

1985/25. A preliminary gravity survey at the Hellyer prospect

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Abstract

A gravity survey over Aberfoyle Limited's Hellyer prospect (near Que River) clearly detected the orebody (base sulphides).

INTRODUCTION

The Hellyer prospect, three kilometres north of the Que River mine, was discovered by a drilling intersection of 24.4 m of Que River-style base metal sulphides grading 12.6% Zn, 4.4% Pb, 0.3% Cu, 157 g/t Ag and 1.9 g/t Au. The drilling was sited on a coincident UTEM geophysical and C horizon geochemical anomaly.

The HEC transmission lines running directly over the prospect effectively prevented further useful surface EM work. The orebody was considered to be too deep for conventional IP surveys. A gravity survey over the Que River mine mineralisation had demonstrated that gravity is a viable detection method for this style of mineralisation where the lenses rise to the surface or near surface. It was decided to evaluate the gravity method as a useful detection tool for Hellyer-type orebodies where the zones are of different shape, orientation and depth to top from those of the Que River mine.

GEOLOGY

Both the Que River and Hellyer deposits occur within the andesites and associated rocks of the central belt of the Early to Middle Cambrian Mt Read Volcanics, the most important Tasmanian host of mineralisation (Corbett, 1981). Corbett reported that "...The volcanics resemble rhyolitic caldera complexes in part, and large sections appear to be subaerial. Sediments and tuffs which probably represent marine embayments are also present, and the exhalative massive sulfides tend to coincide with local marine units".

THE SURVEY

The Hellyer gravity survey base station was established on top of the concrete block (near the main camp) in which have been set lengths of casing used to calibrate the borehole survey instruments. Two gravimeters were used, a Worden (W913) and a Sodin (S183). The Hellyer base station gravity value was measured to be 6.81 mgal lower than the Waratah tie station with S183, and 6.82 mgal lower with W913. It had originally been planned to read the gravity meter along the lines of the northerly extension of the Que River Mine Grid which covered the Hellyer prospect. Inspection of this grid revealed that most of the lines had practically disappeared and although many old pegs were found at odd intervals, the locations of these pegs were no longer known to the accuracy required for the gravity survey. It became apparent that the survey would have to be conducted by locating stations only at those points for which current accurate survey information was available. This restricted stations to drill hole locations for which Aberfoyle supplied the survey data, and one recently cleared line (10800N) on which stations were established every 24 m over the cleared section and later kindly surveyed by Aberfoyle. Each station was read twice (once by each meter). Seventy-one drill-hole stations were occupied but some of these stations were clustered in twos

or threes. Along Line 10800N there were thirty-two stations 24 m apart (except the westernmost station which is 16 m from the adjacent station).

RESULTS

The results from each gravimeter have been treated separately. However, the results may be combined if an increase in precision is required. This has not been necessary as yet. The readings were Bouguer corrected using a density of 2.67 (and the 1930 formula) and terrain corrected to a radius of 19 km using a density of 2.67.

The (terrain corrected) Bouguer anomaly plots for each meter are shown in Figure 1. For each station the Bouguer anomaly was then replaced by the average of the Bouguer anomalies of all stations falling within a circle of a chosen diameter centred on that station. The map resulting from this procedure is a regional anomaly map. The corresponding residual map is obtained by subtracting the regional anomaly from the Bouguer anomaly. Residual anomalies have been produced for both meters for averaging circles of diameter 0.4, 0.75 and 1.5 km (figs. 2 to 4).

QUALITATIVE INTERPRETATION

The overall regional trend is for the gravity anomaly to decrease to the south-east. This is in agreement with the 1:1 000 000 gravity map of Tasmania and the regional contours are approximately aligned with the gross pre-Carboniferous structural grain. The most striking anomaly superimposed on the regional trend is a positive anomaly, roughly oval in shape and 200 or more metres across with the long axis oriented roughly east/west. The centre of the anomaly is at about 393350mE and 396510mN. Immediately adjacent to the north-west is a pronounced low, about 125 m across. Adjacent to the north-west side of this low is a weak high of about the same size. Another low is situated to the SSW of the prominent high and a weak high about 200 m across is situated somewhat to the WSW of the prominent high. The low to the SSW of the main positive anomaly is probably very local as it is not clear on the Bouguer anomaly maps nor on the 1.5 km residual maps. The other features are distinct on all maps.

The main positive anomaly coincides in position with the main part of the Hellyer orebody (fig. 5). The anomaly is well covered by stations (fig. 6) and is therefore to a first order, not subject to contouring vagaries. In order to ascertain the expected gravity anomaly associated with the orebody, two-dimensional profiles across the strike of the body were calculated and the results contoured. The results of this method are not of the same standard as three-dimensional modelling but are quite sufficient for a qualitative comparison. The profiles and densities used in the modelling were provided by Aberfoyle and are shown in Figure 7. The resulting theoretical anomaly is shown superimposed on the (terrain corrected) Bouguer anomaly plots (fig. 8).

The fit is considered to be quite satisfactory (allowing for the approximate nature of the method) and the Hellyer orebody is strongly detected by the gravity survey. If further orebodies are thought to exist in the immediate vicinity then possible gravity targets are the two weaker highs already noted. On a cautionary note, the gravity coverage away from the Hellyer orebody is relatively sparse (fig. 6) and these highs are based on too few points to be completely reliable, although what readings are available are believed to be reliable, being similar for the two meters.

CONCLUSIONS AND RECOMMENDATIONS

The gravity survey, despite being done on an unfavourable grid in unfavourable terrain, has proved highly successful in detecting the Hellyer orebody. This gravity survey by itself could have provided the drilling target which discovered the Hellyer prospect. That is not to say that it would be wise to rely on gravity (or any one method) alone but rather that it may be unwise not to include gravity in the geophysical exploration suite for orebodies having a marked density contrast, particularly when such orebodies are either non-conductive or occur at depths which decrease the usefulness of induced polarisation, electro-magnetic and geochemical methods. In order for the gravity survey to be useful, however, the field work should be properly controlled, the station co-ordinates and levels should be known, the readings should be terrain corrected and some form of two dimensional high pass filtering (albeit a simple but effective method such as that applied to this survey data) should be carried out.

The two gravity highs near the prominent high delineating the Hellyer orebody should be further investigated by adding gravity stations to the grid in the vicinity of these bodies. Three-dimensional modelling of a more detailed version of the Hellyer orebody could be carried out but is not recommended as having much value for demonstrating that gravity may be a very useful tool in the exploration for heavy metal orebodies. That has already been demonstrated by this preliminary survey.

REFERENCE

CORBETT, K.D. 1981. Stratigraphy and mineralization in the Mt Read Volcanics, Western Tasmania. *Econ.Geol.* 76:209-230.

