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Mineral investigations near Bodmin, Cornwall. Part 7—New occurrences at Quoit and Higher Trenoweth

T K Ball, B C Tandy and K Turton

BRITISH GEOLOGICAL SURVEY

Technical Report WF/90/2

Mineral Resources Series

Mineral investigations near Bodmin, Cornwall

Part 7
New occurrences at Quoit and Higher Trenoweth

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Cover illustration

A banded carbonate/sphalerite/marcasite/galena vein from the Gwynfynydd Gold Mine, near Dolgellau in North Wales

This report was prepared for the Department of Trade and Industry

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SUMMARY

Radiometric anomalies near Quoit and Higher Trenoweth have been investigated to determine their subsurface continuity and their potential for associated metal Co, Ni etc) concentrations. The Quoit anomalies are too isolated for immediate interest, while the Higher Trenoweth anomaly, although showing continuity over 300m+, indicates grades which are too low for current exploitation.

INTRODUCTION

A uranium reconnaissance programme in south-west England, undertaken by the Institute of Geological Sciences and sponsored by the UK Atomic Energy Authority, included a carborne scintillation survey of parts of north and mid-Cornwall undertaken in April/May 1972 (Tandy, 1974). Anomalies were recorded near Quoit (NGR 922 621) and at Higher Trenoweth (958 618), north-west of St Austell (Figures 1 and 2). Subsequent radiometric surveys using hand held instruments outlined a linear feature extending at least 300m at Higher Trenoweth and identified a number of other radiometric anomalies in the Quoit area.

Investigations under the Mineral Reconnaissance programme funded by Department of Industry were aimed at determining whether there was underground continuity between the isolated anomalies, whether there was a significant depth extension and whether there were substantial quantities of other metals associated with the uraniferous occurrences.

These investigations included detailed radiometric gridding, selective radon investigations, geochemical soil sampling, X-ray spectrometry and, finally, rotary percussion drilling.

GENERAL GEOLOGY

An easterly-trending periclinorium, made up of the Dartmouth Beds in the core, succeeded by the Meadfoot Beds, both of Lower Devonian age, underlies the St Columb Major area (Ussher, Barrow and MacAlister, 1909). The outcrop of the Dartmouth Beds widens westwards from St Columb to the coast, and the remainder of the area is occupied by the Meadfoot Beds. Both groups consist mainly of slates, for which the local term 'killas' is used.

Dykes, sills and bosses of 'greenstone' (altered dolerites) traverse the area and just pre-date the granite. These units, mostly following the strike of the country rock, were a controlling factor in localising enrichment of uranium and base metals elsewhere in Cornwall such as at South Terras. The St Austell granite, of Variscan age, exhibits a variety of metasomatic effects. Two small satellite granite intrusions at Castle-an-Dinas and Belowda Beacon lie 4km east of St Columb (Figure 2). The last major tectonic event occurred during the Alpine orogeny, when south-west England underwent large scale dislocation along north-westerly oriented dextral wrench faults (Dearman, 1963), which may traverse the St Columb area.

The scheme of mineral zonation in Cornwall (Dewey, 1925), suggests that the St Columb area should lie within the lower temperature zones, in which uranium may be emplaced. Metals commonly associated with uranium in low temperature suites in Cornwall, such as cobalt, nickel, bismuth and iron, have been mined in the area, along with other metals such as tin, lead, copper, tungsten and manganese (Dines, 1956).

An association of uraniferous deposits with NW-SE trending faults has been indicated by Bowie and others (1973).

LOCAL GEOLOGY

In distinction to other uraniferous occurrences in the St Columb area, there is no association of uranium with greenstones and calc-silicate rocks such as occurs at South Terras (Dines, 1956) and Tremayne (Tandy and others, 1981). Moreover, the host rocks are slates situated near the crest of an anticlinal axis, and calc silicates cannot be implicated in the mineral genesis since they occur at a higher stratigraphical level. Although greenstones can be intruded an any level they have not been observed in any of the boreholes.

Tombs (1977) has analysed the gravimetric data from the area and indicates a very shallow depth to granite contact for most of the uranium occurrences. At Quoit and Higher Trenoweth the occurrences lie directly above a horizontal granite contact at a distance of less than one km (Figure 2).

Thick continuous dykes of potassic microgranite (elvan) post-date the granite emplacement and one such, the "Royalton Elvan" passes close to Higher Trenoweth. Cassiterite has been mined at a number of localities in this elvan at Royalton, Beacon and Brynn, and concentrations occur where north-south lodes make a high angle intersection with the elvan, often causing stockworks of north-south veinlets to be produced (Dines, 1956).

INVESTIGATIONS AT QUOIT

Soil geochemistry

Figure 3 shows the distribution of surface radiometric values in relation to the salient geographical features, mainly field boundaries, of the Quoit area. Seven anomalous areas are recognisable, labelled A-G. It is the location of a boulder in a hedge which gave rise to the initial roadside radiometric anomaly.

A radon survey (Figure 3) indicated that there is little or no evidence of continuity of uranium values between the various anomalies but there is some slight evidence that both B and E extend further to the south than was indicated by the surface gamma radiometry.

Figures 4, 5, and 6 give values for Pb, B, Zn, Cu, U and the results of the gamma-spectrometric survey for anomaly G. None of the values are sufficiently high to merit further investigation for these elements. Sn is likewise low and since the total range is only 23-75 ppm the data are not presented. High values of B in soil are observed (Figure 4), and these values are in general greater than those at Higher Trenoweth.

Borehole logs

Figure 7 shows the distribution of boreholes in relation to the radiometric anomalies, and the borehole logs constructed using Geiger-Muller probes are given in Appendix 1.

Boreholes (BH1 and 2) were designed to test the possibility of a depth extension to anomaly C and were drilled in the same direction, both at an inclination of 50°.

BH1 intersected a radioactive zone at an inclined depth of about 3m and remained in a zone of high values to a depth of 10m. BH2 was directed to intersect the structure at a greater depth and, in fact, penetrated rocks with high concentrations of radioelements at about 5m, 11m and 14m. The data are consistent with the presence of a steeply dipping zone containing isolated ore shoots.

Anomaly B shows a large area of moderately anomalous values. Unfortunately, none of the boreholes (3, 4, 5) intersected high concentrations of radioactivity. Either the surface anomaly has no "roots" or the uranium is very unevenly distributed.

Three boreholes were drilled to test the surface anomaly E. BH6 was vertical and BH7 was drilled at the same locality but with an inclination of 50°. In the second hole anomalous radioactivity was intersected at a depth of 25m and a lower value at 38m. No evidence of high radioactivity was observed in BH8. The data are consistent with a thin ore shoot dipping steeply to the south.

BHs 9 and 10 were drilled to test the anomaly at G but failed to penetrate rocks with anomalous radioactivity.

Three overlapping boreholes (BH 11, 12, 13) were drilled on a NW-SE traverse between anomalies E and F (Figure 7). Only BH12 intersected a moderately anomalous zone, at a depth of about 12m.

INVESTIGATIONS AT HIGHER TRENOWETH

Figures 8, 9 and 10 show the relationship between the radiometric surface anomalies, Rn in soil air, U in soils and Bi -214 photopeak intensity. A radioactive linear feature is concluded to be the surface expression of ore shoots of uranium extending a substantial distance (>300m of strike) with underground continuity. Its suboutcrop is placed slightly upslope (to the NE) from the surface radiometric anomalies and is confirmed by the result of the radon investigation and by the drilling programme at the southern end of the structure where a line of overlapping drill holes (Figure 8) failed to intersect anomalous radioactivity.

Although anomalous concentrations of Cu, Pb and Zn are located in soils overlying the radioactive structure they are not sufficiently high or continous to be of great interest. Some B concentrations (Figure 14) are very high along the structure but the greatest concentration is at the southern end where the elvan has been shown to occur and this mapping is confirmed by the abundance of kaolinised granitic fragments brought up by drilling. Sn concentrations of 100 ppm to greater than 500 ppm also occur in soils over the southern part of the soil sampling grid (Figure 15) and they are concluded to reflect the concentration of Sn in the elvan.

CONCLUSIONS

The apparent isolation of the individual radiometric anomalies at Quoit is largely confirmed by surface geochemical investigations and drilling. There is no evidence that the radiometric anomalies conjoin at depth. Most of the anomalies have subsurface extensions, however, and steep pipe-like ore shoots, a not uncommon occurrence in south-west England, are predicted.

The results of the soil geochemical investigation over the southern-most anomaly indicates that B is high but that Sn, Pb, Cu and Zn are generally low. The association of Ni and Co with U, such as occurs at nearby Wheal Trugo, has not been tested, but the low values of Cu, Pb and Zn, which elsewhere are commonly associated with uraniferous cross-courses, suggests that the structure is of little importance.

The Higher Trenoweth anomalies can be regarded as one structural unit, at least 300m in length, with continuity between the surface radiometric anomalies indicated by the radon studies. The soils do not reveal coincident Cu, Pb and Zn anomalies, but Sn is high in that part of the soil grid underlain by kaolinised elvan and is accompanied by high B. High B values are also found in isolated samples near the northern end of the structure.

The current interest in U is insufficient to warrant further work at the Quoit anomalies. The Higher Trenoweth structure is sufficiently long to merit further attention if the uranium and associated metal demand becomes more buoyant.

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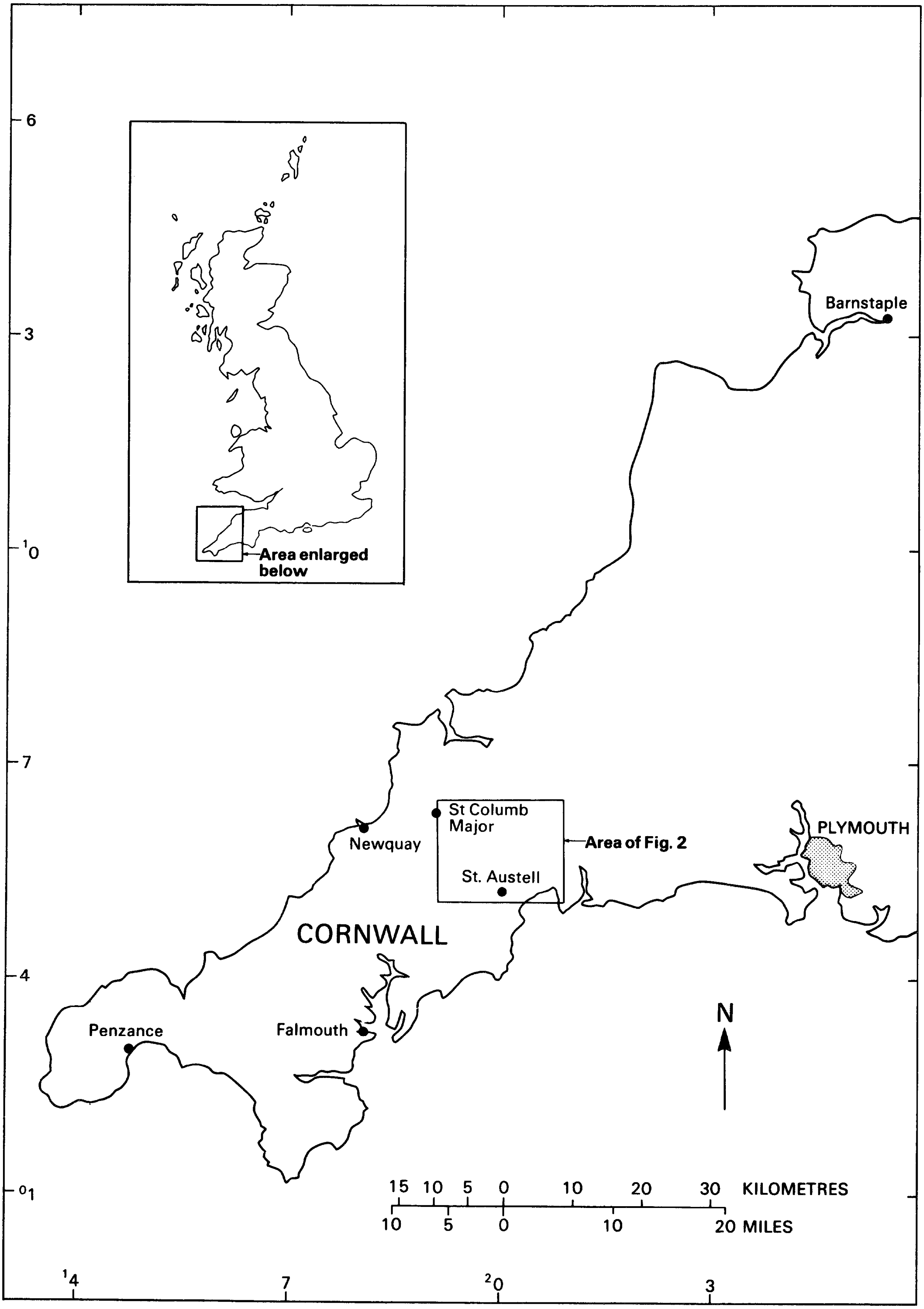


Figure 1 Location map.

