# BURNTWOOD FARM, KINGS WORTHY, HANTS.

## Geophysical survey report

This report concentrates results of topographical and geophysical surveys made of a low mound, about 25m in diameter, at SU508358, on the land of Burntwood Farm near Winchester. While new plotting instruments were tested, the work provided information for H C Bowen Esq of the Royal Commission on Historical Monuments, at whose request the survey was initially undertaken.

Preliminary site inspection suggested that this mound, partially overlain by a fenced shaw, could either be the eroded tail of a long barrow, as marked on the Ordnance Survey map, intersecting an adjacent disc barrow, or a round barrow separated from the disc barrow by intervening features. The prime task of the survey was to distinguish the most likely possibility. An initial scan by A J Clark of the Ancient Monuments Laboratory with a Plessey fluxgate gradiometer revealed a roughly semicircular buried ditch circumscribing the mound, of up to 10 gammas anomaly strength. This ditch was relocated and plotted on two further occasions.

On the first, on 19.iii.74, F V Philpot Esq, then of Radar Research, the Plessey Company, and the author used a newly commissioned Plessey Radionavigation system to record the output from a redesigned fluxgate gradiometer. The results as shown on Plan 1 were included in a lecture a few days later at the Oxford Symposium on Archaeology and the History of Art. Plan 2 shows the significant details abstracted for the comparison mentioned in Discussion of Results, below.

This system uses a radionavigation principle to allow the magnetometer carrier to walk at random within a given area, eg a 100m square, while automatically plotting his movement to scale on a chart recorder, drawing circles proportional in radius to the instrument signal. A simultaneous record is taken on a digital tape recorder for subsequent computer enhancement of the data. In this instance, although the system reproduced the walking pattern, the circular line-thickening failed, and the ditch had to be recorded by a zigzag progress round its course, keeping within the magnetic bounds of its width as defined by the audible signal from the magnetometer. Actually this was no bad thing, as this probably produced a clearer definition than would have been possible from the circles had they been wider than the scale picture of the ditch they represented.

On a later visit, on 15.iii.77, various members of the Ancient Monuments Laboratory Geophysics Section used a commercial plotting system to record the ditch line retraced with a fluxgate gradiometer. With a Zeiss Reducing Telemeter, type BRT 006, and a KARTI plotting table, on loan from the Zeiss Jena Company, ten stations along the ditch and two fence points were observed from an intsrument station roughly 3m from the centre of the mound.

This telemeter takes a scale measurement of the distance from target to observer from the baselength separation of two prisms adjusted to give a coincident image in an eyepiece. This measurement is then transferred to the radius arm of a plane table whose rotation is geared to the telemeter. From Plan 3, which shows the superimposition of a convincing 2m wide circular ring on the plotted points, the Royal Commission draughtsmen prepared Plan 4, on which feature d. is the barrow.

## Discussion of results

It is certainly as well that the second survey was able to make use of a commercially tried instrument as a control. Although, for various reasons, no archaeological surveys have been carried out before or since with the Plessey system, its effectiveness in detecting and plotting the barrow ditch as well as the fence lines in accurate proportion is demonstrated in Plan 5. Here the data from both surveys are plotted together as circles drawn through each set of points. Each circle is fitted by a least squares method (deduced from a least squares method for straight lines and other functions linear in the unknown coefficients) using the Honeywell Mk III computing system for the tedious calculation.

Possible sources of error in this process include :-

(i) Radionavigation system

- unknown and hence uncalibrated plotting non-linearity

(ii) Zeiss system

- inaccuracy in distance measurement, and
- translation of the measurement to the plotter, both of which could have been worsened by heavy rain blurring the optical system.

(iii) Both systems

- imprecise ditch location with the magnetometer
- transfer of coordinates from field plot to computer
- adjustment of scale for comparative plotting

In a separate test with the Zeiss system, 17 points along a steel tape from 5m to 35m were observed from a fixed station. A fitted regression line gave a standard error of measurement of $\pm$ 1.4 cm, probably due mainly to slight inaccuracies in the verticality of the target staff. An angular inaccuracy of about $1^{\circ}$ was found to originate in the backlash of the plotter coupling. The manufacturers quote a mean relative error of $\pm$ 0.006% in the distance measurement.