[23 May 1985]

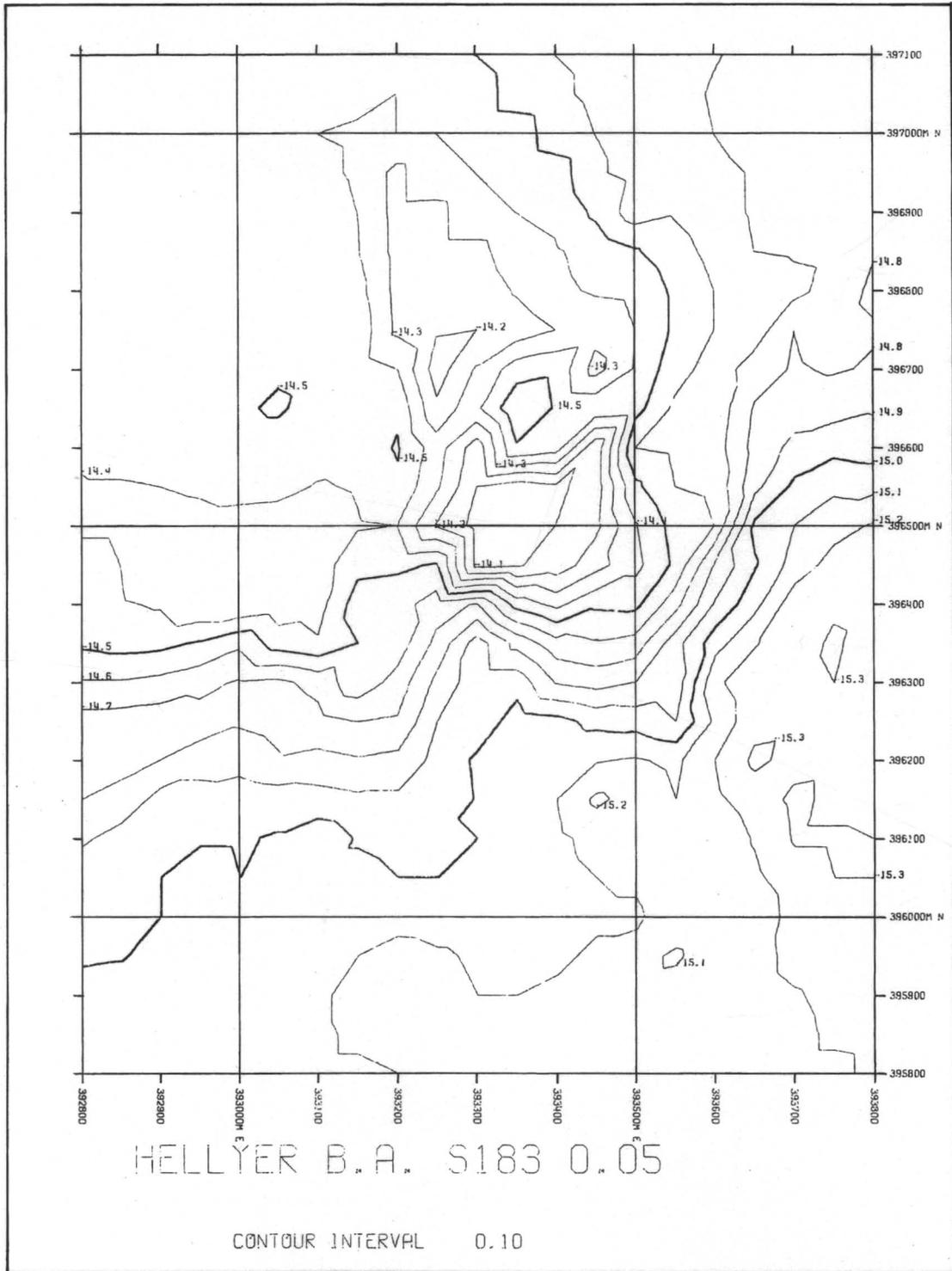
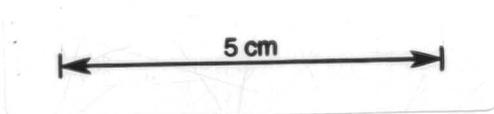


Figure 1a. Terrain corrected Bouguer anomaly plot, Sodin gravimeter.



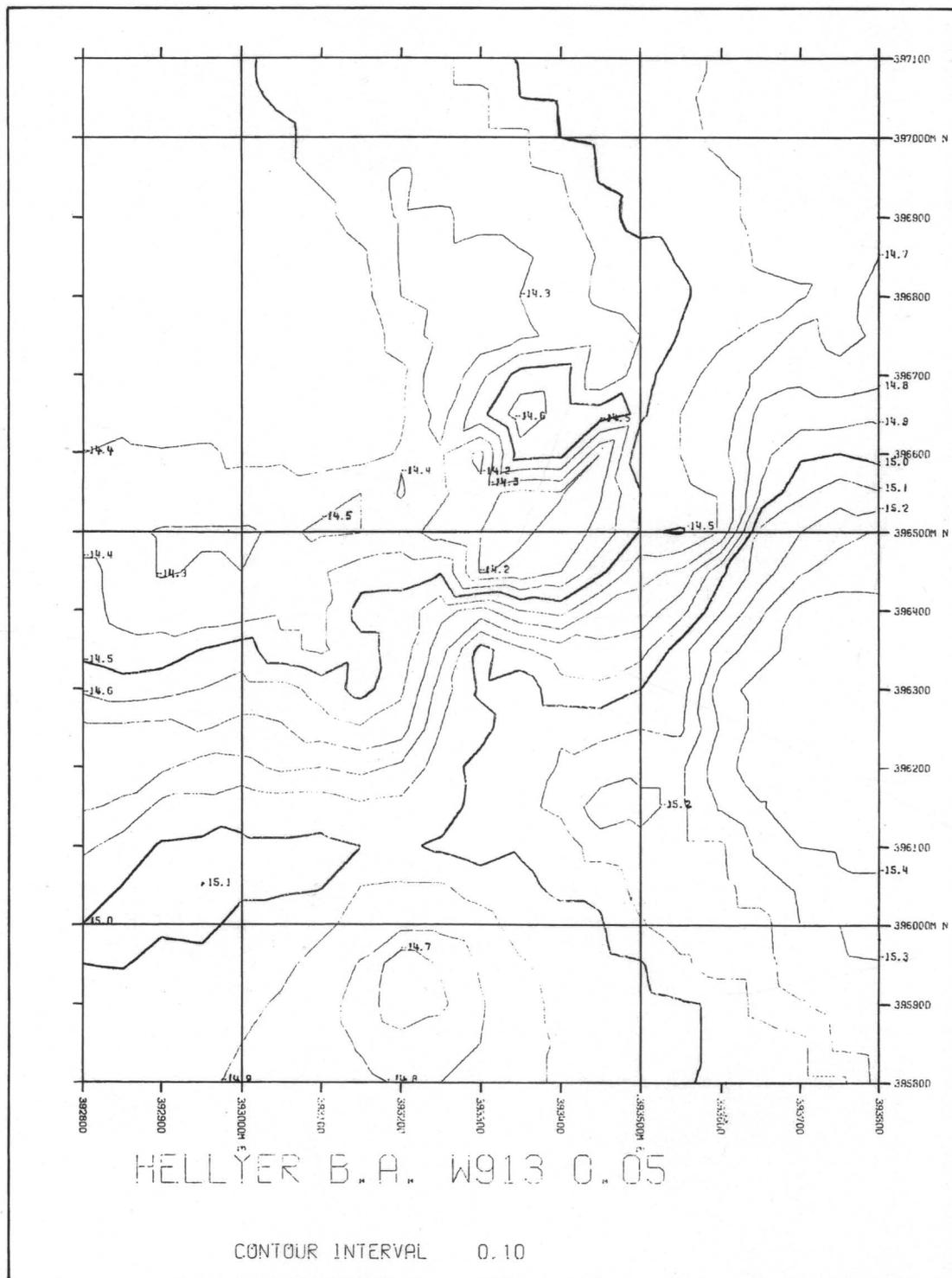
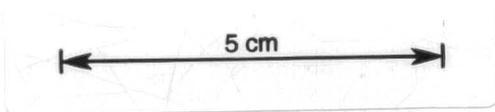


Figure 1b. Terrain corrected Bouguer anomaly plot, Worden gravimeter.