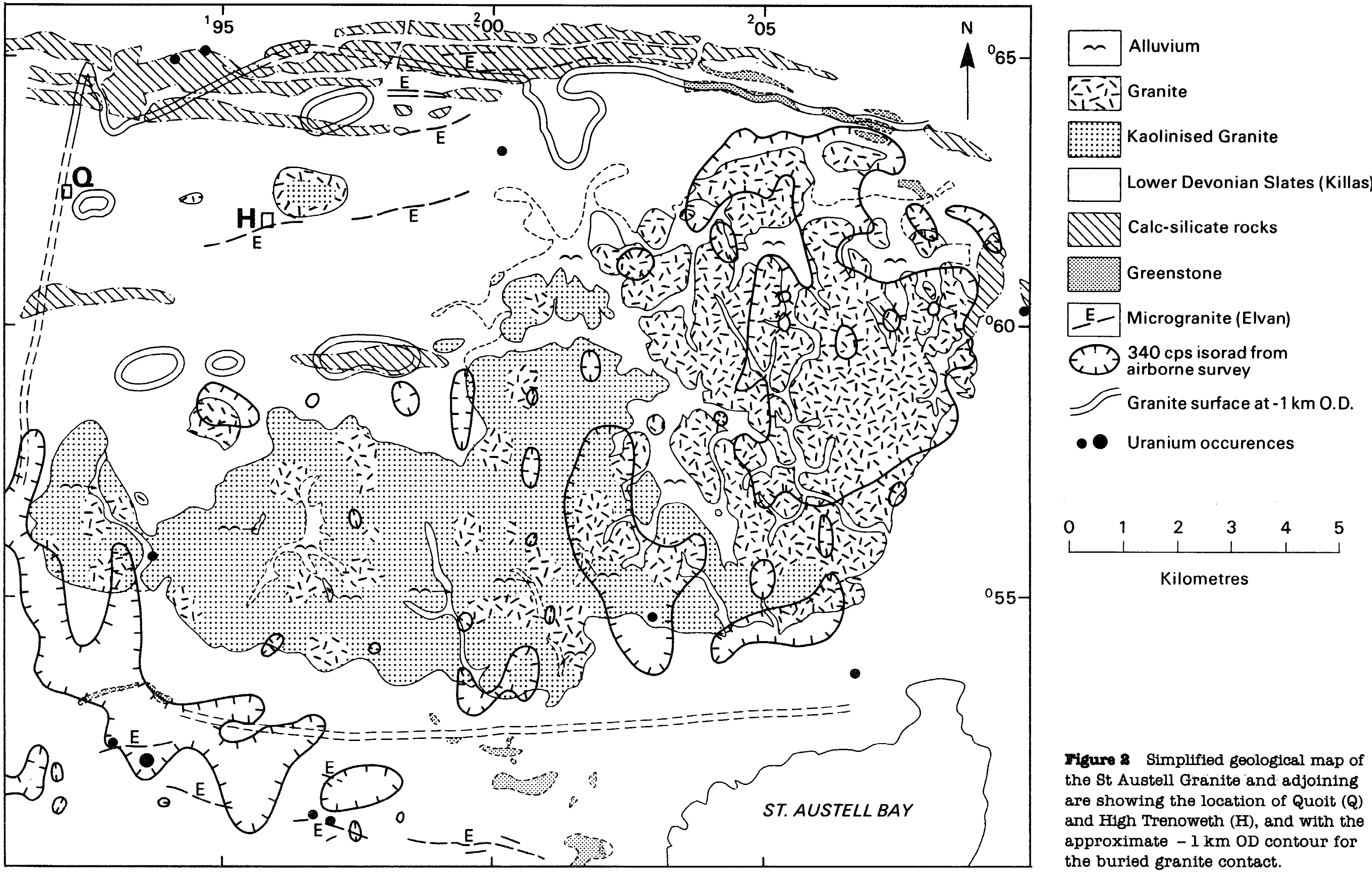


Figure 2 Simplified geological map of the St Austell Granite and adjoining are showing the location of Quoit (Q) and High Trenoweth (H), and with the approximate – 1 km OD contour for the buried granite contact.

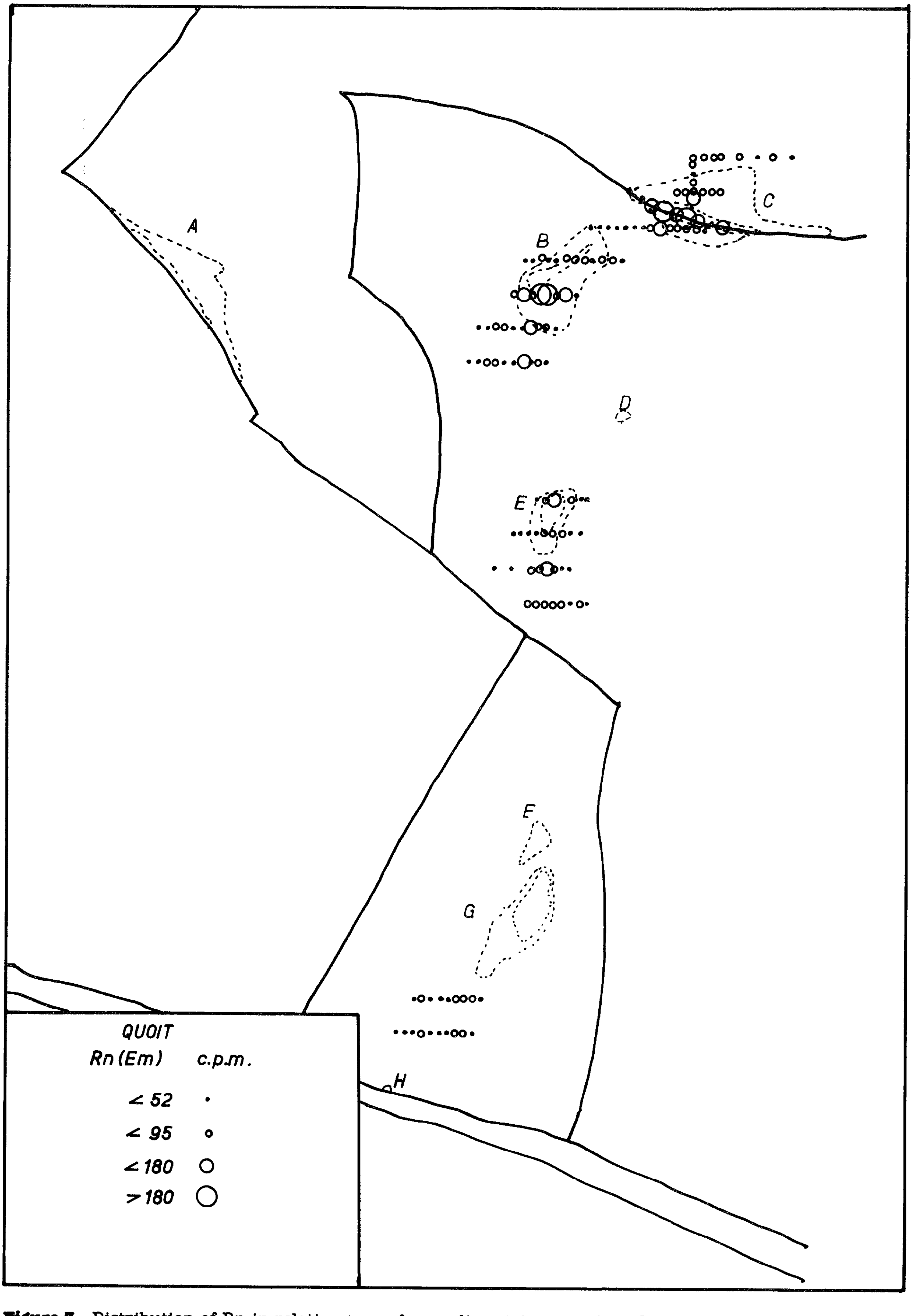


Figure 3 Distribution of Rn in relation to surface radiometric anomalies, Quoit.

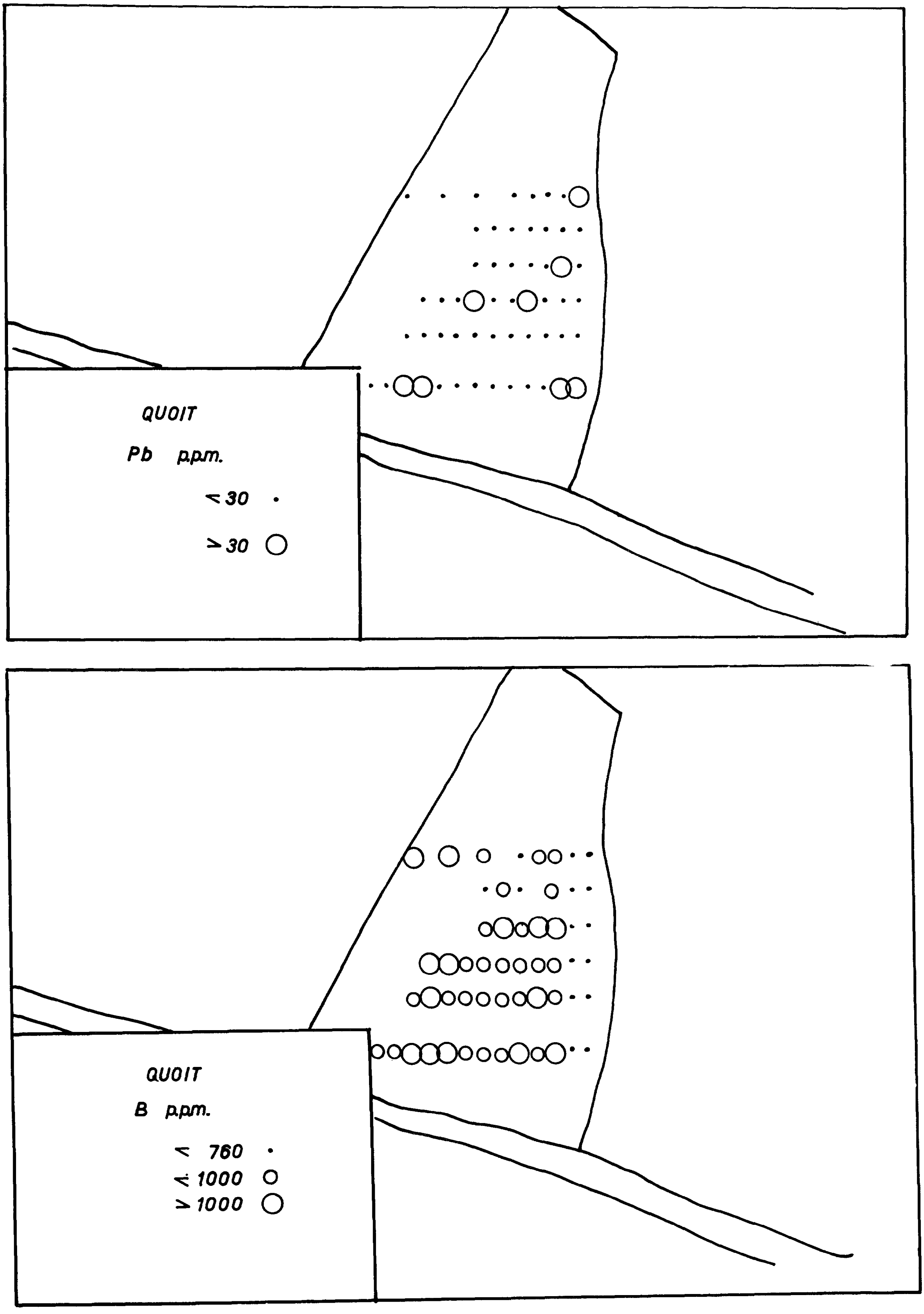
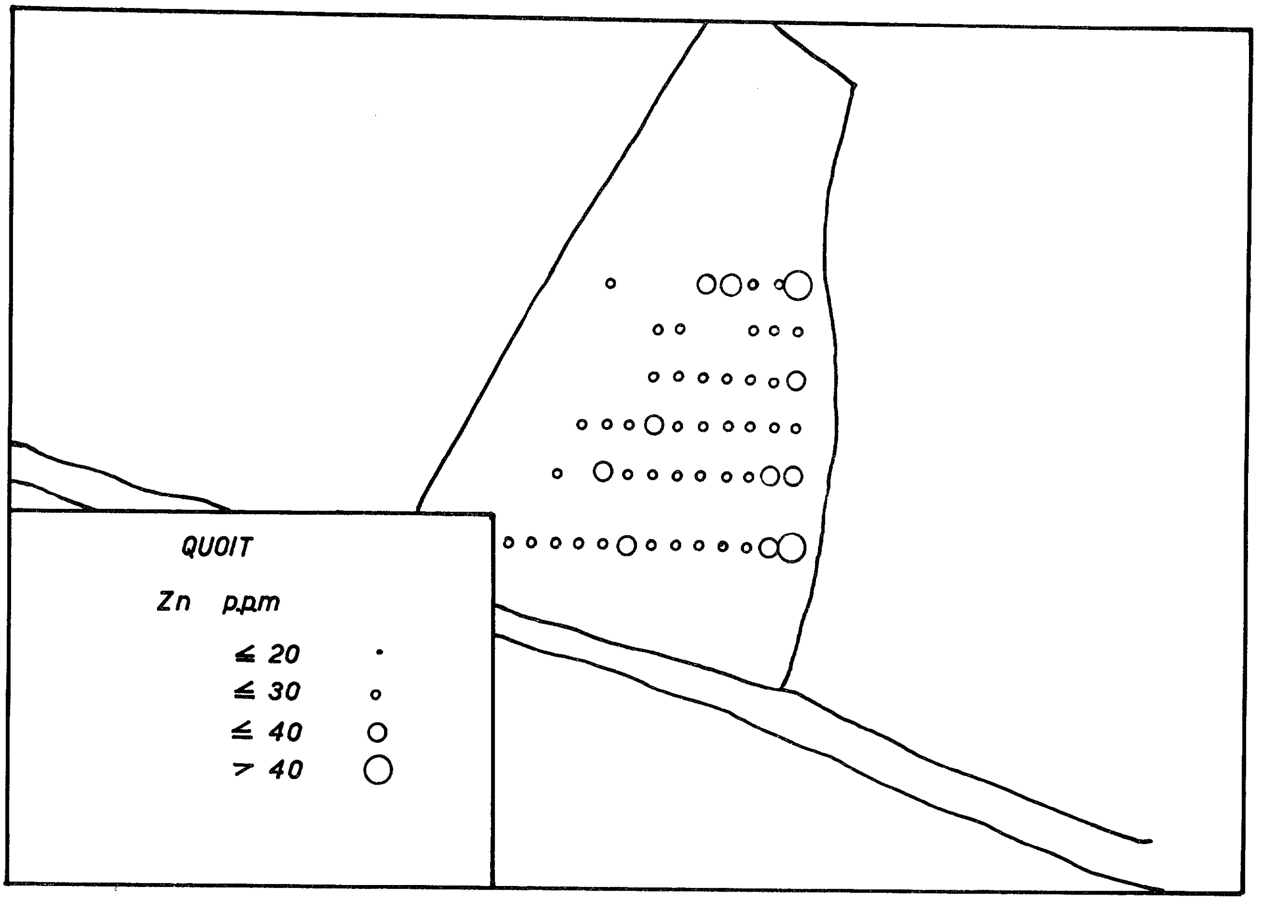


Figure 4 Distribution of Pb and B in soil samples, anomaly G, Quoit.