The main sources of error in this plot seem to come from the magnetic effect of the ditch, therefore, and not from the plotting system, which is at least one order of ten higher in accuracy. The assumption of a circular ditch is not proved to be an unreasonable one.

## Summary

The records from various visits to the mound at Burntwood Farm are combined in this report. Work with two systems novel to archaeology displayed comparable field results in plotting the course of a buried ditch as well as landmarks such as fences. The opportunity offered by this site to test these instruments under typical field conditions such as cold, rain and mud, has left both systems showing considerable promise for the future while satisfying the original purpose of the survey in testing the subsurface shape of the mound.

Acknowledgements

The assistance and guidance of F V Philpot Esq, then of the Plessey Company, and P Fasham, Esq, of MARC 3, is gratefully acknowledged. The Laboratory is grateful to the Carl Zeiss Jena Company for the loan of the Telemeter system for field evaluation.

Reference

Statistical methods for Technologists, Paradine and Rivett, 1970

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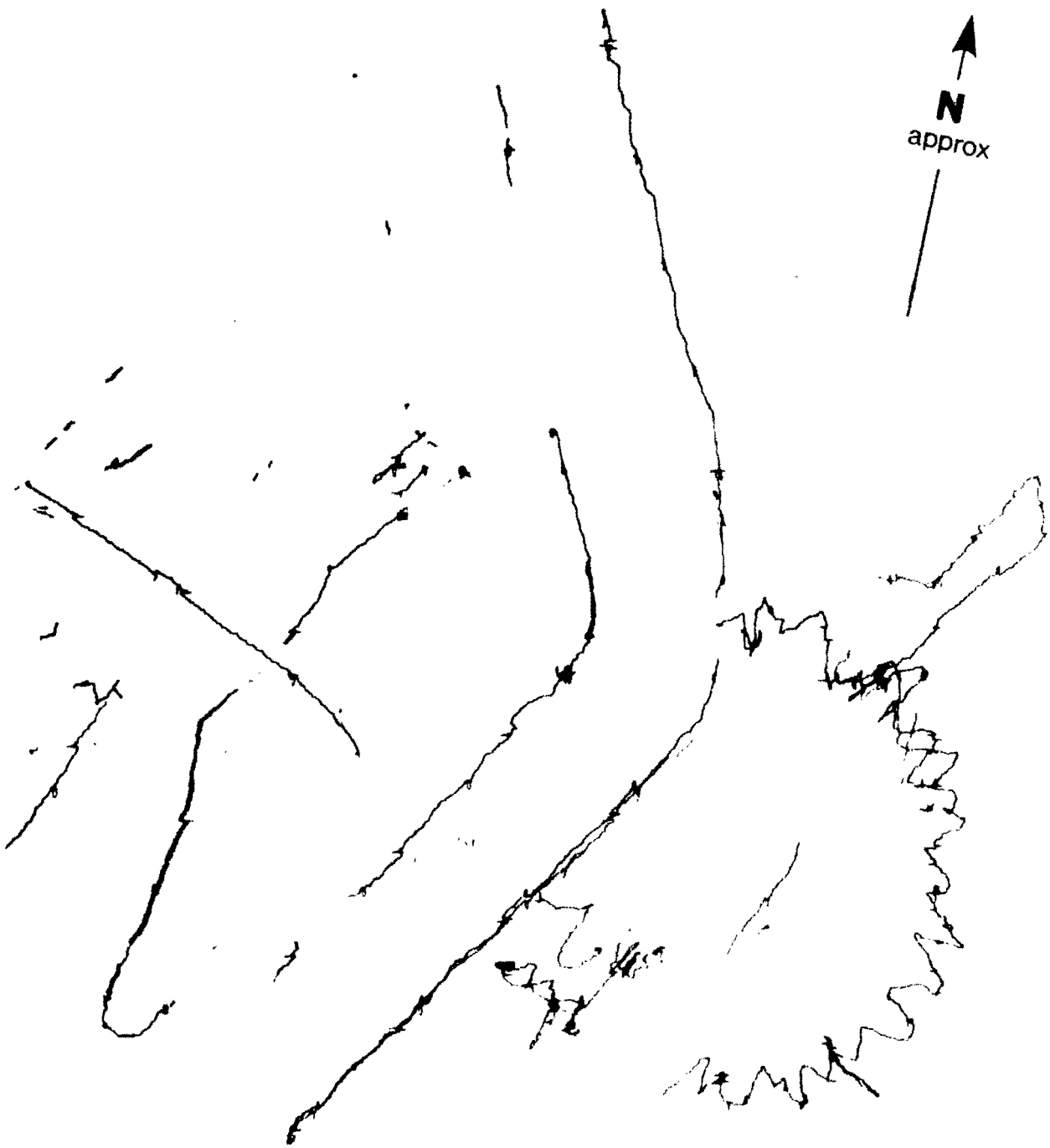
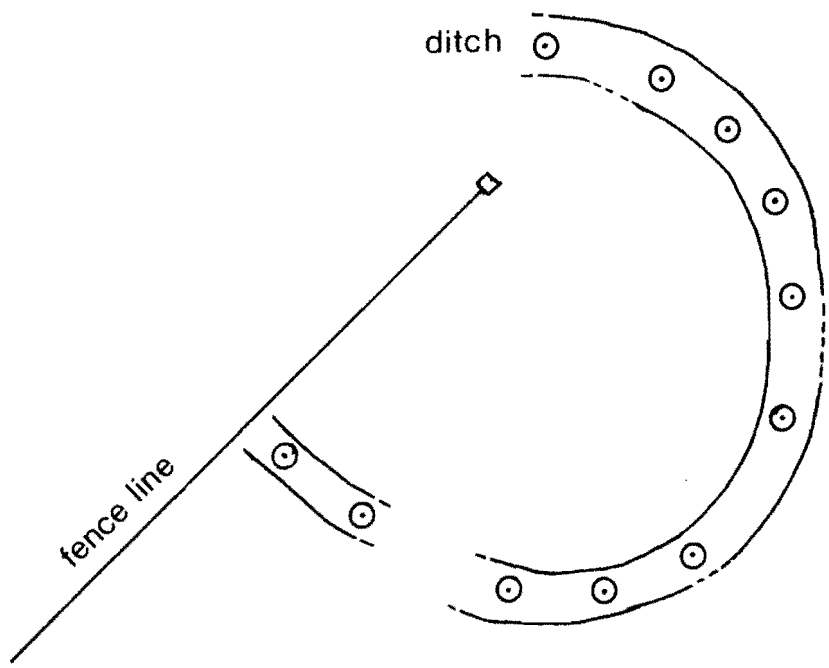