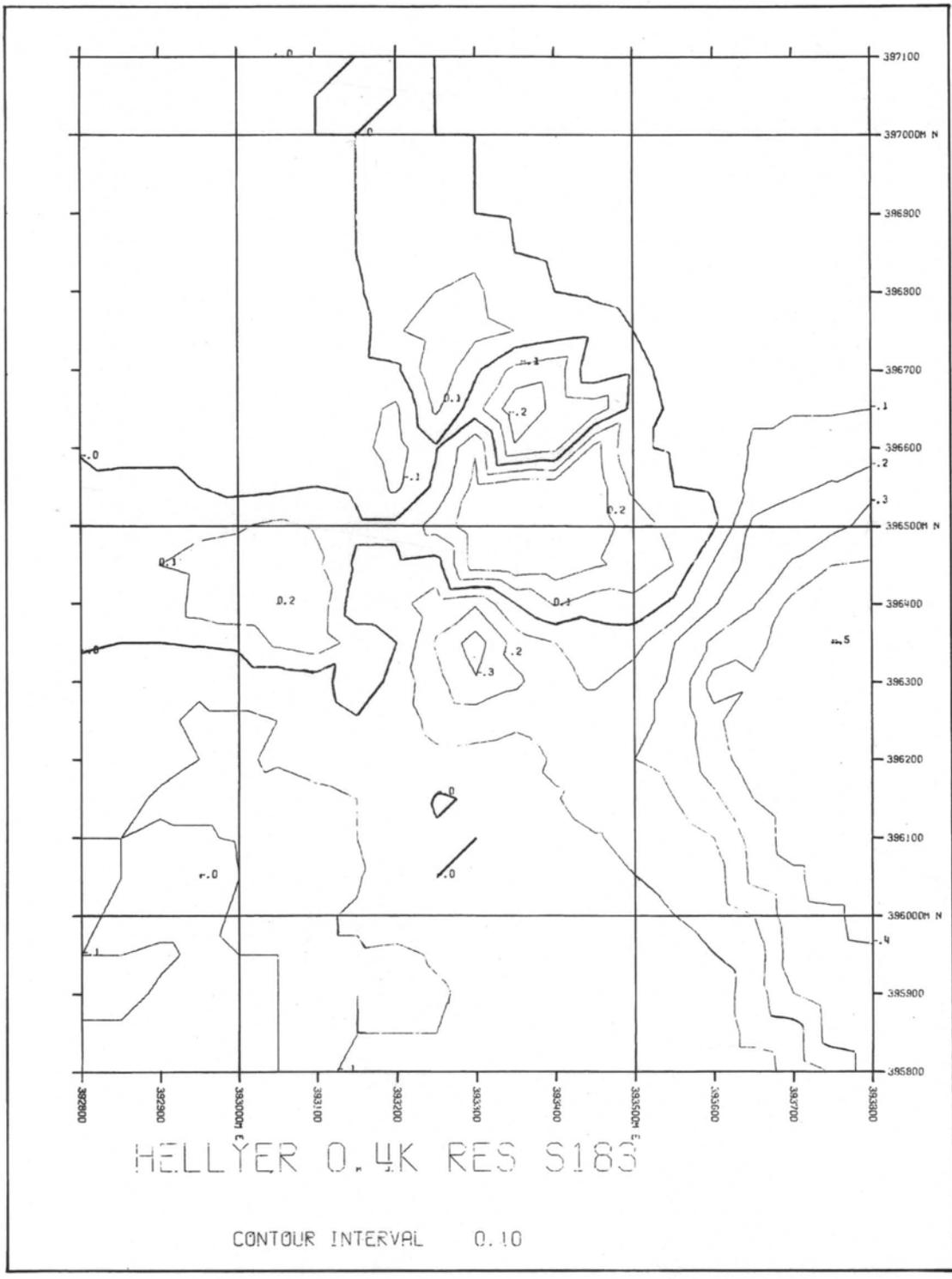


Figure 2a. 0.4 km residual anomaly, Sodin gravimeter.

5 cm

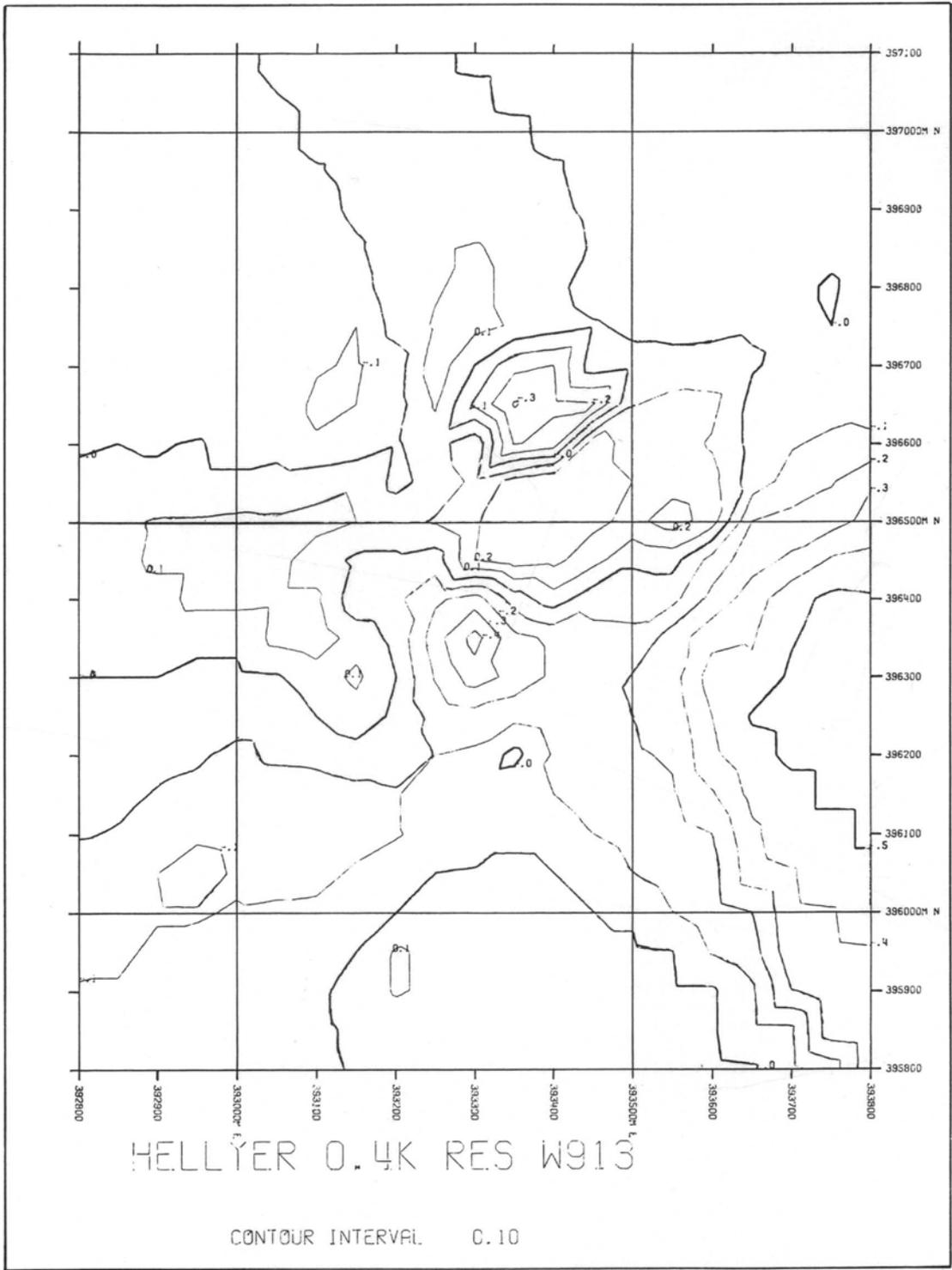
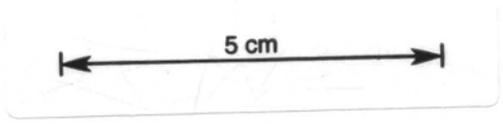


Figure 2b. 0.4 km residual anomaly, Worden gravimeter.