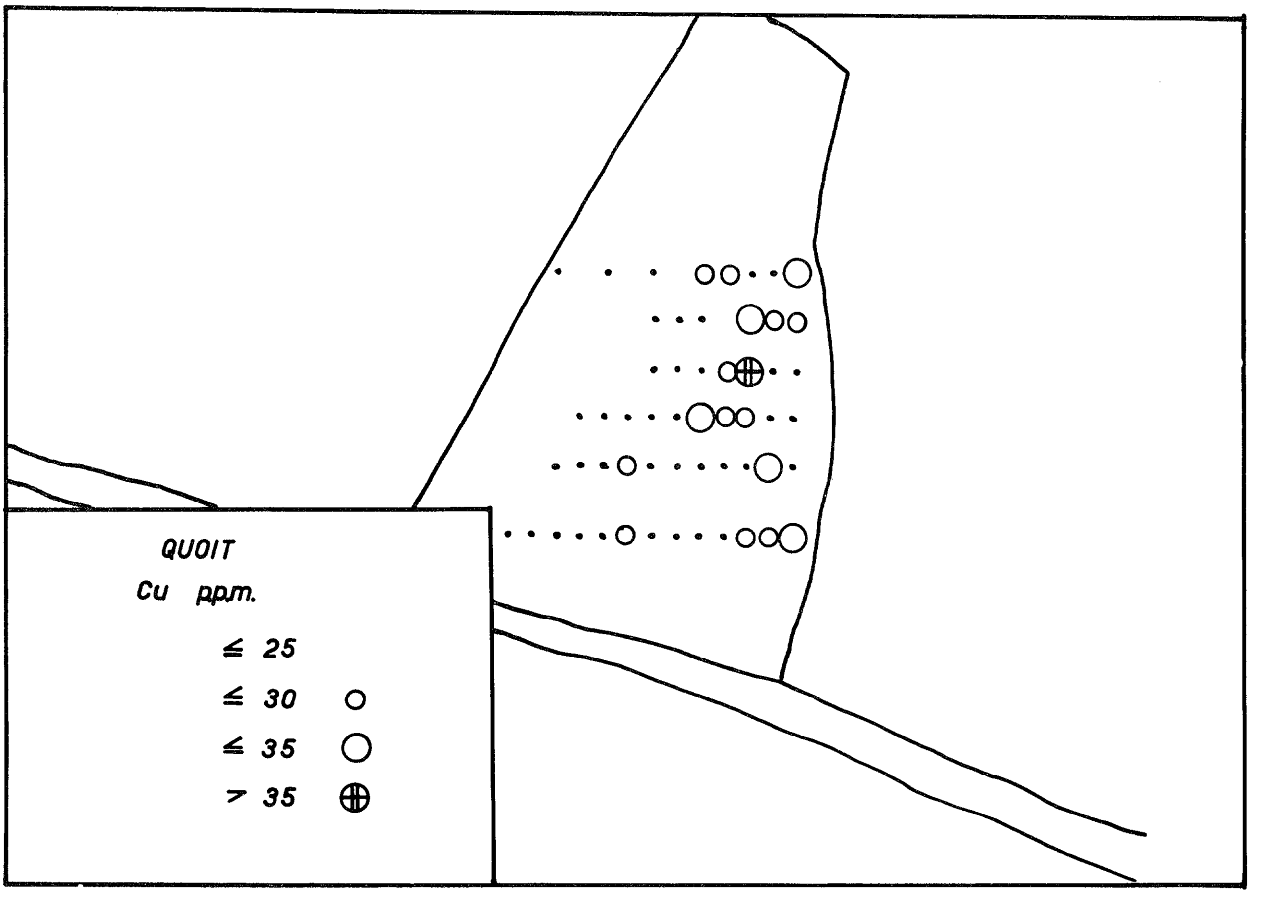
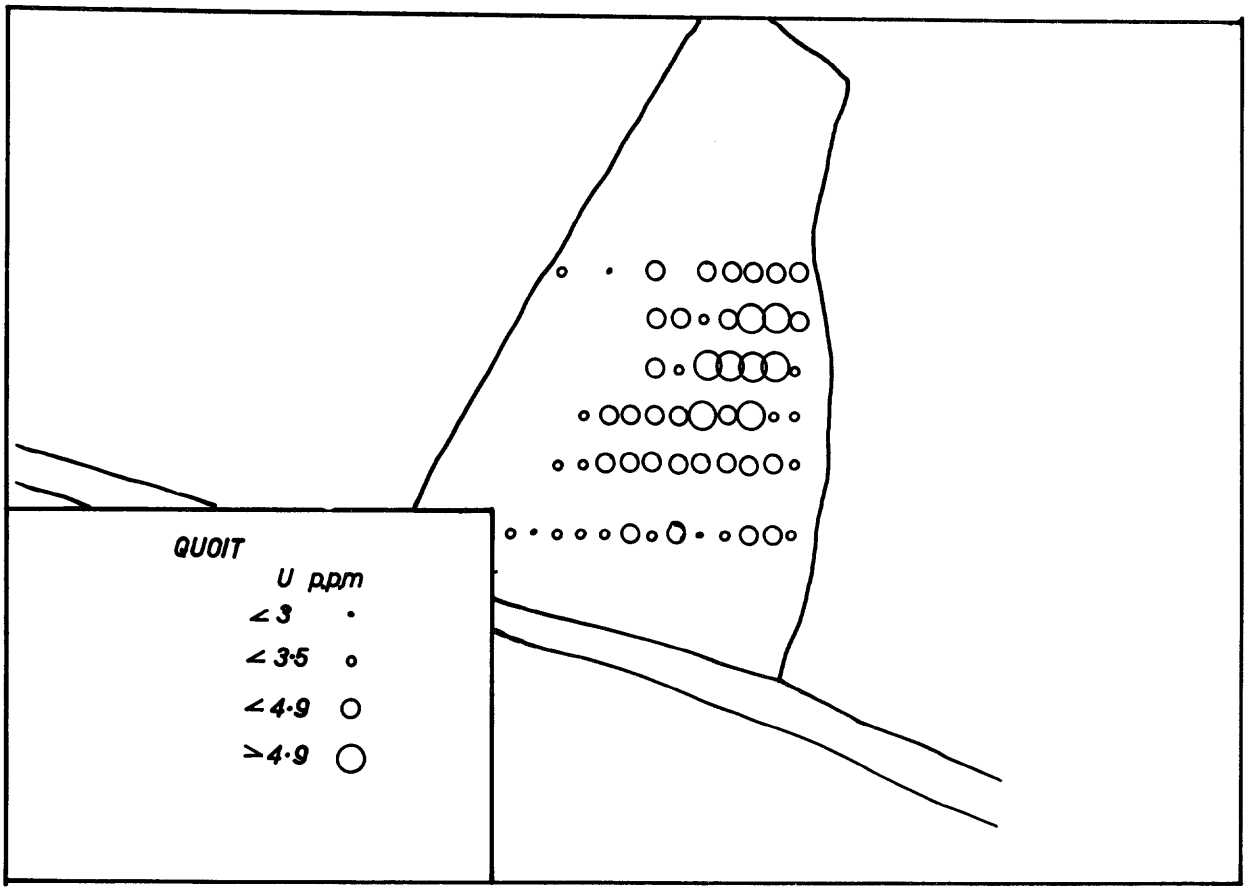


Figure 8 Distribution of Zn and Cu in soil samples, anomaly G, Quoit.



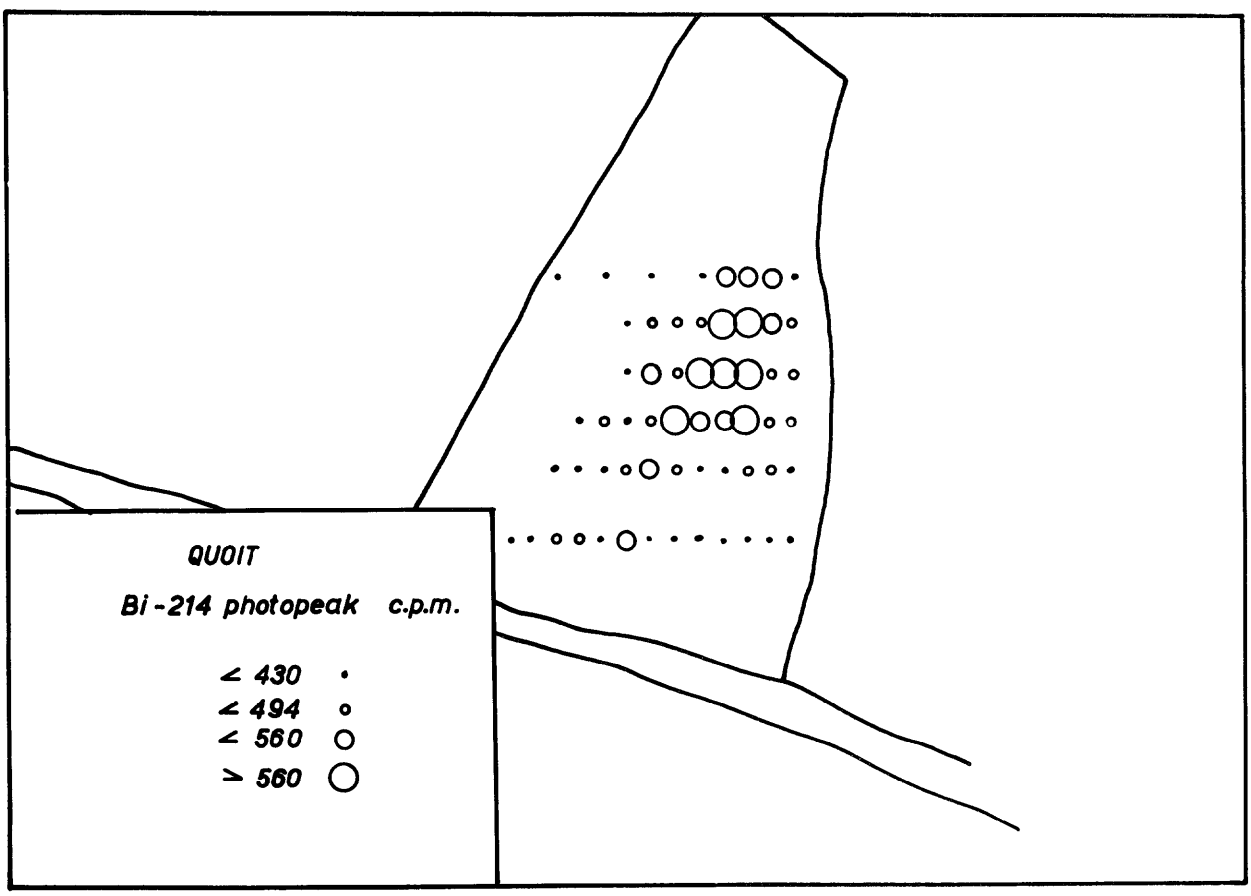


Figure 6 Distribution of U and Bi-214.