## BURNTWOOD FARM

Radionavigation plot using fluxgate gradiometer

Scale : 0 30m approx

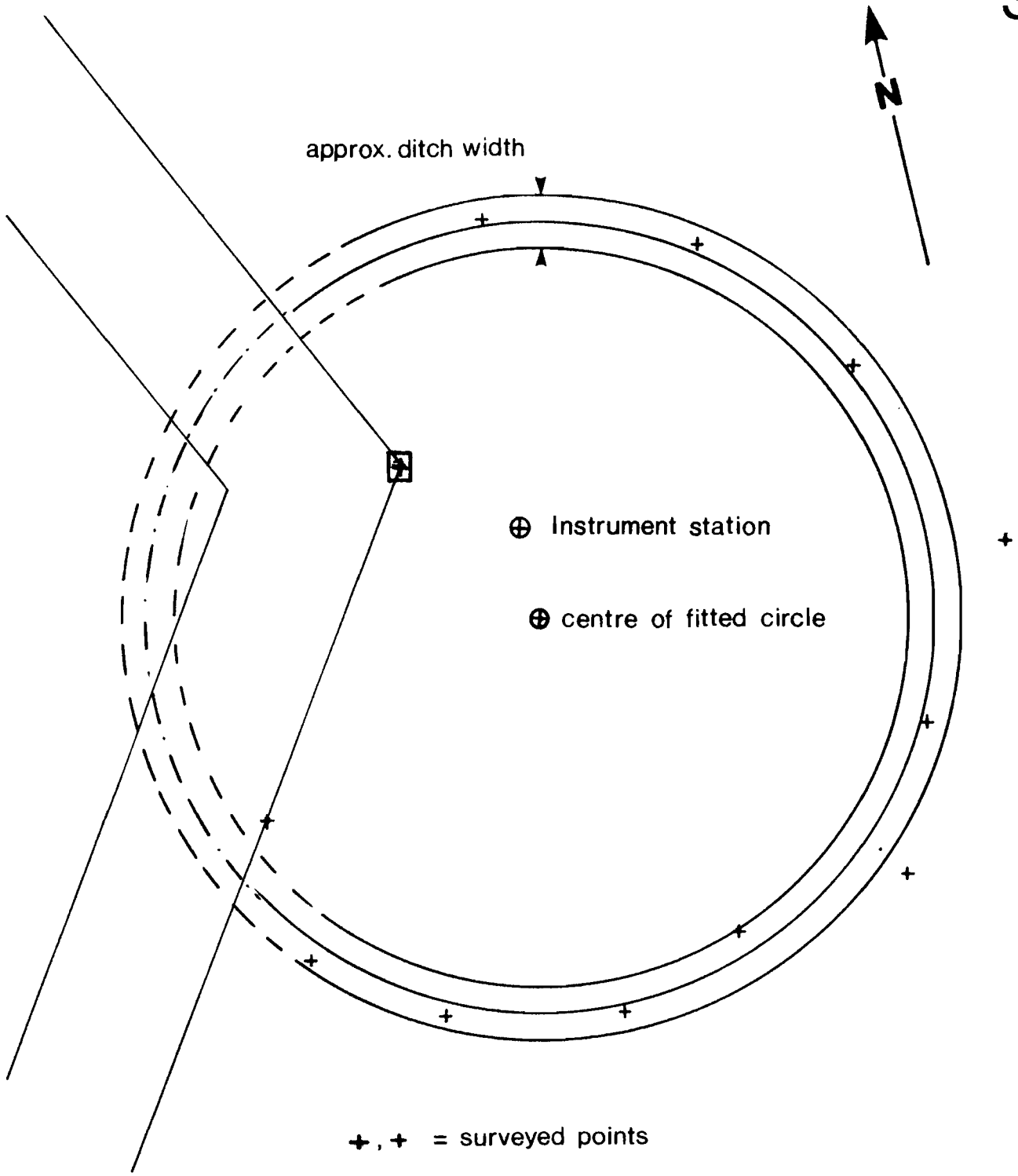

⊙ = point used for circle fitting in Plan 5




# BURNTWOOD FARM

Main details from Radionavigation plot

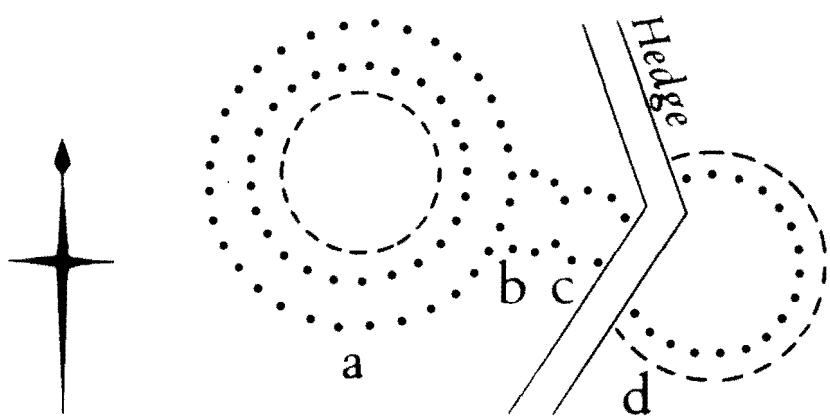
Scale  approx




# BURNTWOOD FARM

Tracing of ZEISS telemeter plot at 1:200