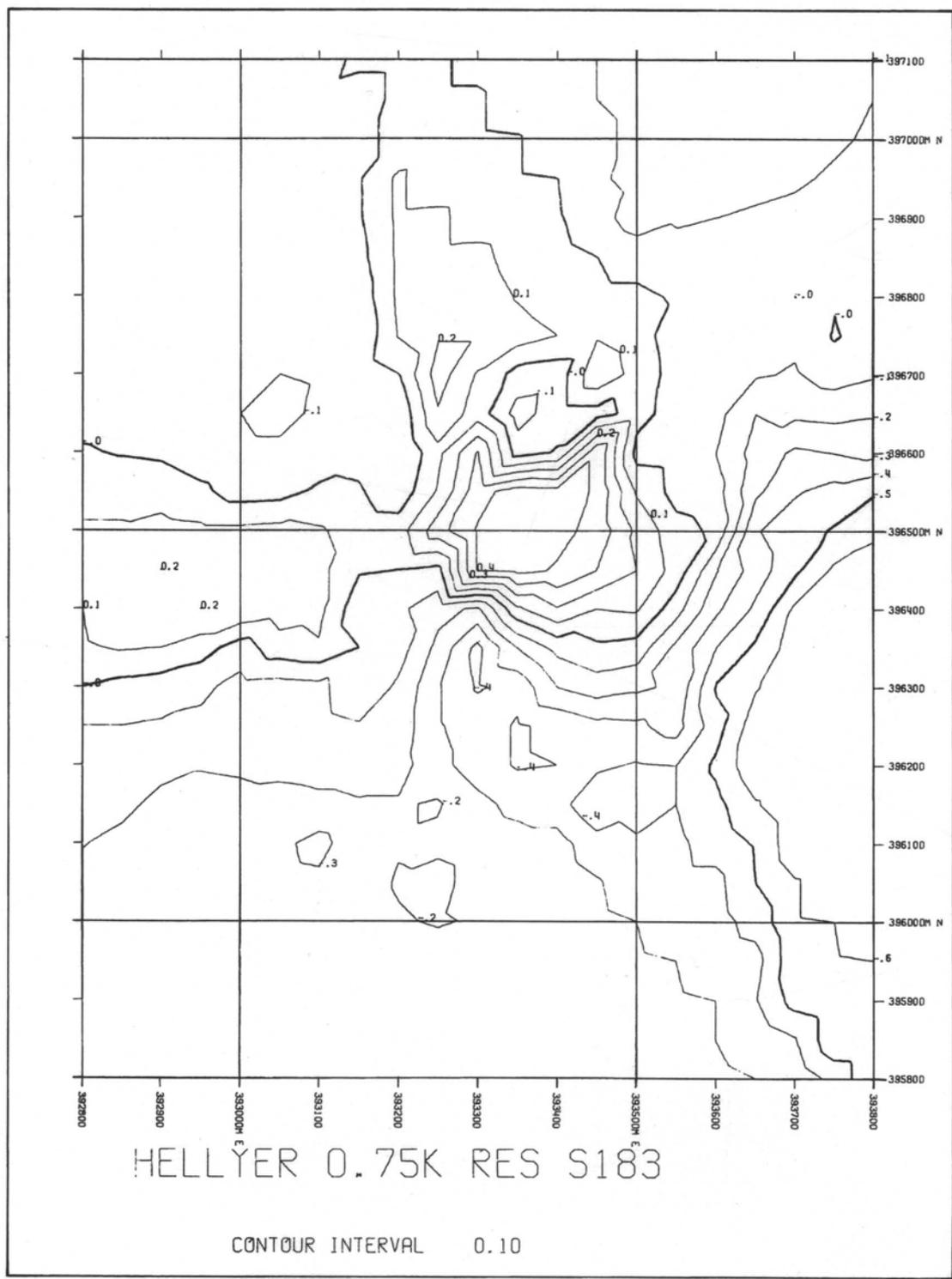
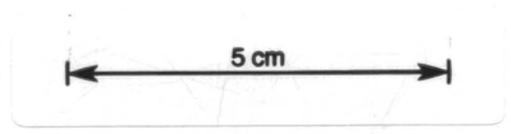


Figure 3a. 0.75 km residual anomaly, Sodin gravimeter



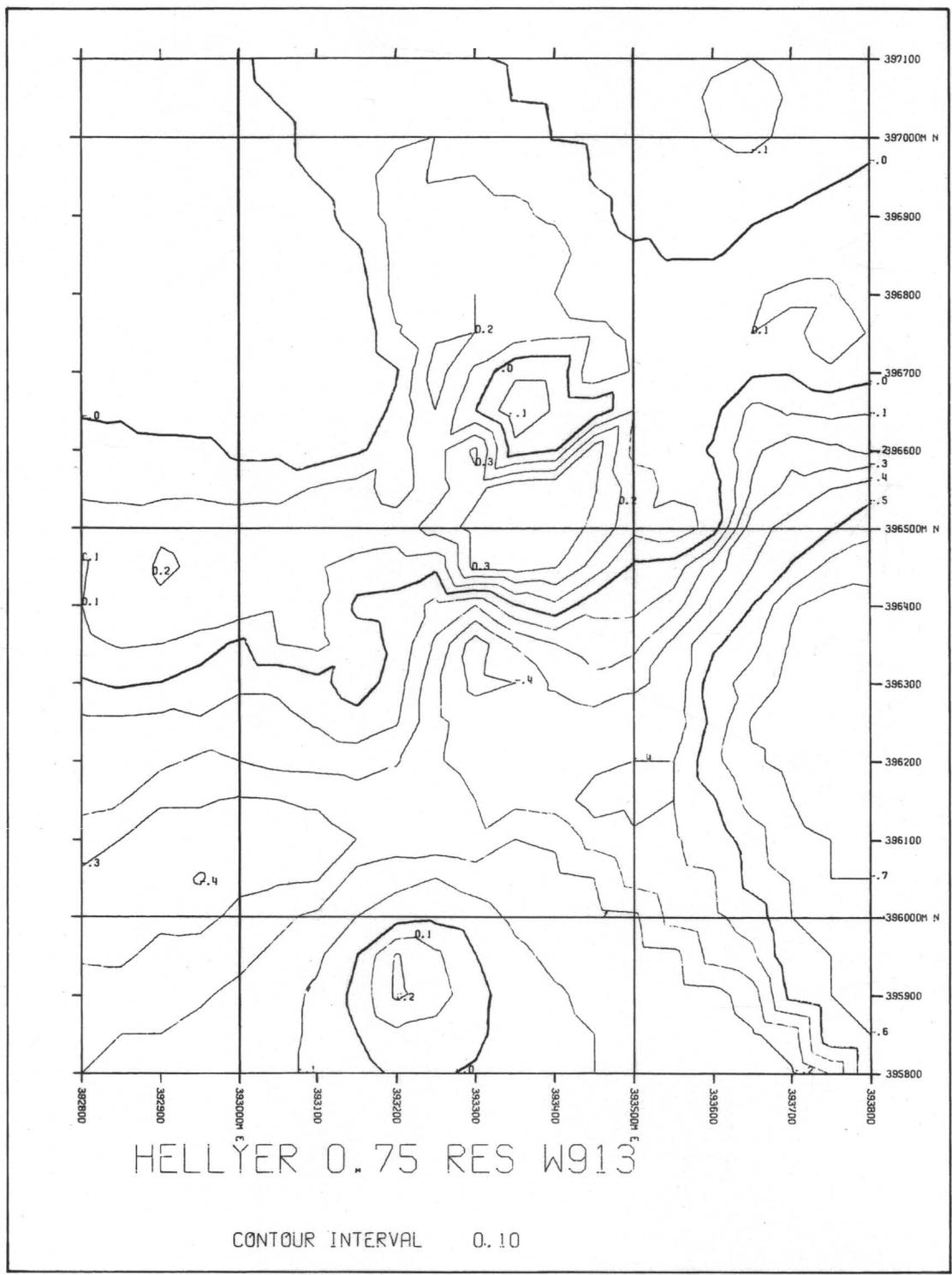
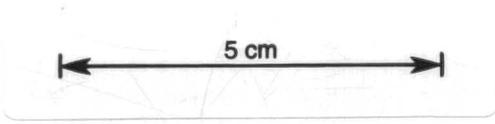