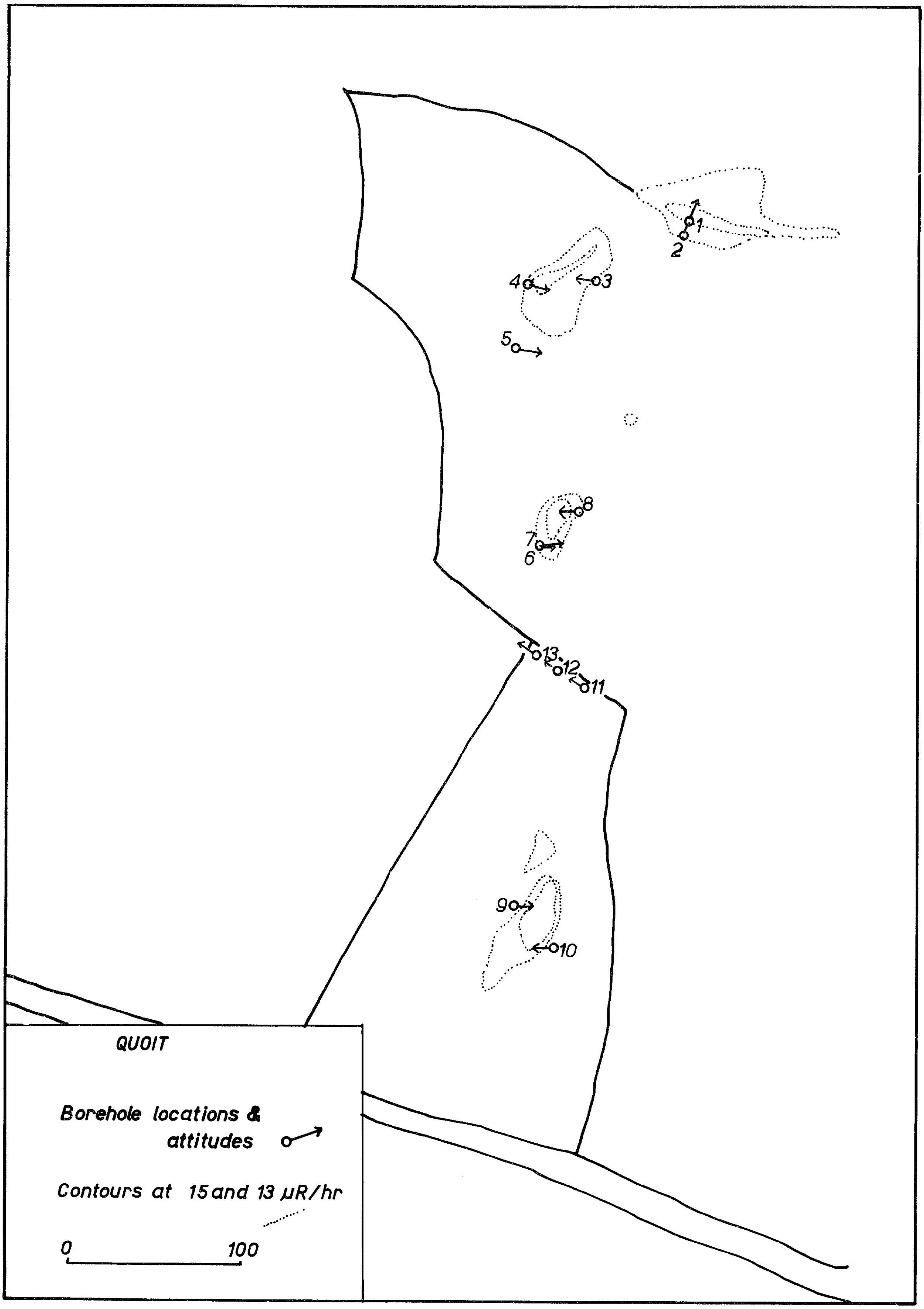


Figure 7 Positions and attitudes of boreholes in relation to surface radioactive features, Quoit.

Figure 8 Distribution of radon in soil air in relation to the surface, radiometric survey, Higher Trenoweth. The position of the borehole traverse is shown.

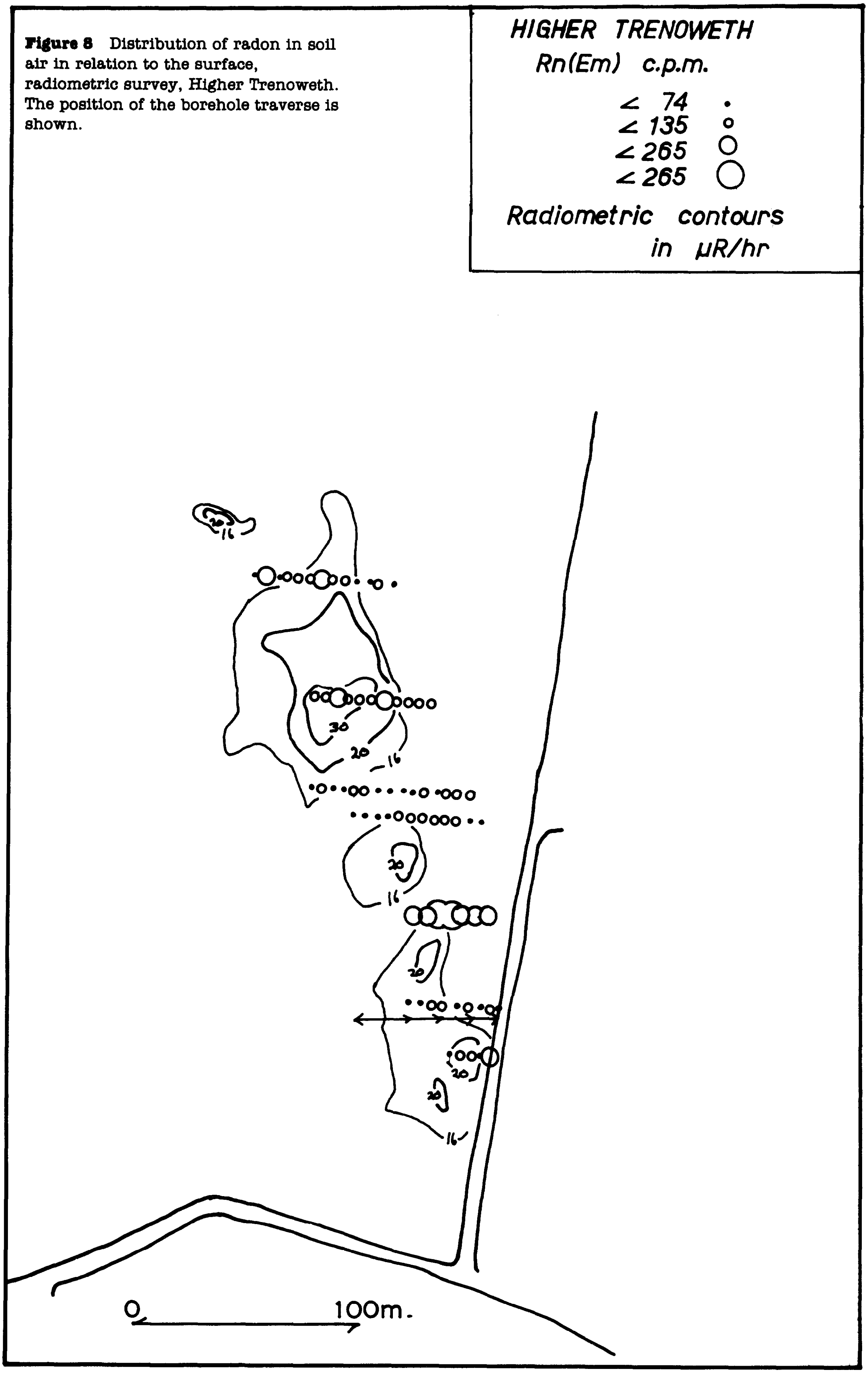


Figure 9 U in soils, Higher Trenoweth.

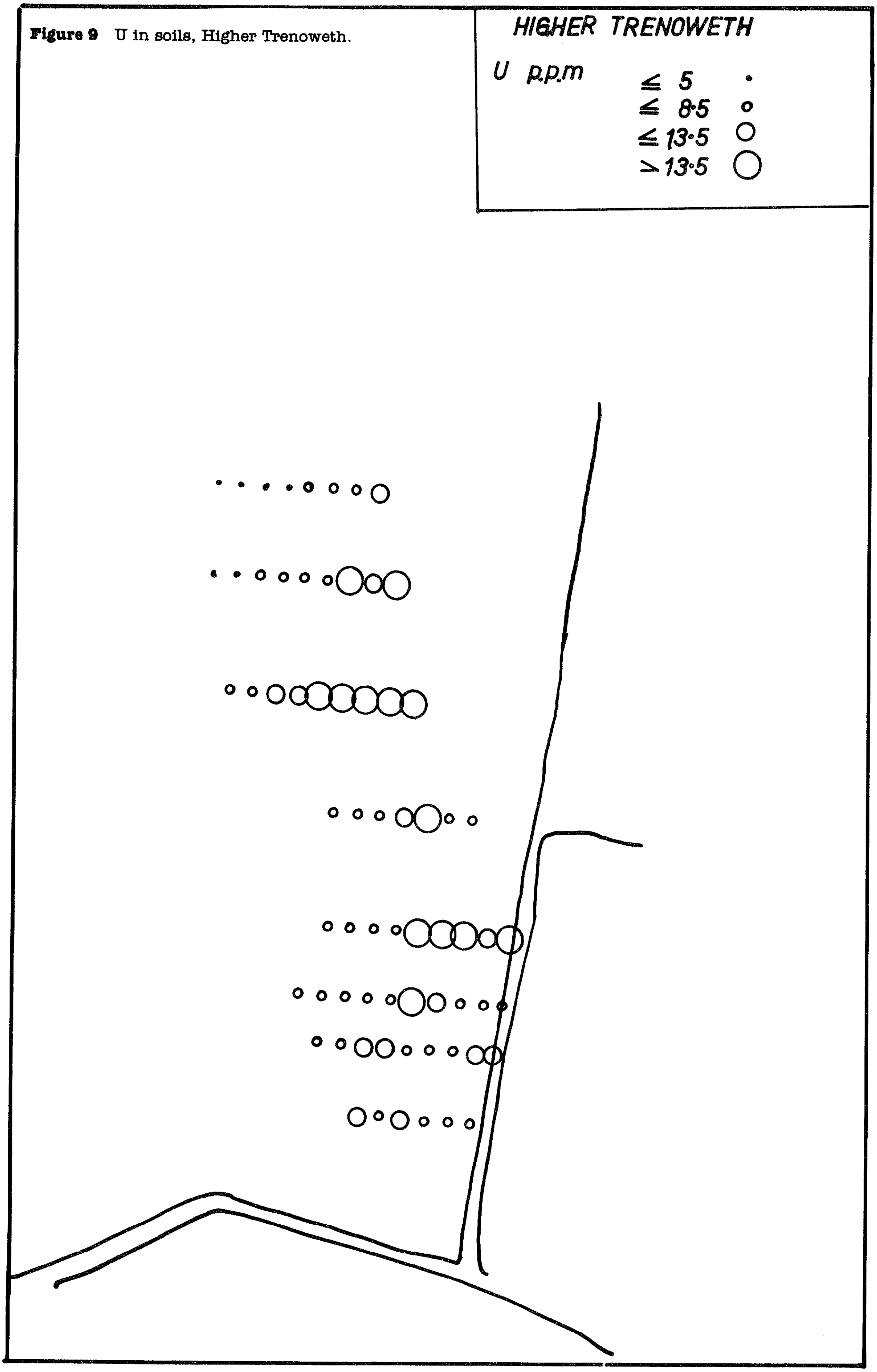
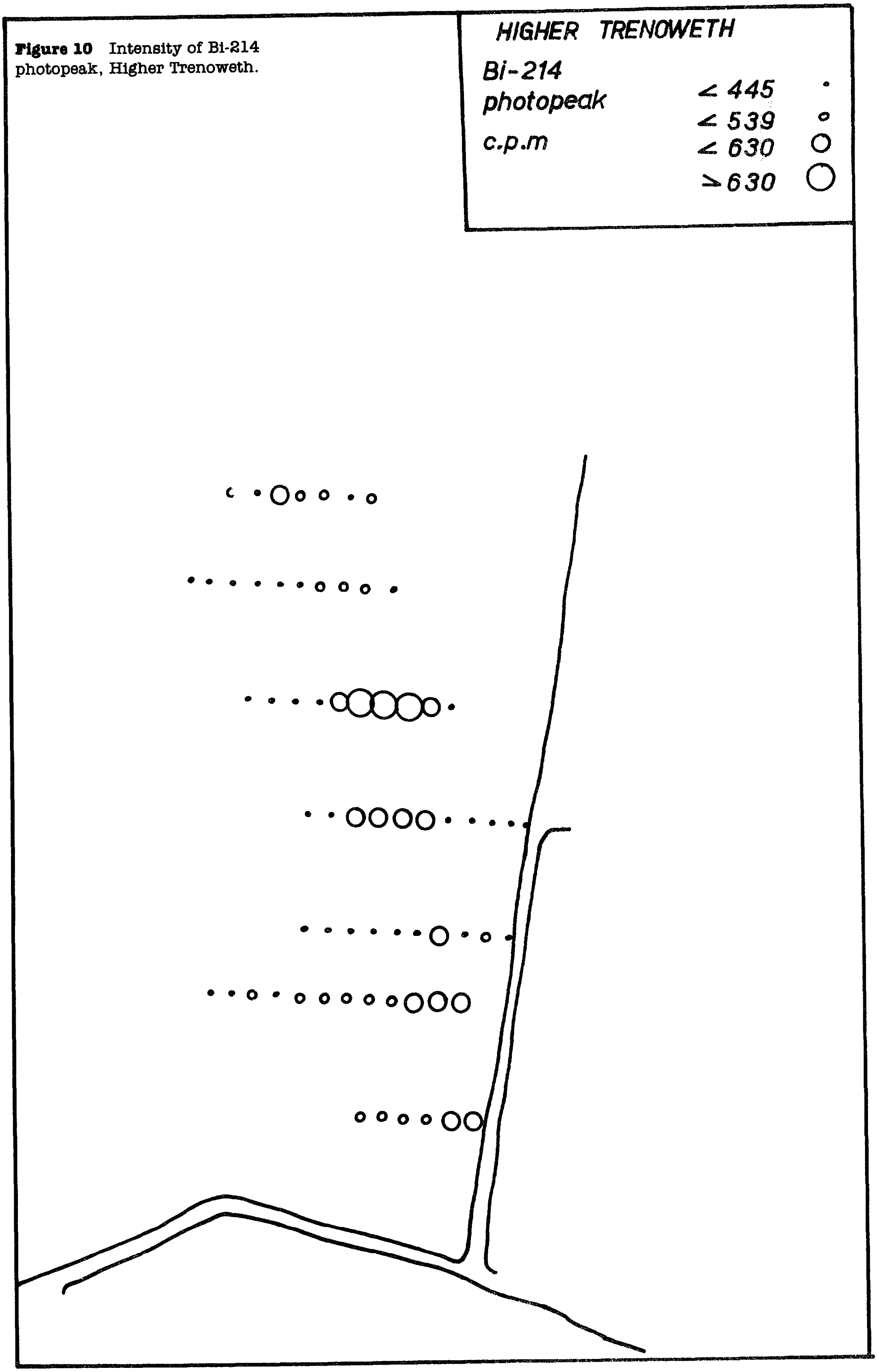


Figure 10 Intensity of Bi-214 photopeak, Higher Trenoweth.



