Survey of Maesglase and Maen Du

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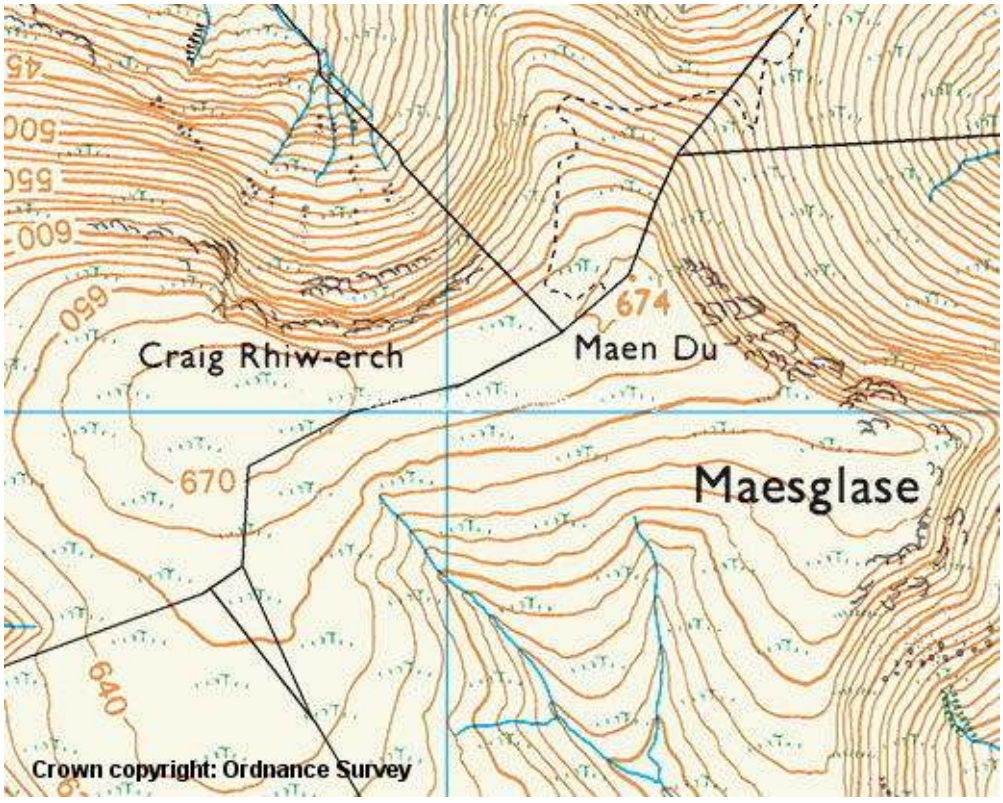
1) Introduction

Maesglase (Hill 2145, Section 30F, OS 1:50000 Maps 124/125, OS 1:25000 Map 23E, Grid Ref SH817150) is listed as a Marilyn, Hewitt and Nuttall. An extract from the OS 1:25000 scale map is shown below. Previously there has been doubt about the position of the highest point of Maesglase. Maen Du (Hill 2146), marked with a spot height of 674m was considered to be the summit of this hill. However, as described in Anne and John Nuttalls' book "The Mountains of England and Wales" Volume 1 – Wales, an observation made in 1996 by Tim Jones suggested that Craig Rhiw-erch was indeed higher. Anne and John Nuttall subsequently surveyed these two positions and reported in the second edition of their book that the highest point of Craig Rhiw-erch was about 2m higher than Maen Du. Therefore the accepted summit of Maesglase has now moved to Craig Rhiw-erch. The purpose of this survey was to confirm the hill's summit position.



2) Equipment used and Conditions for Survey

All optical work for this survey was carried out with a Leica NA730 Professional Automatic level (X30 telescopic system)/tripod system and a "1m" **E**-staff extendable to 5m.

Conditions for the survey, which took place between 12.00hr and 13.00hr, were good. Although not sunny, visibility through the level was clear and there was no excessive wind to hamper measurements. It was quite cold, about zero degrees Celsius, with a significant wind chill.

3) The Survey

3.1) Character of Hill

Maesglase is the highest point in the Dovey Hills which lie just south of the A470 and west from Dinas Mawddwy. The Dovey Hills include a number of other summits; Craig Portas, Cribin Fawr, Mynydd Dolgoed, Waun-oer and Mynydd Ceiswyn which are linked together with a series of ridges. Generally the northern faces of these hills are very steep with crags but the southern flanks are less steep and wooded with conifer plantation. The valleys here are typically "U" shaped glacial valleys and there are a number of excellent examples of hanging valleys.

Due to the nature of the terrain it is quite difficult to carry out "circular walks" to ascend these hills. Access can be gained from Aberllefenni to the South but distances are then quite large. For this survey we used the parking area on the A470 at SH802170 which at about 250m altitude provides a useful height gain to commence the walk. A footpath ascends Cribin Fawr and then the rims of the cwms are followed over Craig Portas for the final ascent of Maesglase. The two tops of Maesglase, Craig Rhiw-erch and Maen Du are 520m (calculated from GPS measurements) apart with a small dip in height of a few metres between them. The return to the car park was made by retracing the ascent route.