Figure 3b. 0.75 km residual anomaly, Worden gravimeter.



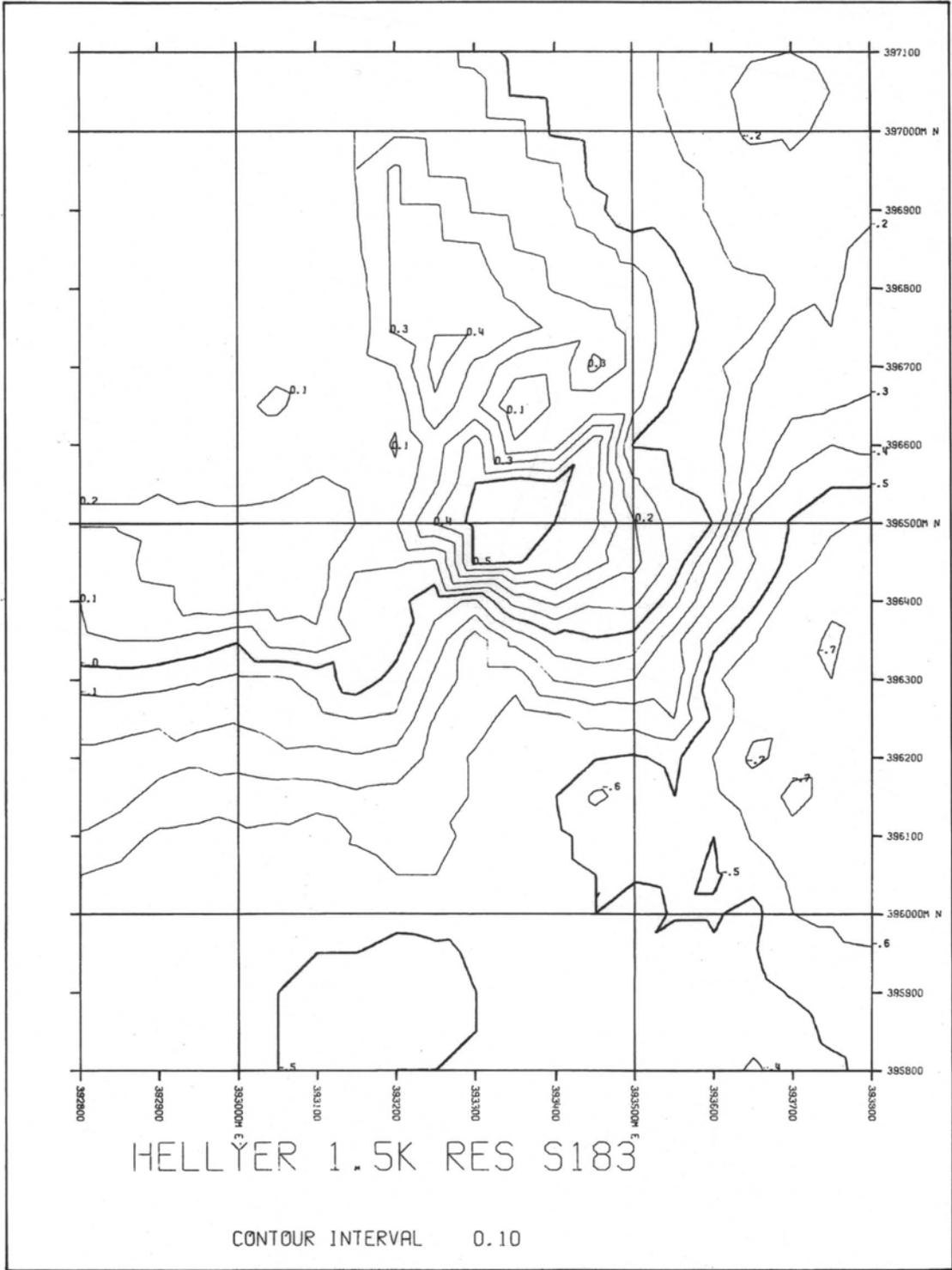
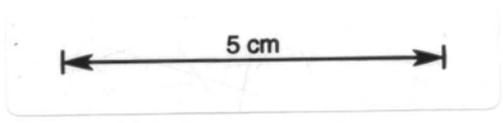