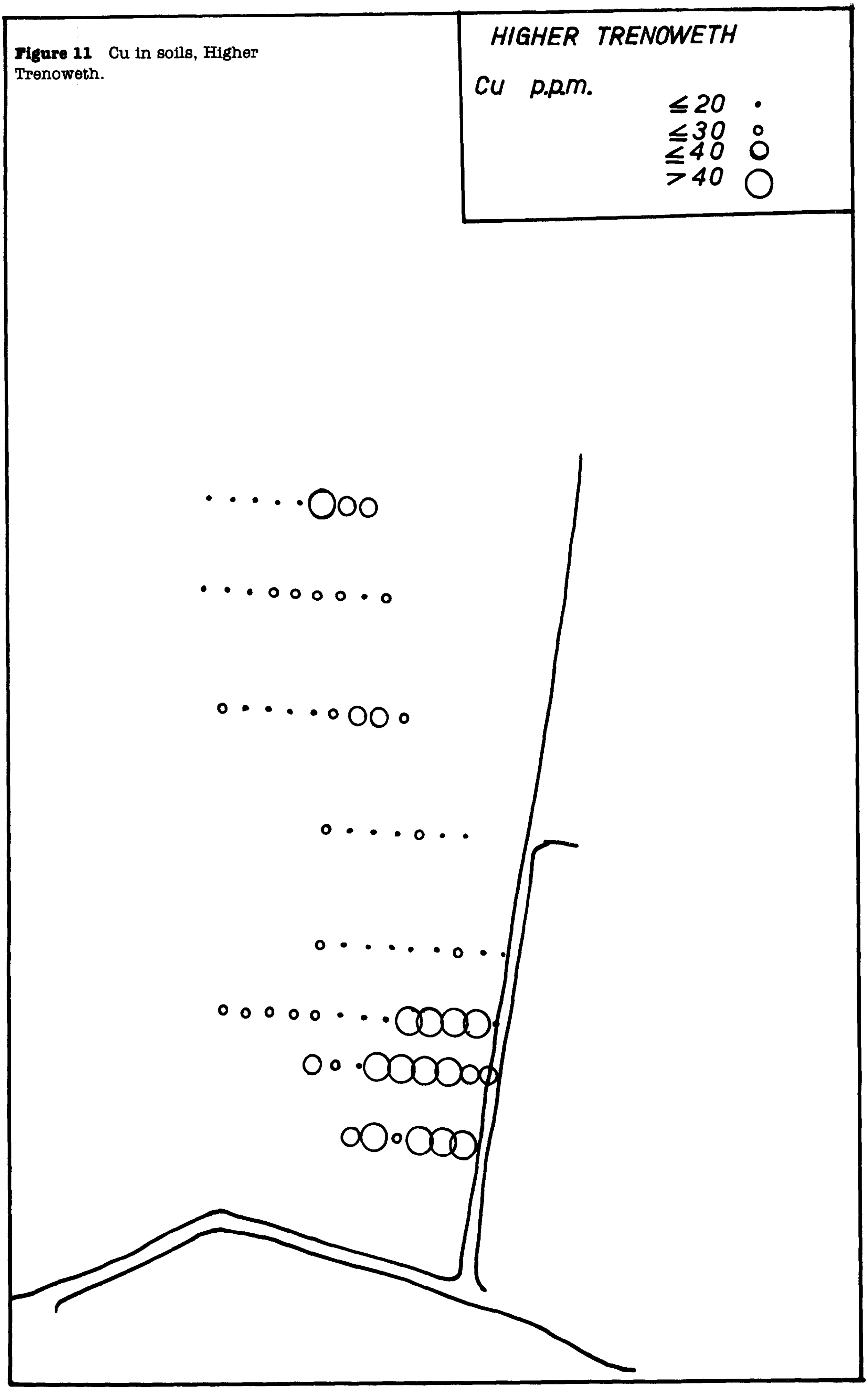


Figure 11 Cu in soils, Higher Trenoweth.

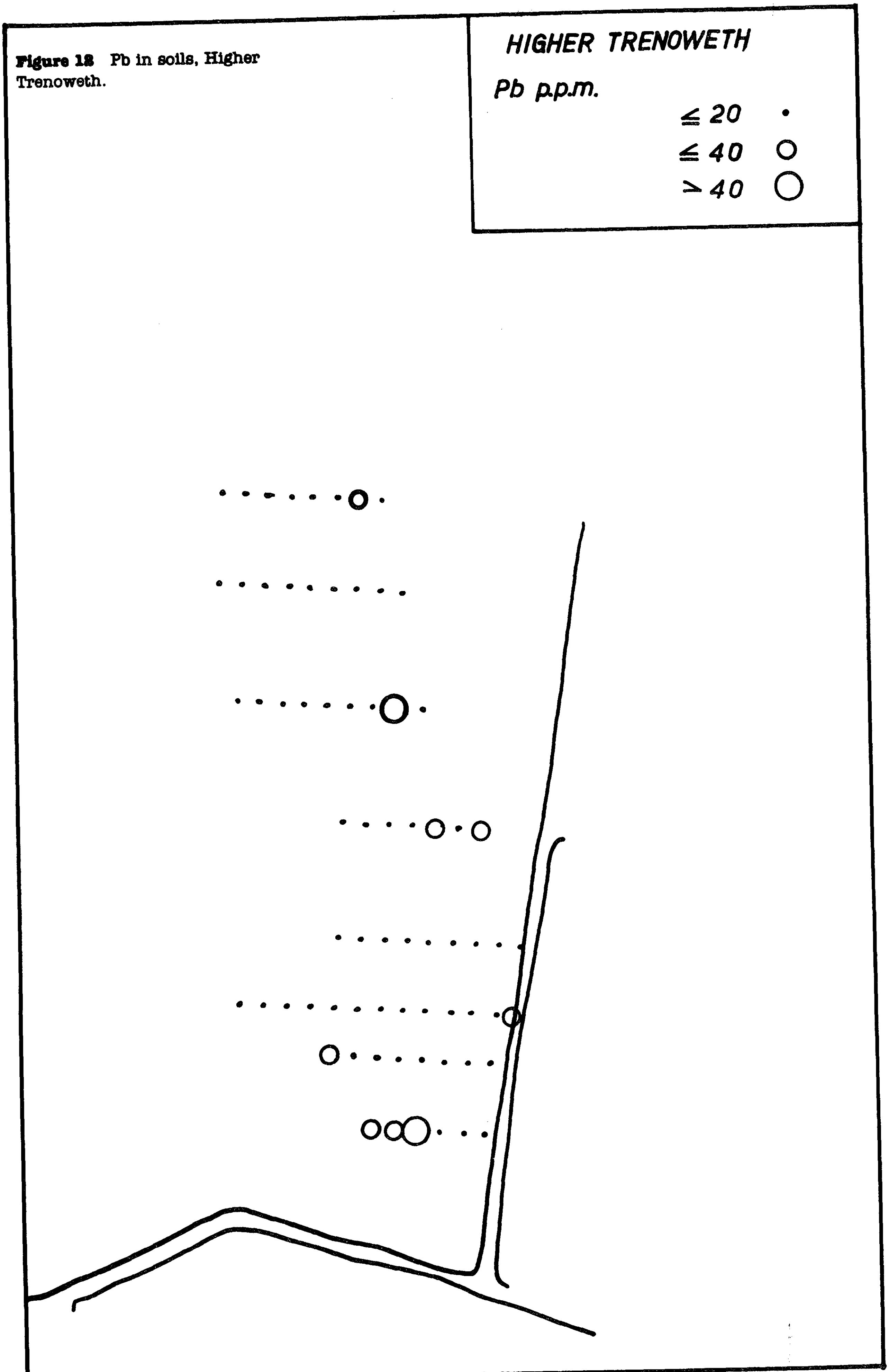


Figure 12 Pb in soils, Higher Trenoweth.

Figure 13 Zn in soils, Higher Trenoweth.

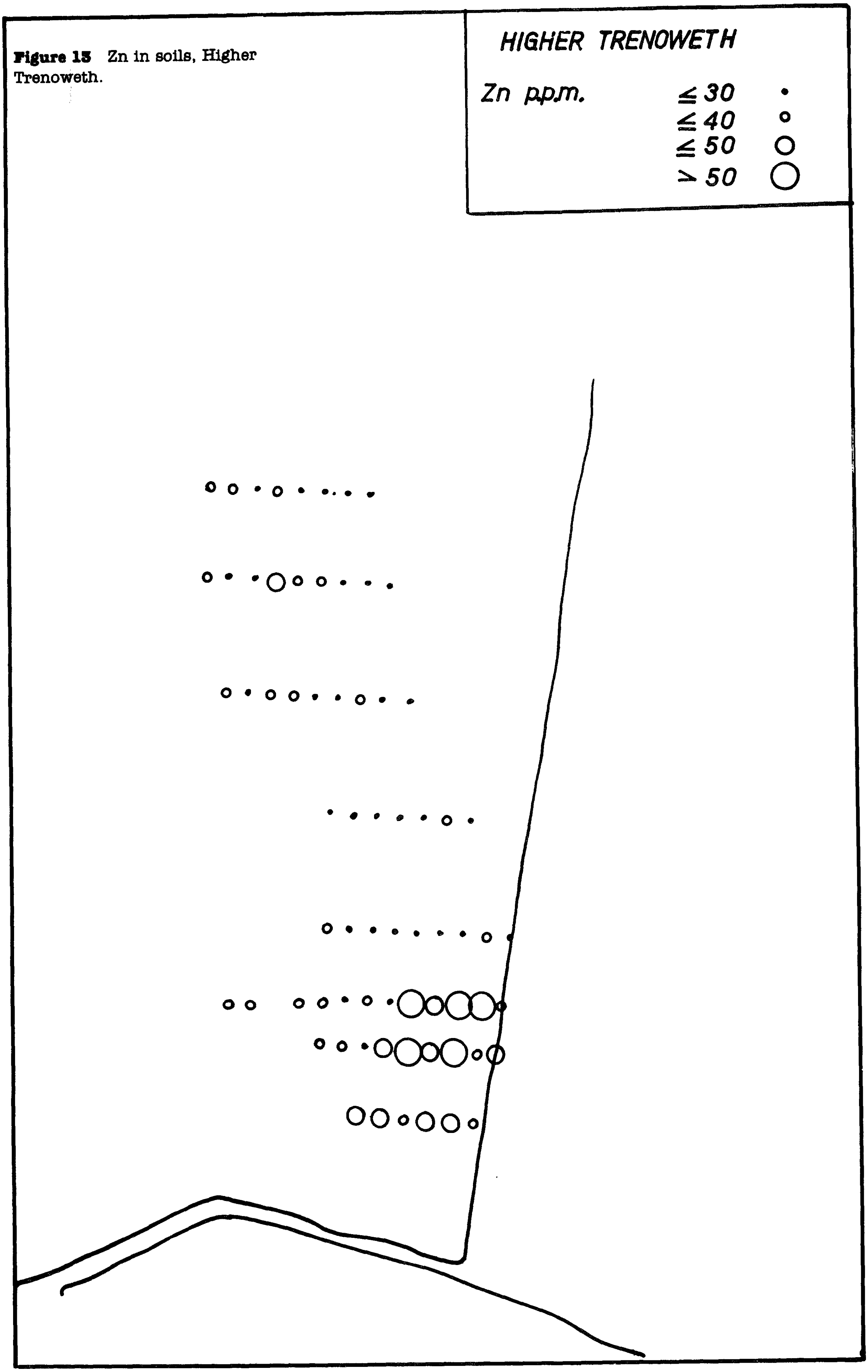
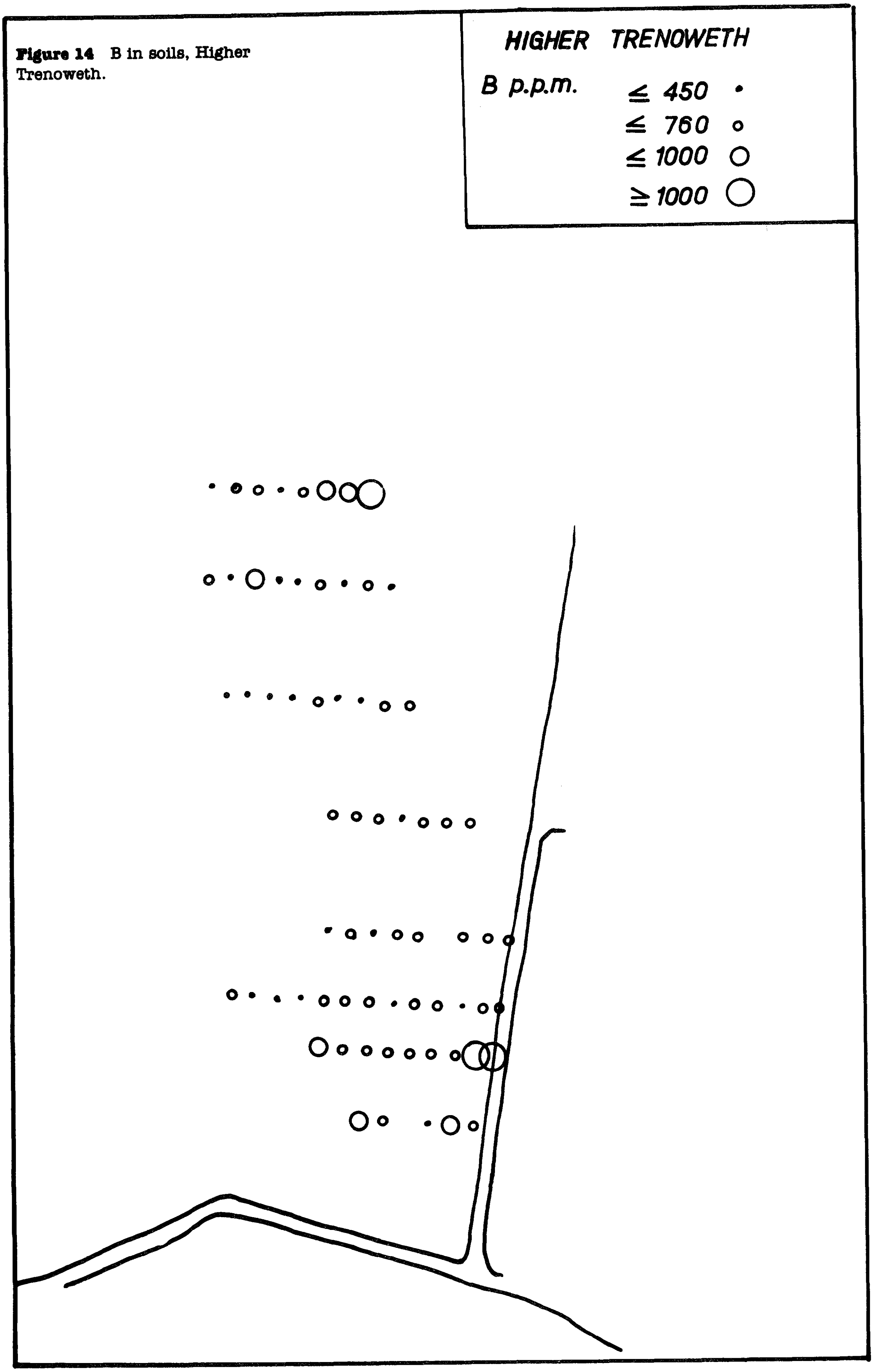


