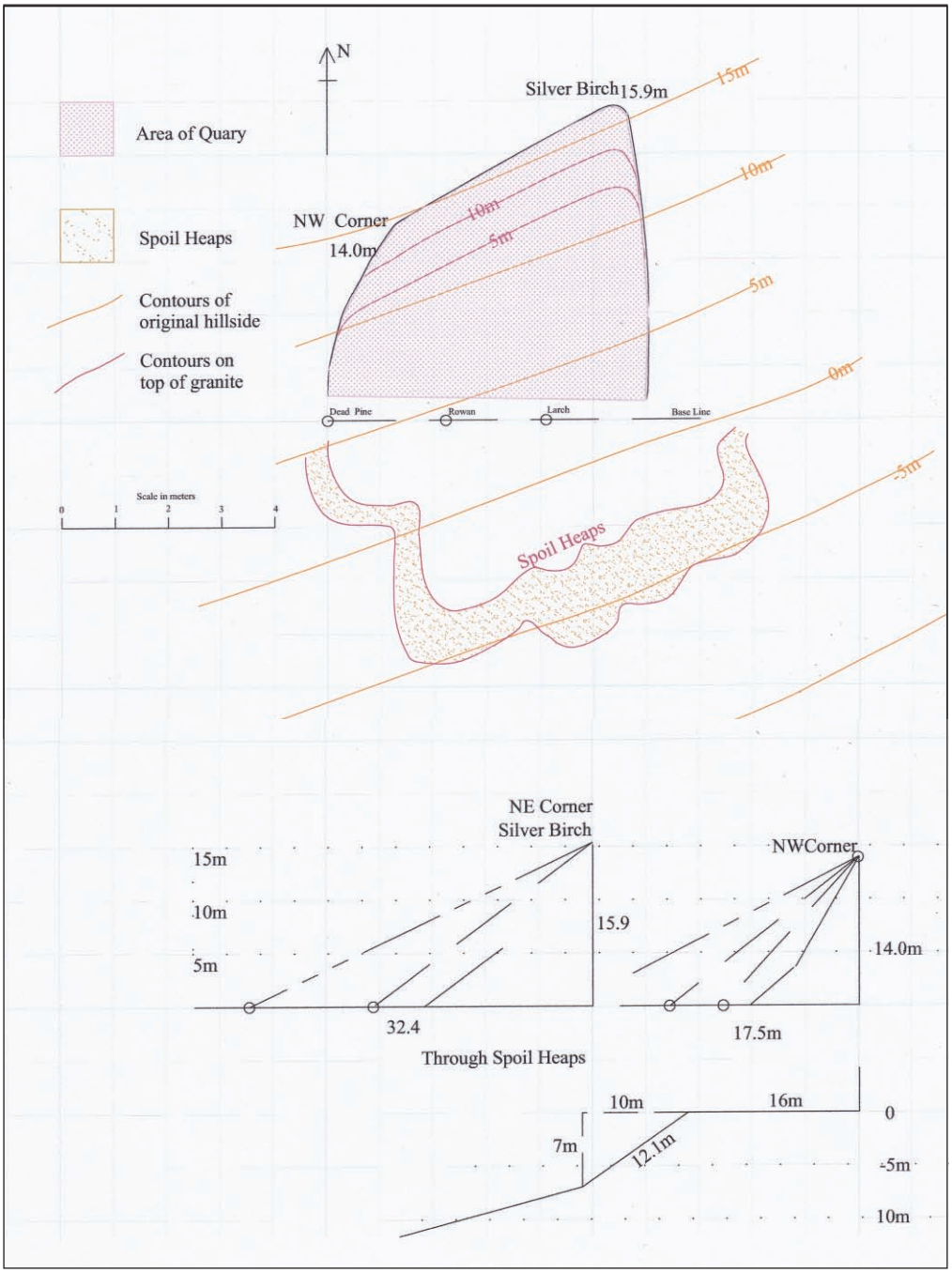


Figure 1. Surveyed quarry and spoil heaps showing plan and sections.

The granite blocks were dressed on site before export. This is clear from the large spoil heaps on the south side of the quarry. These are made up of tabular flakes between 20 and 50cm across and from 5 to 10cm thick. Estimating the amount of waste granite in these heaps is difficult because of their irregular shape, but again is depended on estimating the contours of their upper and lower surfaces. The volume between these two surfaces gives the gross volume which has to be reduced to take account of the void space between the slabs. The void space or porosity of clean gravels is usually taken as around 40% but can be higher.

Results

From these calculations the volume of the quarry, i.e. the amount of granite dug out, is about 4000 cubic metres. However, the volume of the spoil heaps is about 1300 cu. m. With an assumed porosity of 40%, this gives a volume of waste granite of 800 cu. m. Thus the volume available for export is about 3200 cu. m. At a specific gravity of 2.65 for granite this volume would have amounted to well over 8500 Tonnes. To put this volume into perspective, if it were all to build a wall for a dock, say 1m thick and 3m high it would reach for about 1km. This is at least the right order of magnitude to build the 18th century naval dockyard at Sheerness.

Comments

The above estimate for the amount of granite taken out of the ground is reasonable. The quarry is a fairly simple shape and this can be appreciated once inside. On the other hand, the estimate of the material left in the spoil heaps is much more problematical. The shape of the upper surface is complex and so hard to map accurately with tape and clinometer. The lower surface is, of course, the original ground surface and mapping this can only be done by extrapolation from the surrounding contours. So, subtracting two inaccurate surface figures will give an estimated volume with even less accuracy. Then there is the matter of the void space which can be little more than a guess. To measure this with any degree of accuracy would involve taking a large tank up to the site and filling it with a representative sample of stone. Then the void space might be measured by the volume of water needed to fill the tank.

More accurate estimates of the exported granite could be made using high accuracy GPS mapping: inside the quarry, over the spoil heaps and on the undisturbed hillside all around the site.

References

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