with superimposed circle

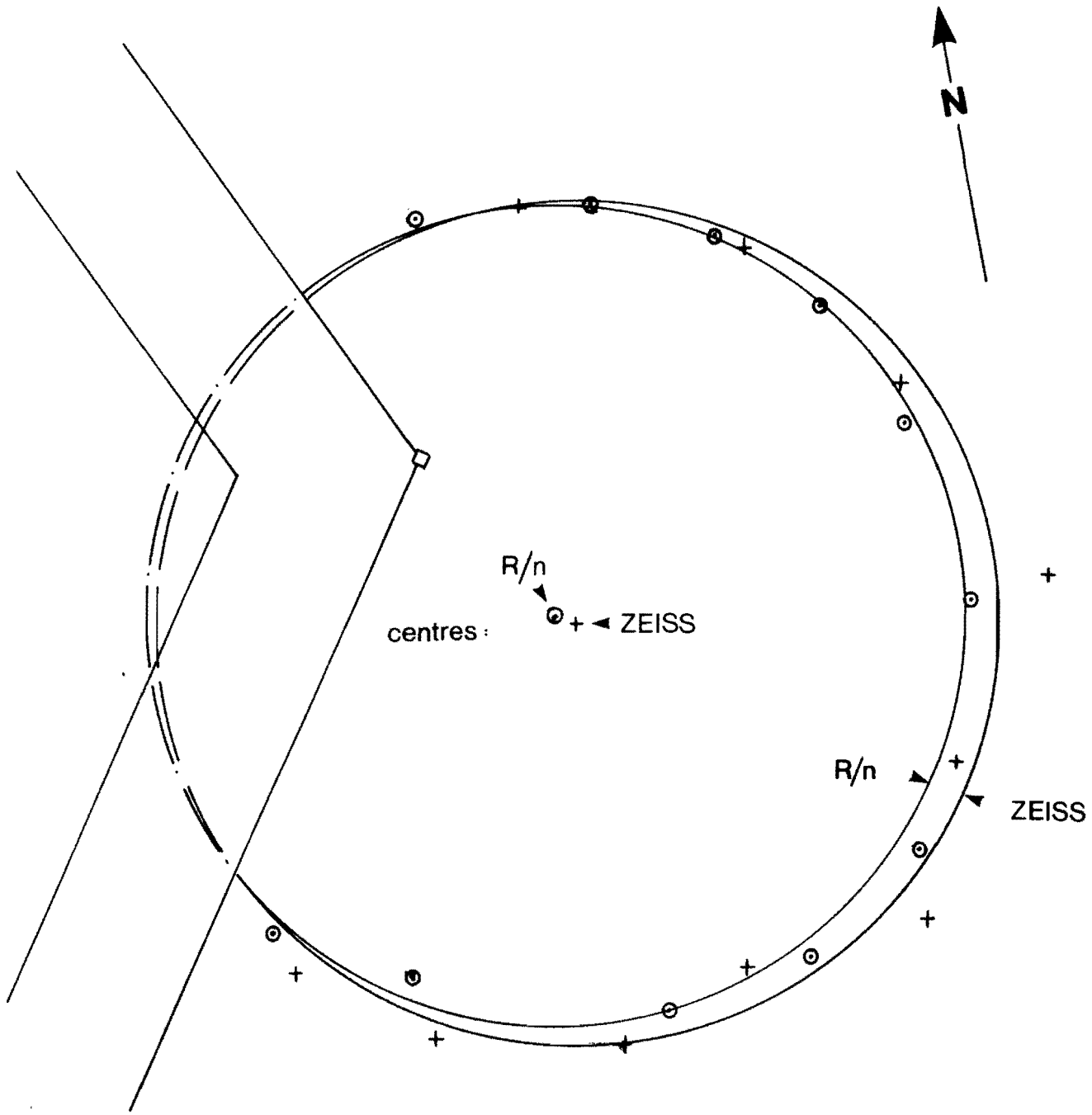



. . . . *Approximate edge of bank or of mound*

- - - *Approximate edge of ditch*

*Based on Ordnance Survey plan and geophysical survey by D.O.E. Ancient Monuments Laboratory*

SCALE




**BURNTWOOD FARM**

Computed best-fit circles (least squares method) for ZEISS and Radionavigation data

Scale 1:200