Figure 4. 1.5 km residual anomaly, Sodin gravimeter



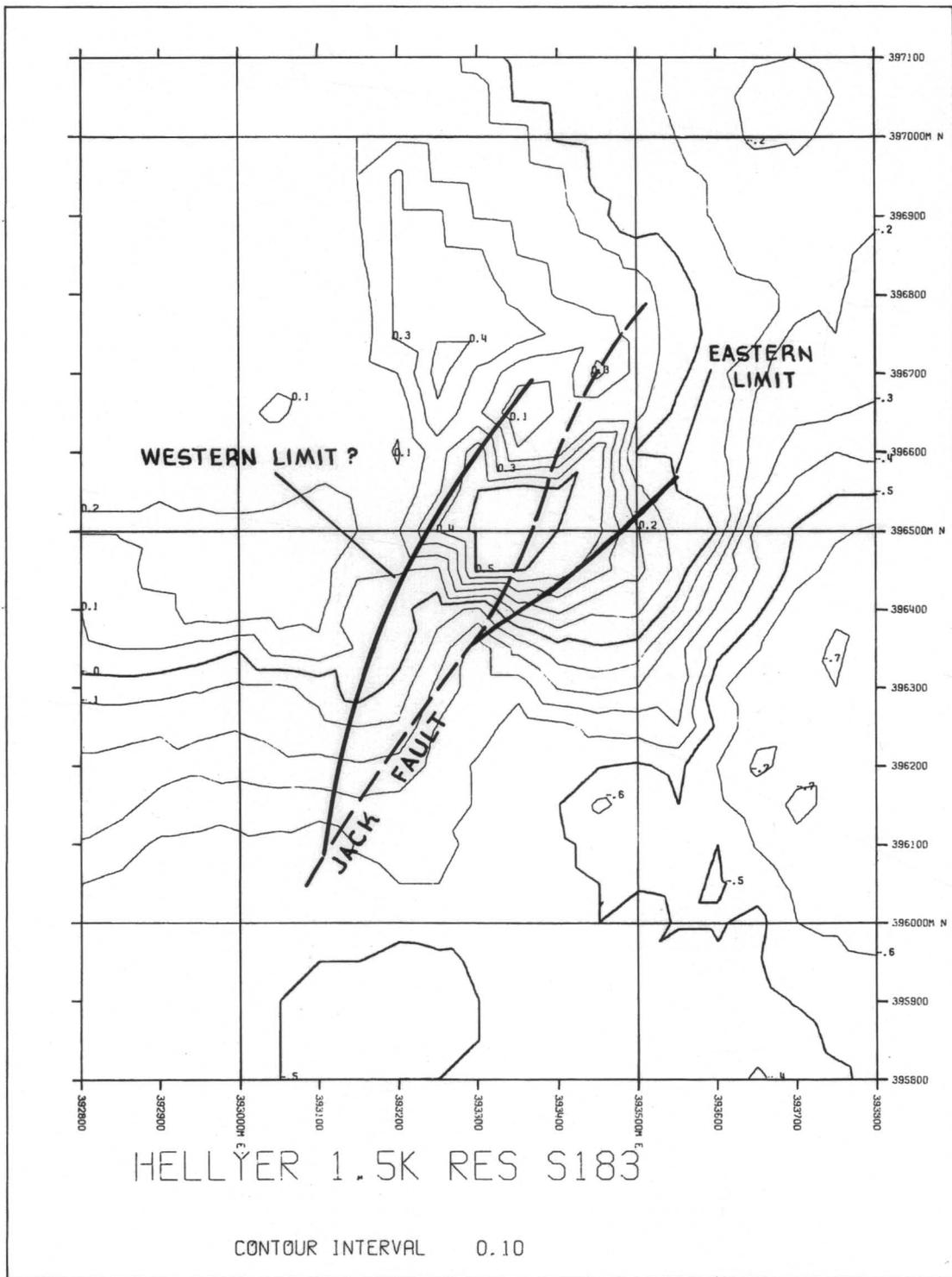


Figure 5. 1.5 km residual anomaly with approximate plan of Hellyer orebody (from Aberfoyle Ltd report, plan compiled by G. McArthur).

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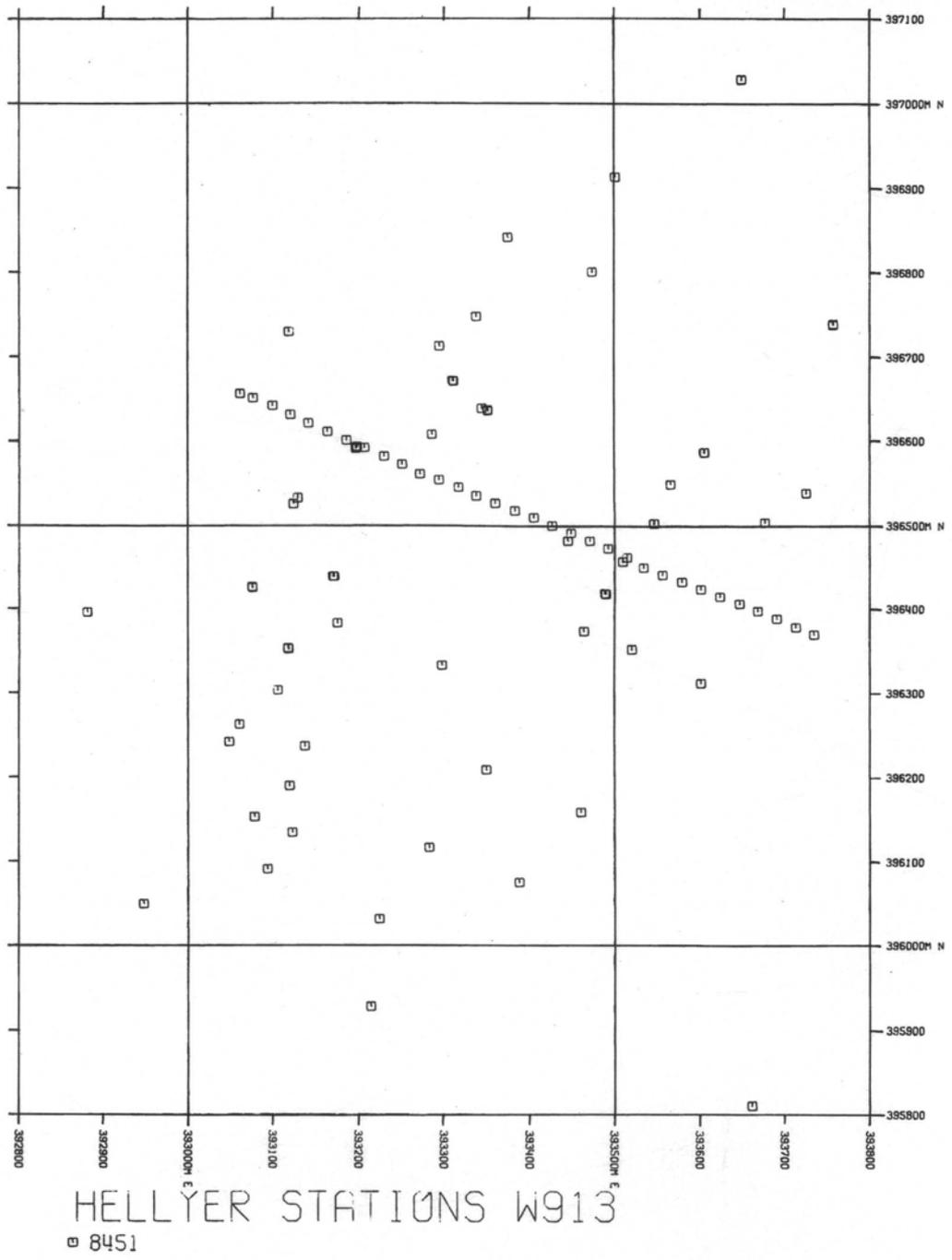
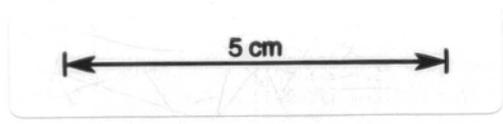