Figure 14 B in soils, Higher Trenoweth.



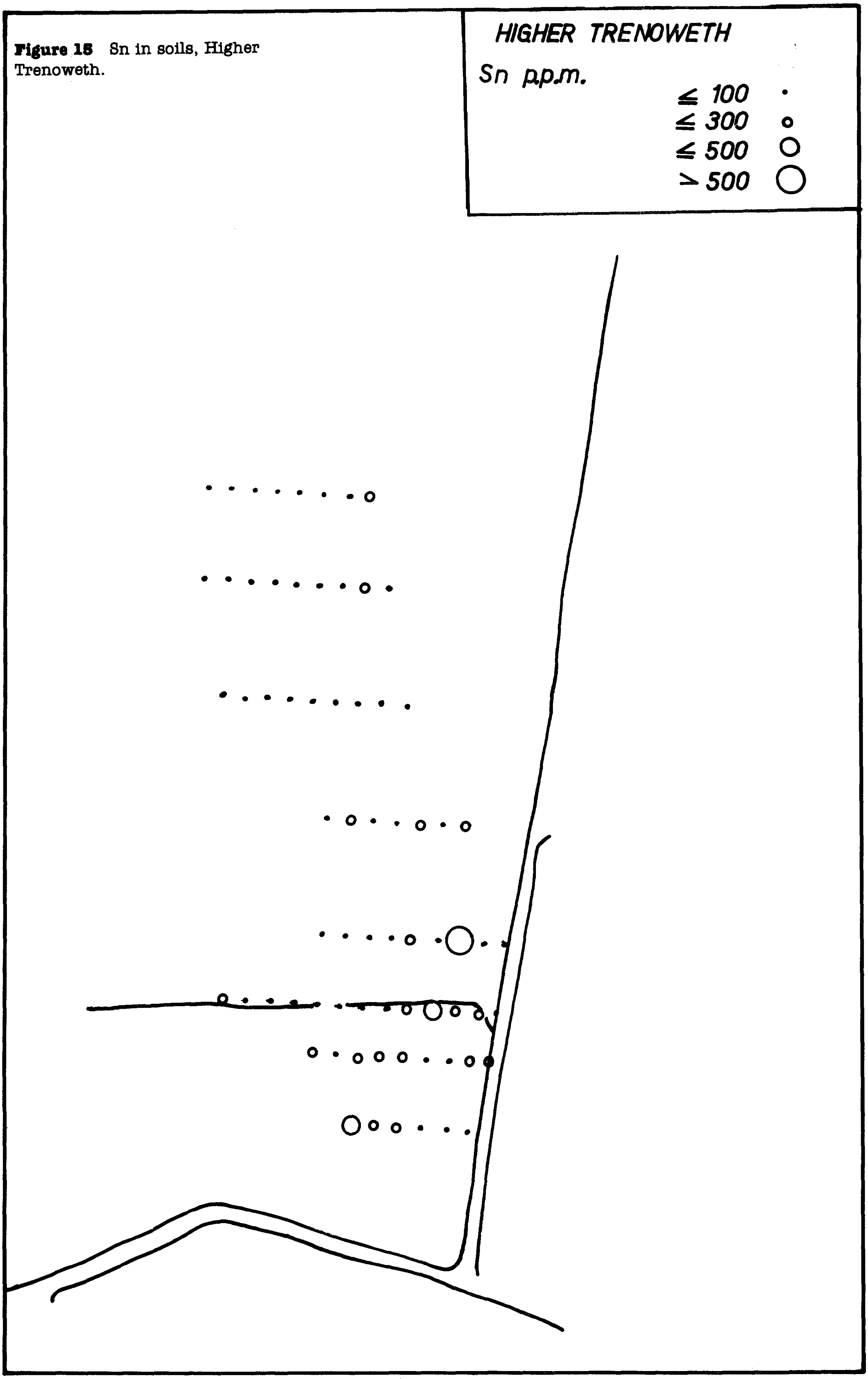
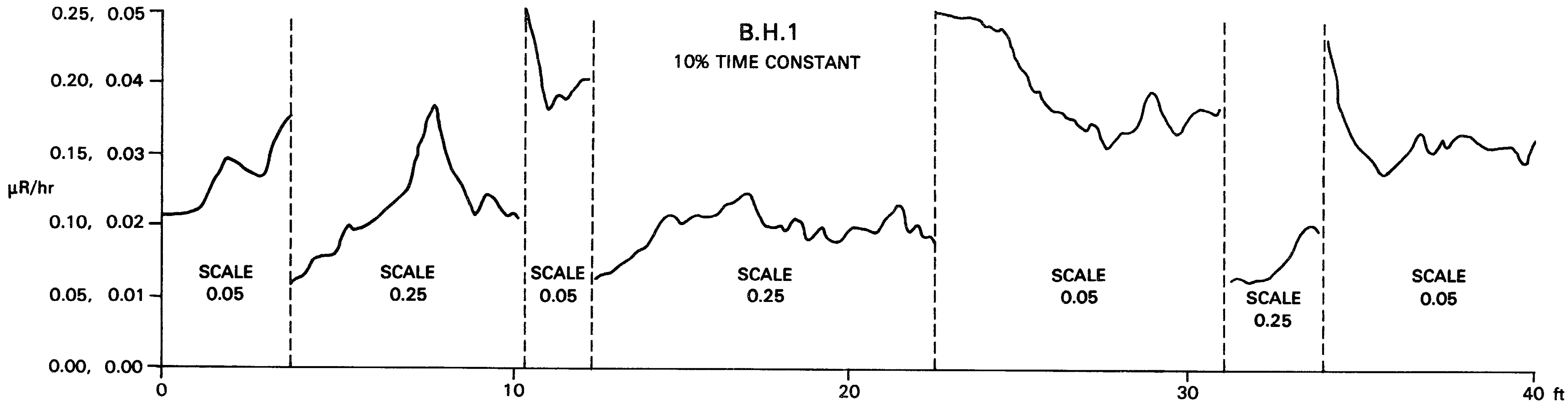
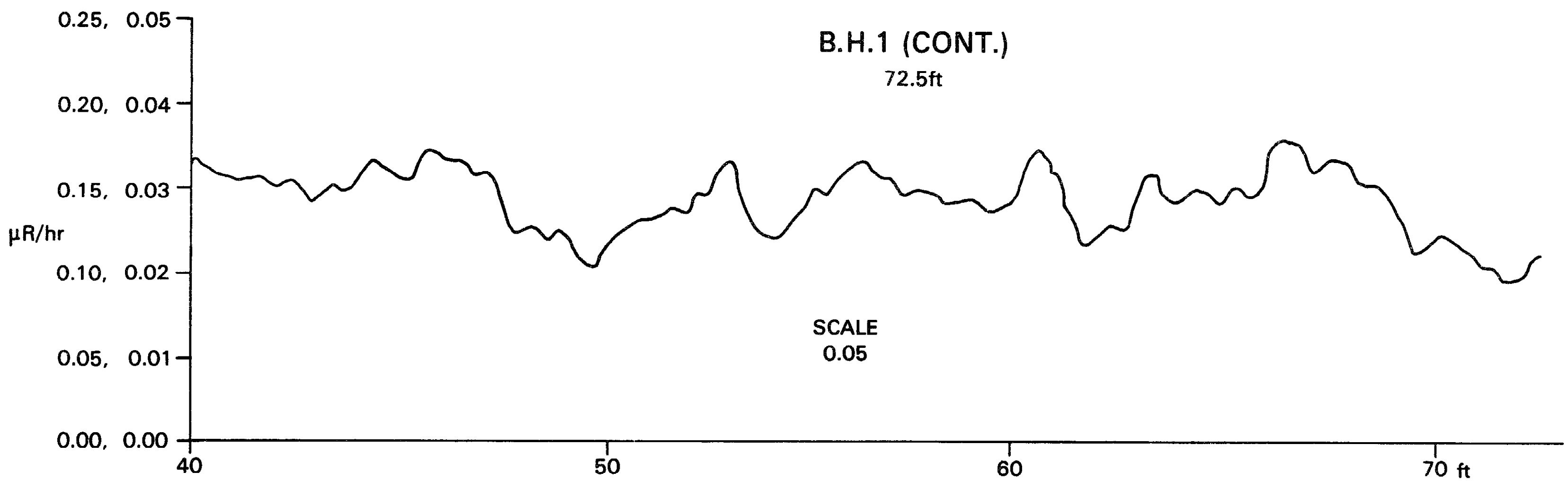


Figure 15 Sn in soils, Higher Trenoweth.

APPENDIX I

Radiometric logs of boreholes





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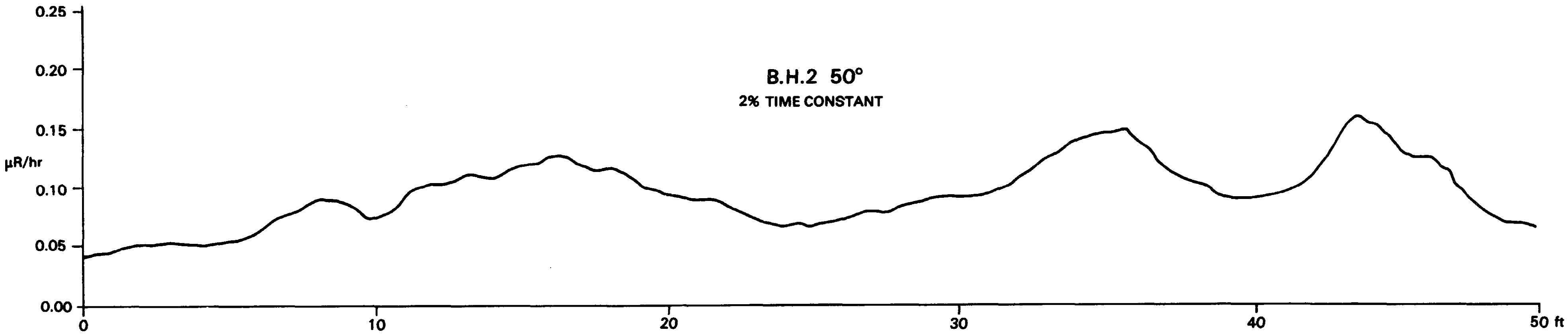