3.2) Survey of Summits

The survey commenced on Maesglase (Craig Rhiw-erch) where, once the Leica NA730 had been set up on a tripod at a convenient position, staff measurements were systematically taken in order to find the highest point. Then the position of the tripod was altered so that the NA730 was set to the same height as the highest point just identified. Maen Du was then observed through the NA730 from this position. A digital photograph (see Appendix 1) was then taken through the NA730.

The same process as above was repeated from Maen Du with an observation and digital photograph (see Appendix 1) of Maesglase (Craig Rhiw-erch) recorded.

From the photographs qualitatively it can be seen that Maesglase is the higher summit. However it is possible to calculate a height difference between the two summits. In the first photograph in the Appendix 1, Maesglase viewed from Maen Du, one can see the upper and lower horizontal stadia lines crossing the vertical axis. At a distance of 520m, these two lines represent a height difference of 5.2m. Having printed the photograph one can then set a height scale for the print and then calculate the height difference between the main horizontal line and the hill's summit. This process is then repeated for the other photograph. The measured height differences were 3.2m and 3.1m from the two photographs. The calculation is described in Appendix 2.

The following ten-figure grid references were taken:-

Maesglase Summit:-

Garmin Montana 600	SH 81734 15039	Height = 682m
Garmin Etrex 20	SH 81735 15040	Height = 678m
Garmin Oregon 450	SH 81734 15038	Height = 686m

Maen Du Summit:-

Garmin Montana 600	SH 82241 15175	Height = 673m
Garmin Etrex 20	SH 82240 15172	Height = 669m
Garmin Oregon 450	SH 82241 15174	Height = 682m

4) Discussion of Results

The results of this survey clearly confirm that Maesglase, the currently adopted summit of the hill, is correct. Previously the height difference that was measured from simpler surveying techniques was found to be 2m. However this survey shows this difference to be greater at 3.2m as a mean of the two observations that were taken. Most of the uncertainty in these measurements arises from the identification of the summit position in the photographs. However, from the variation in the staff measurements taken around each summit position, we can estimate the overall uncertainty in the result to be approximately +/-0.3m and larger than +/-0.2m achieved on previous surveys of this type.

5) Summary and Conclusions

The **summit** of **Maesglase** (Craig Rhiw-erch) is at grid reference ***SH 81734 15039** and is ground 2m East of the cairn. It is **3.2+/-0.3m** higher than the summit named Maen Du at Grid reference ***SH 82241 15173** and is the base of the cairn three metres South of the stile.

- NB average hand-held Garmin GNSS grid references are quoted in the summary.

John Barnard and Graham Jackson 01 March 2016

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Appendix 1

Figure 1: Summit of Maesglase viewed from Maen Du

Figure 2: Summit of Maen Du viewed from Maesglase

Appendix 2: Calculation of Height Difference

Figure 1: Craig Rhiw-erch viewed from Maen Du

In Figure 1 the Leica NA730 level has been set up so that it is level with the base of the small cairn on Maen Du and it has then been focussed on the summit of Craig Rhiw-erch. The upper and lower short horizontal stadia lines may be seen crossing the vertical axis. At a distance of 520m, these two lines represent a height difference of 5.2m.

The central line crossing the vertical axis is the true horizontal. It is thus immediately clear that Craig Rhiw-erch is higher than Maen Du since its cairn (seen as a small protrusion on the skyline) is well above this horizontal line.

The ratio of the distance between the horizontal line and the base of the cairn to the distance between the two stadia lines, as measured on the image, is 0.617.

Therefore the height difference between the horizontal and cairn base is 0.617 x 5.2 = 3.21m. Craig Rhiw-erch is therefore 3.21m higher than Maen Du.

Figure 2: Maen Du viewed from Craig Rhiw-erch

As a check this procedure may be repeated for the reverse direction, that is, from a photograph of Maen Du seen from Craig Rhiw-erch (Figure 2).

Here only the lower stadia line is visible in the photograph. The distance between it and the true horizontal represents half the distance between the two stadia lines.

The true horizontal is well above the summit of Maen Du showing Maen Du to be lower than Craig Rhiw-erch. The ratio of the distance between it and the summit to the distance between the two stadia lines is 0.600.

Therefore the height difference between the horizontal and Maen Du summit is 0.600 x 5.2 = 3.12m

The average of the two values is 3.2m.

The Effect of Earth Curvature

The above measurements do not take into account the effect of earth's curvature. To a first approximation the formula for calculating this is given by:

$H = l^2/D$

Where H is the correction for earth curvature

l is the distance between the two points of interest and

D is the diameter of the earth

Substituting 12,500km for D, 0.52km for l gives a value for H of 0.02m

Therefore the two measurements corrected for earth curvature are 3.19m and 3.10m respectively.

The average of the two measurements is 3.15m. The estimated measurement uncertainty based on previous measurements of this type is +/-0.2m.