Figure 6. Location of gravity stations



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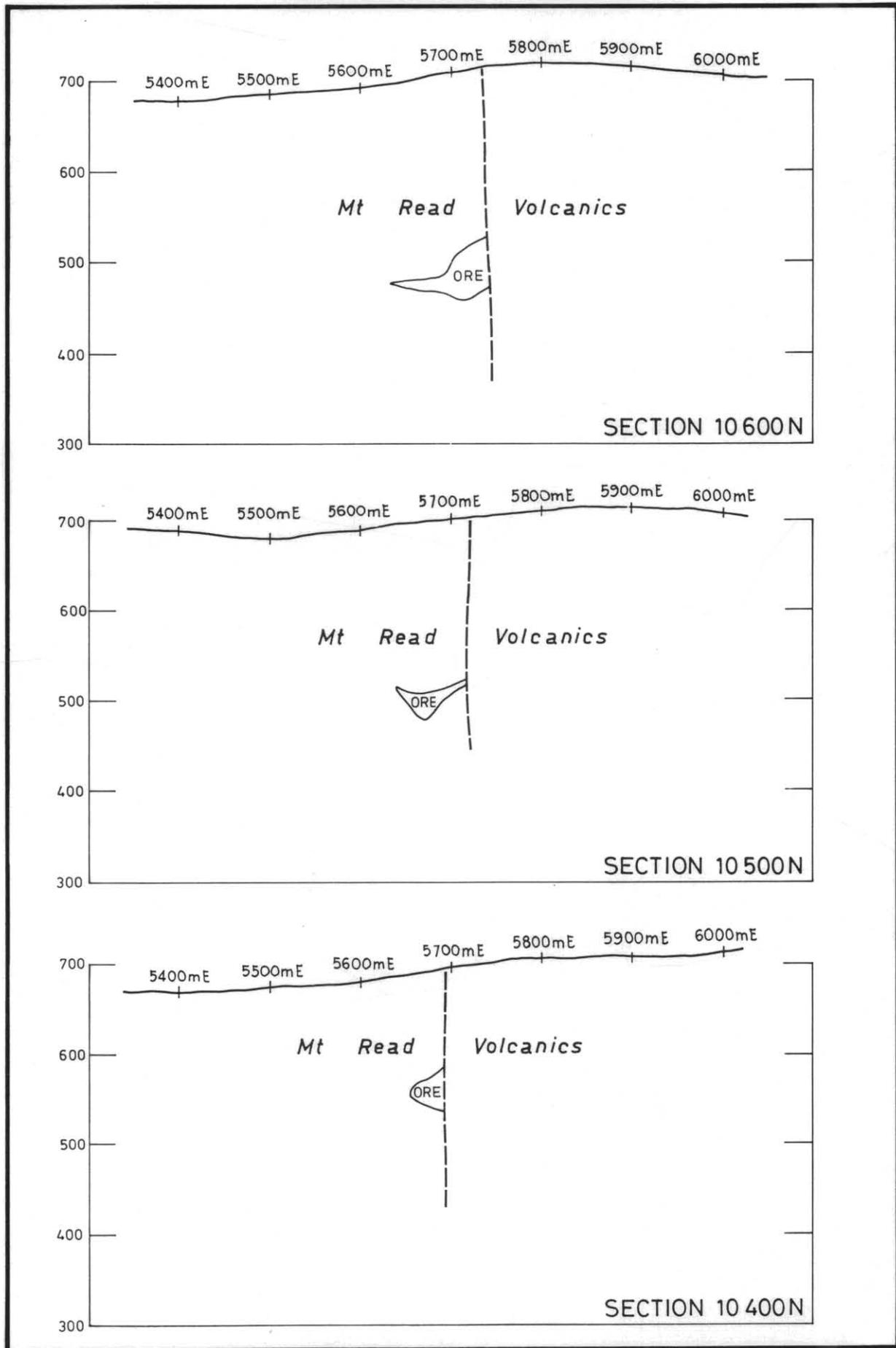


Figure 7a. Aberfoyle profiles across Hellyer orebody, density contrast 1.76 (courtesy Aberfoyle Limited).

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5 cm

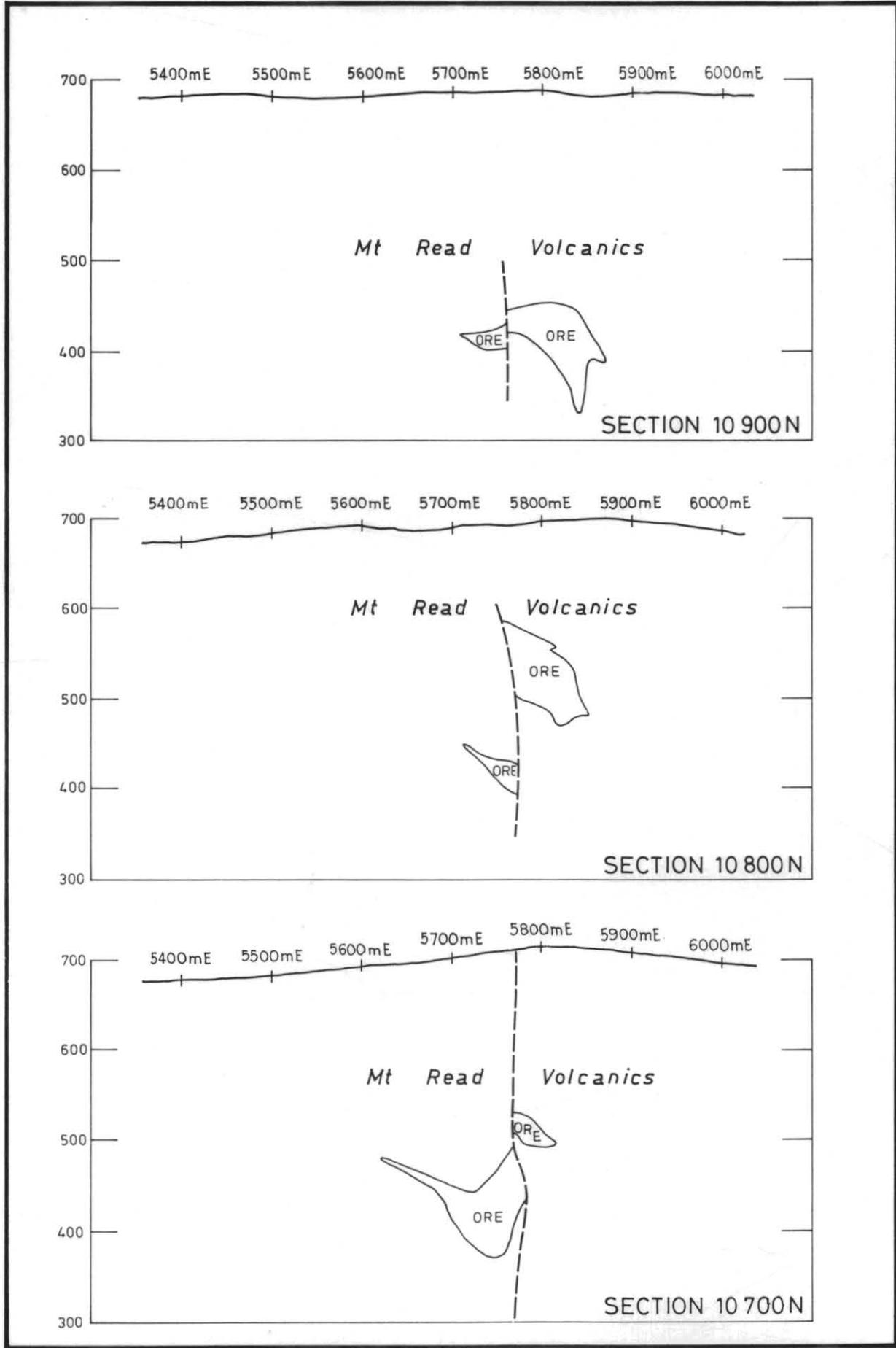


Figure 7b. Aberfoyle profiles across Hellyer orebody, density contrast 1.76 (courtesy Aberfoyle Limited).