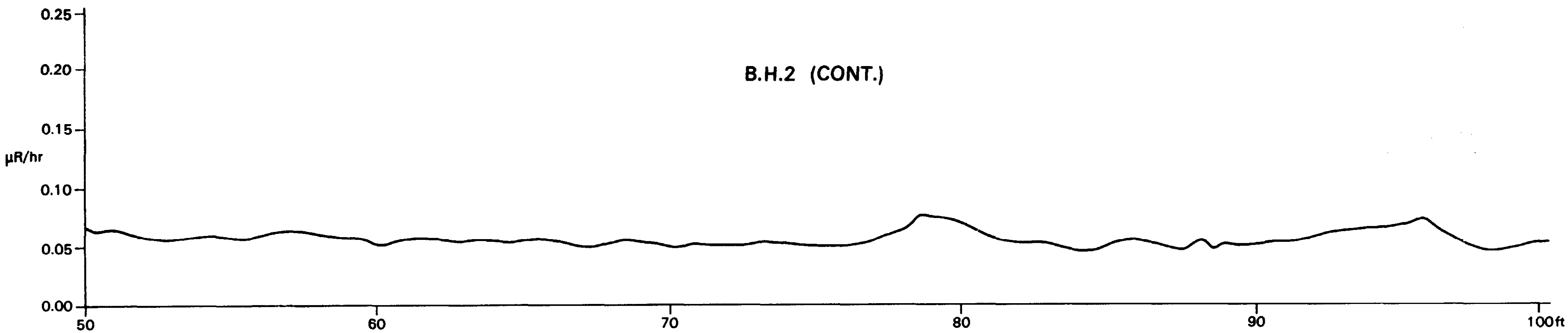

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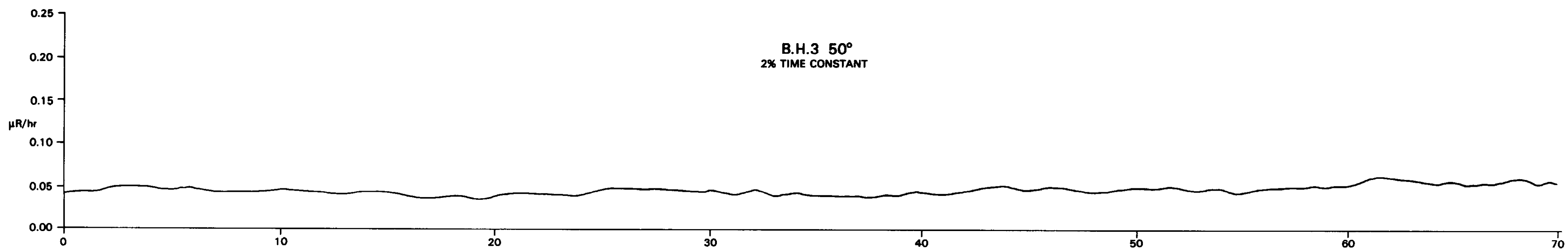

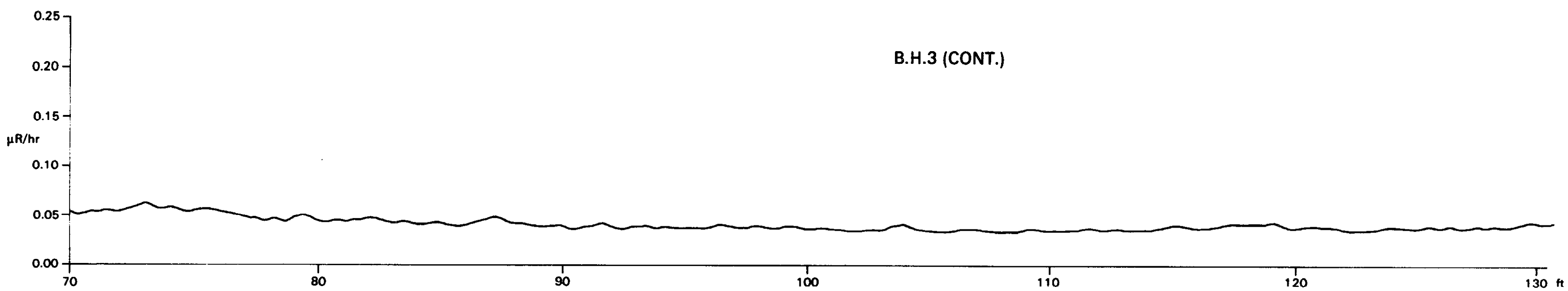

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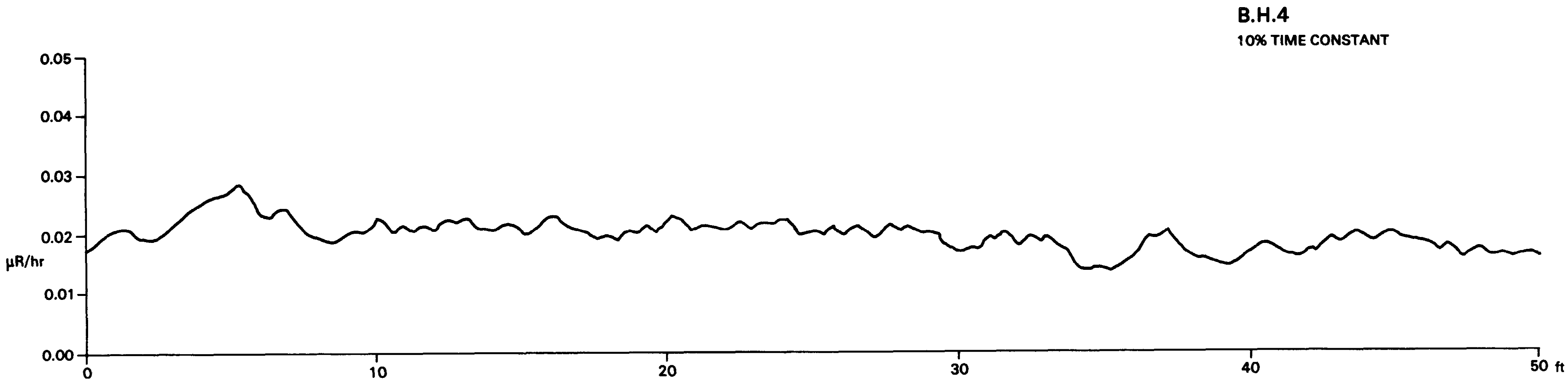

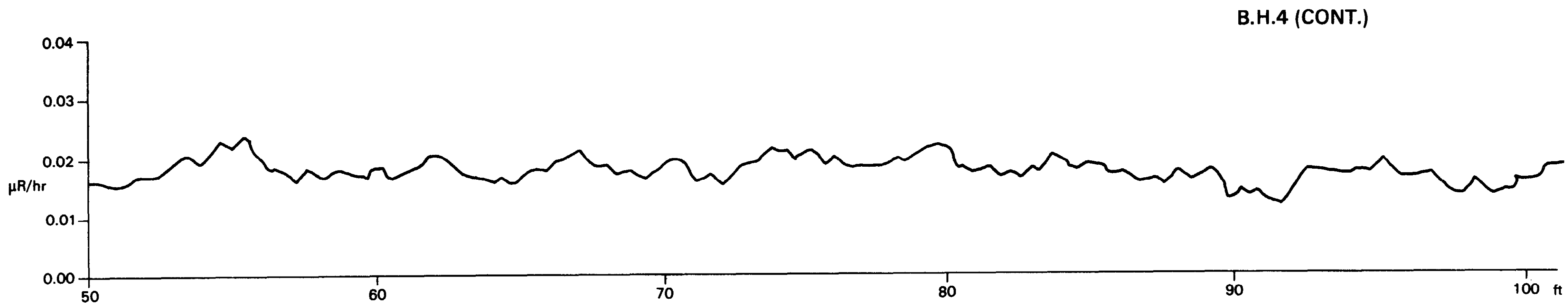

QUOIT RADIOMETRIC LOGS

B.H.5 60°
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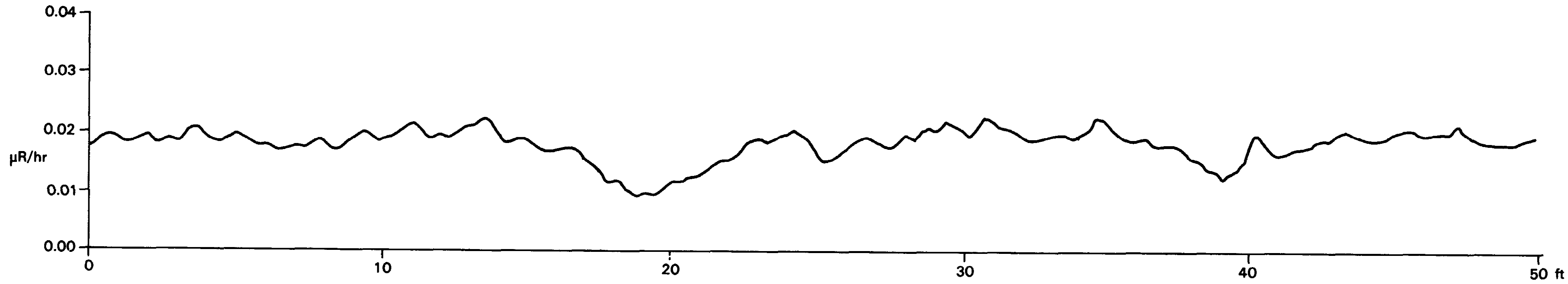

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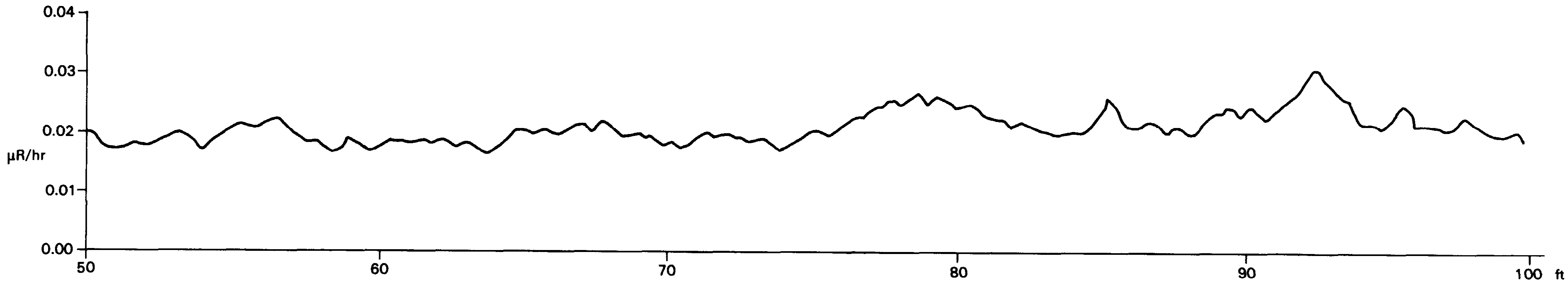

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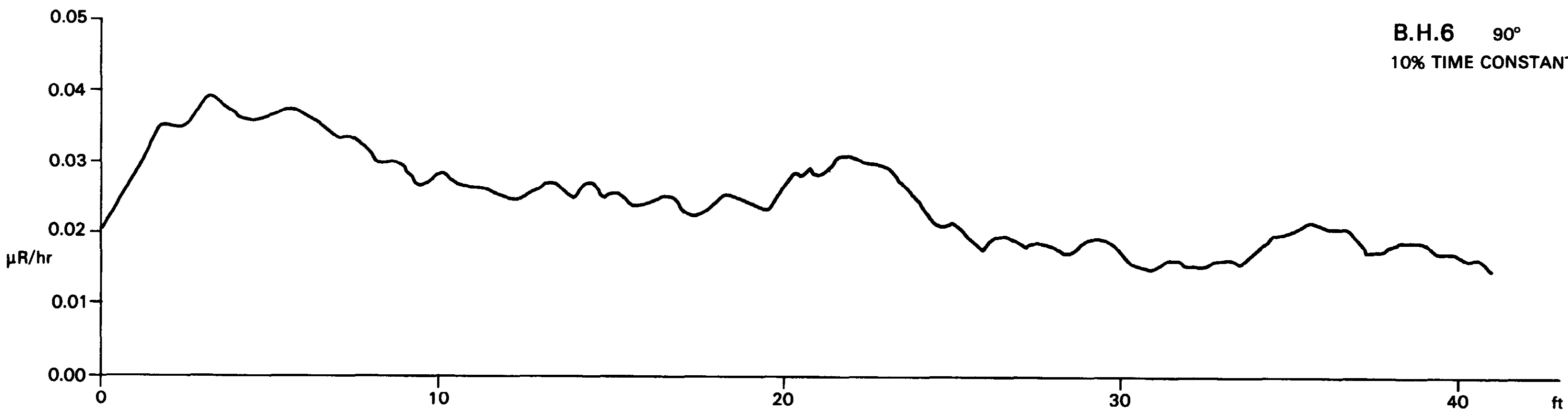

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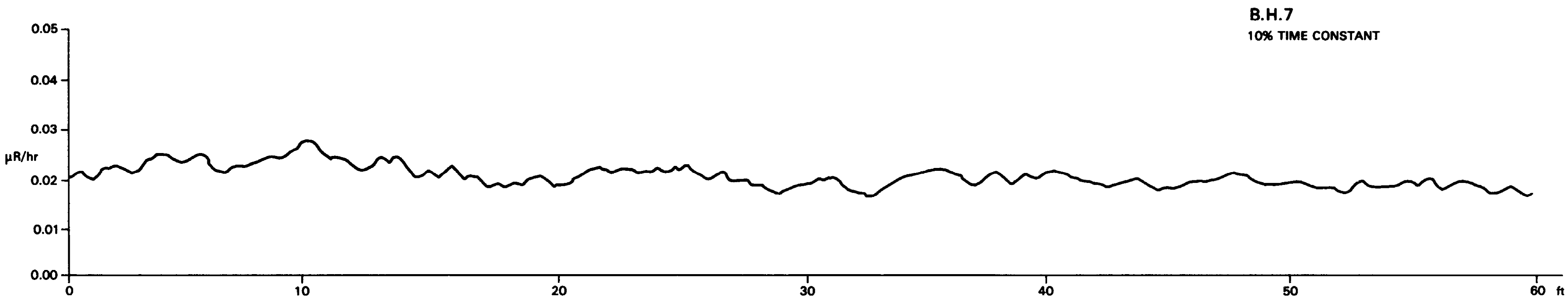