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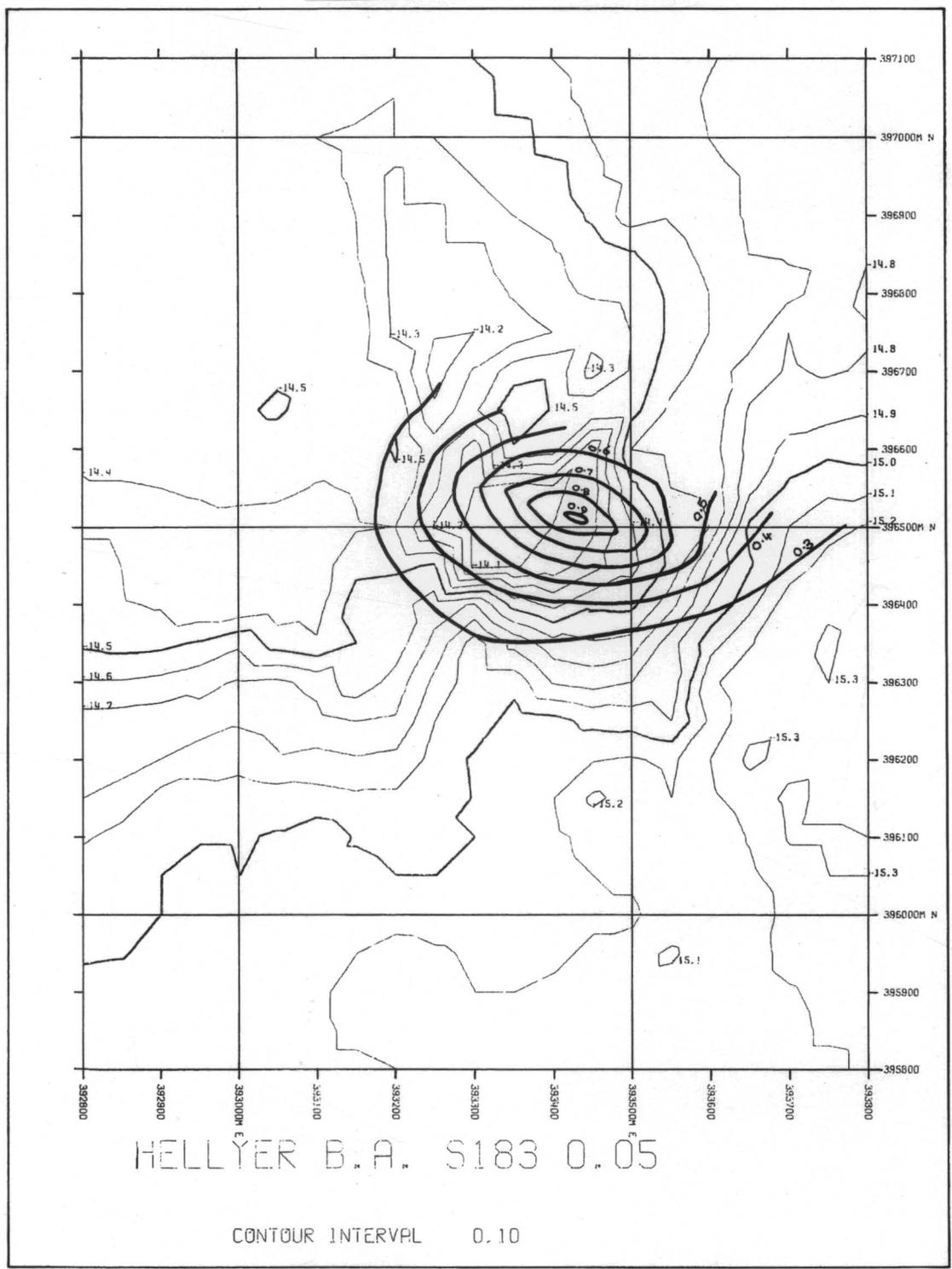


Figure 8a. Terrain corrected Bouguer anomaly plot with modelled anomaly superimposed, Sodin gravimeter

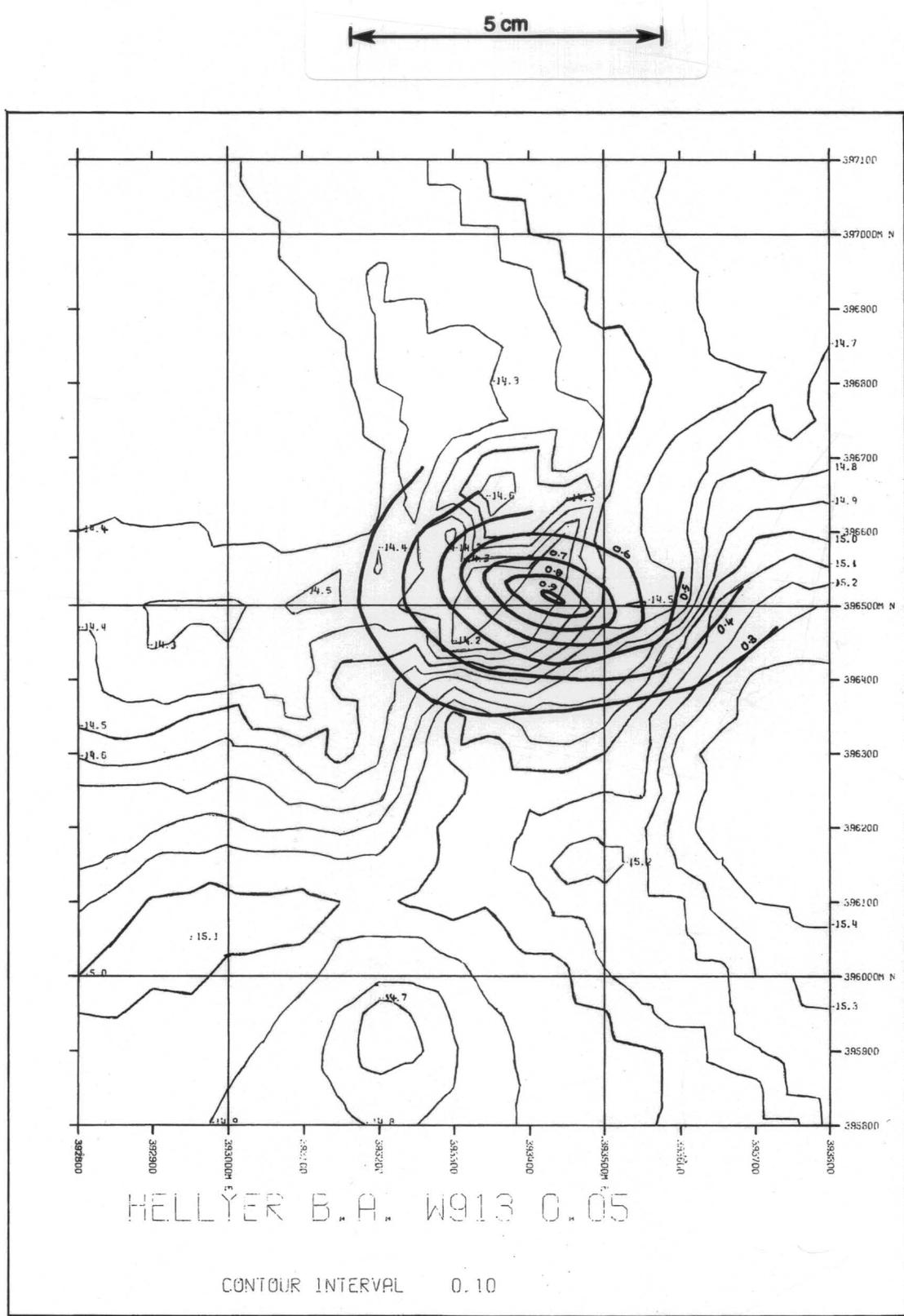


Figure 8b. Terrain corrected Bouguer anomaly plot with modelled anomaly superimposed, Worden gravimeter