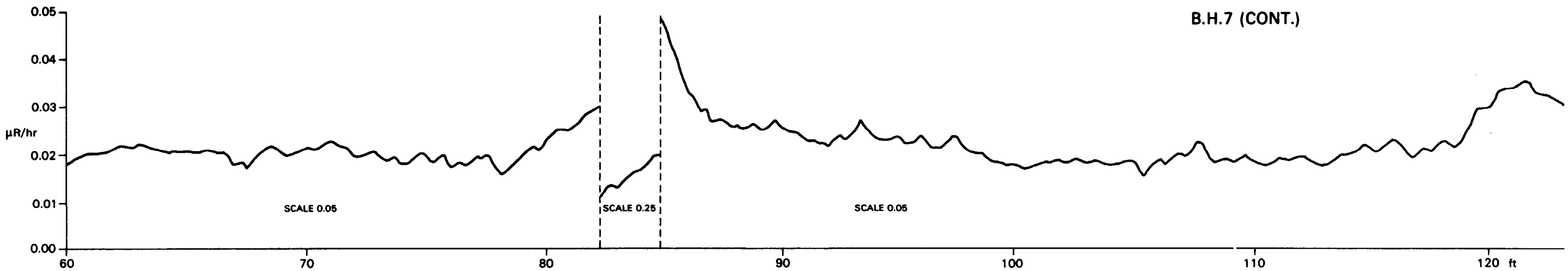

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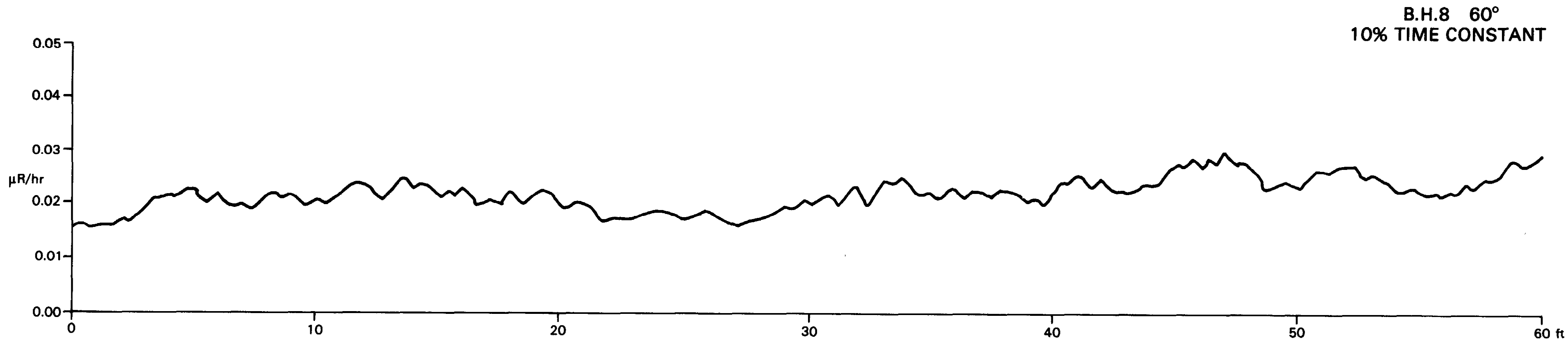
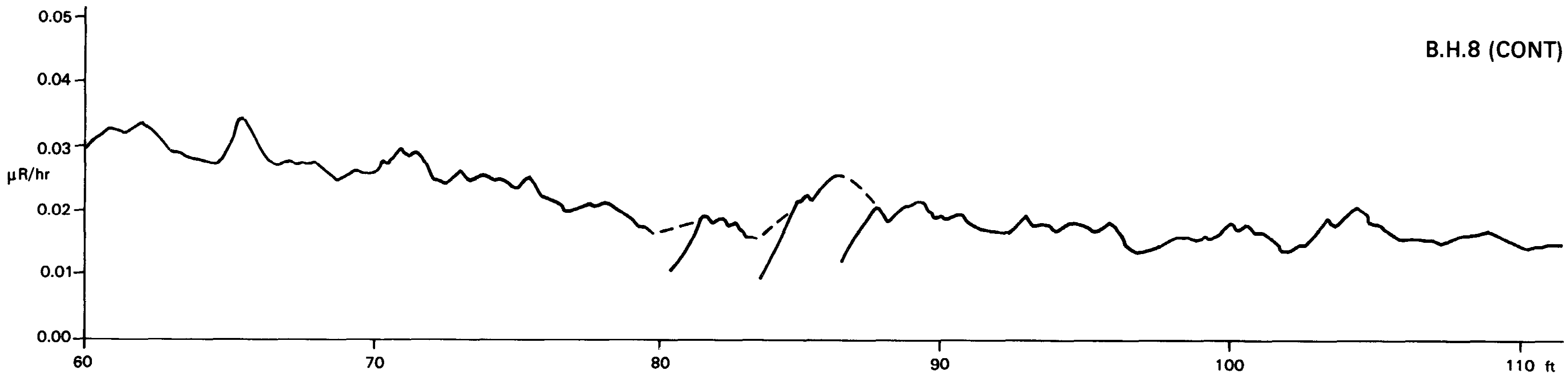
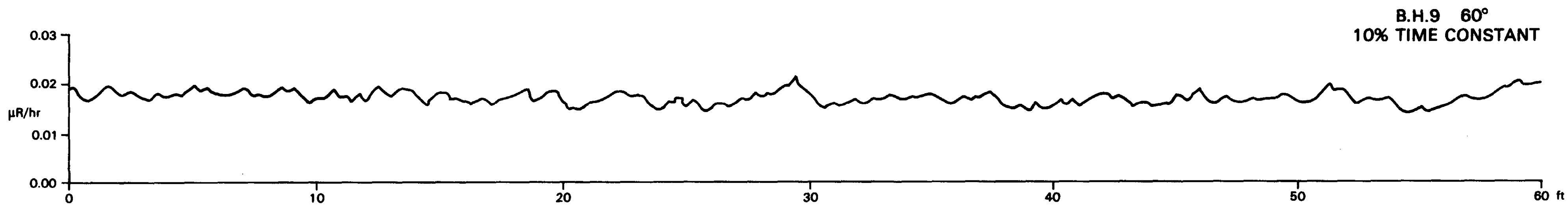
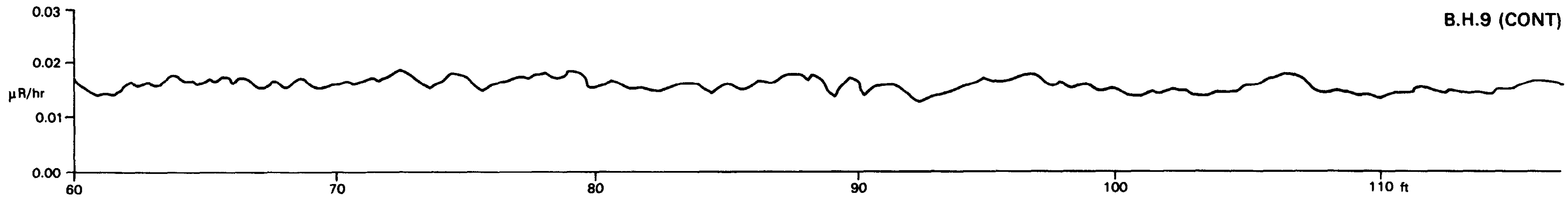




Ratemeter fault, ––––– projected line..

QUOIT RADIOMETRIC LOGS





QUOIT RADIOMETRIC LOGS

B.H.10 60°

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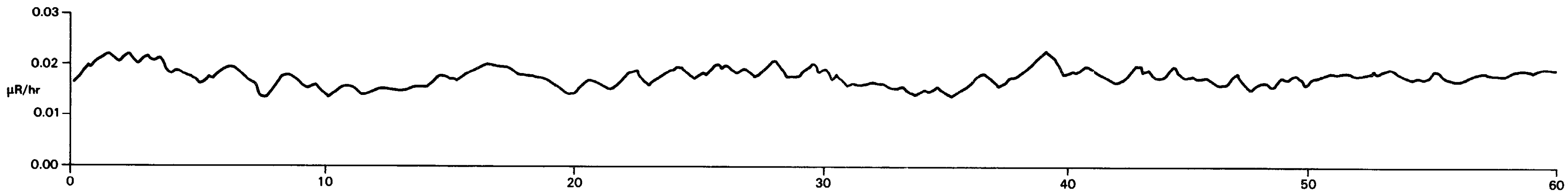

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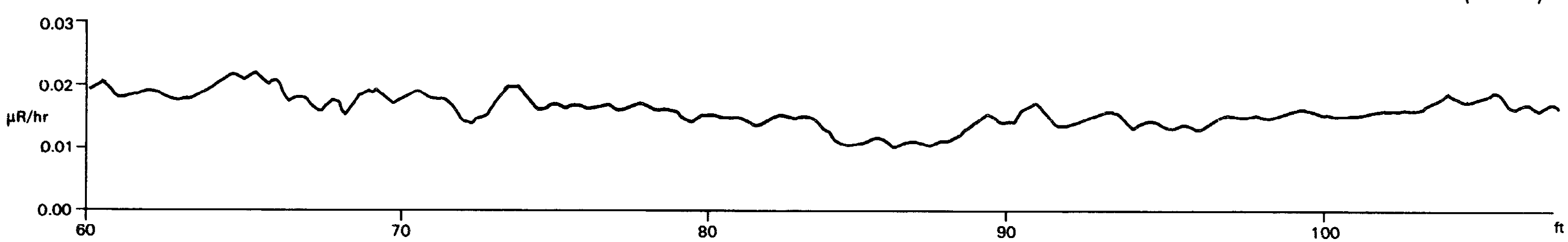

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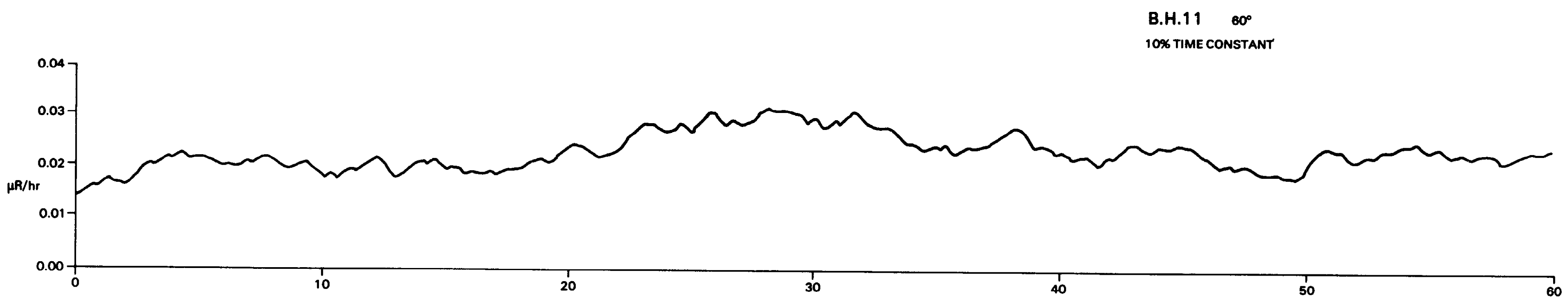
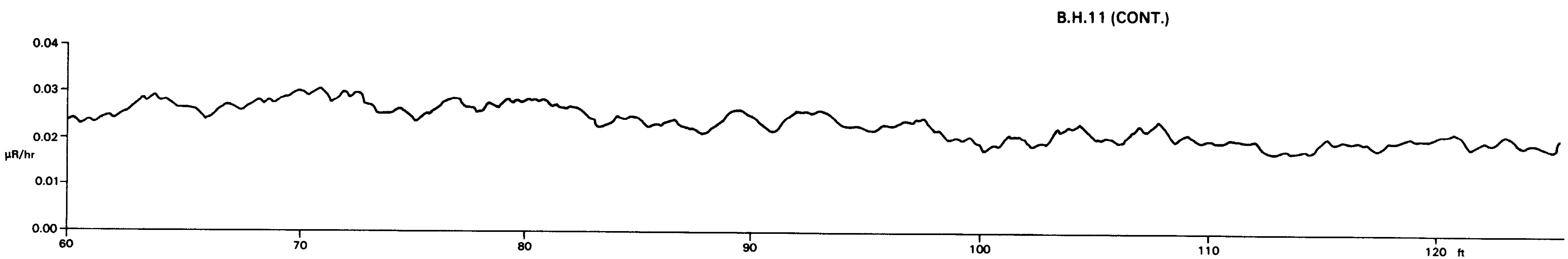
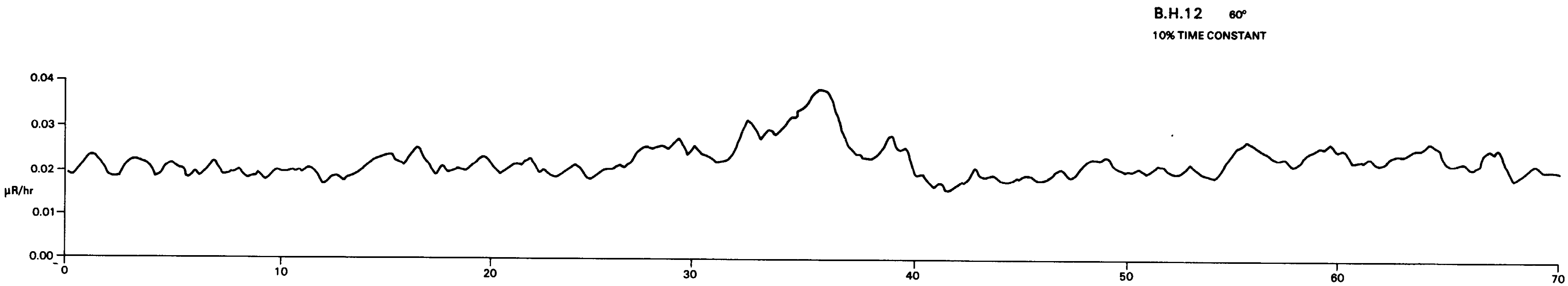
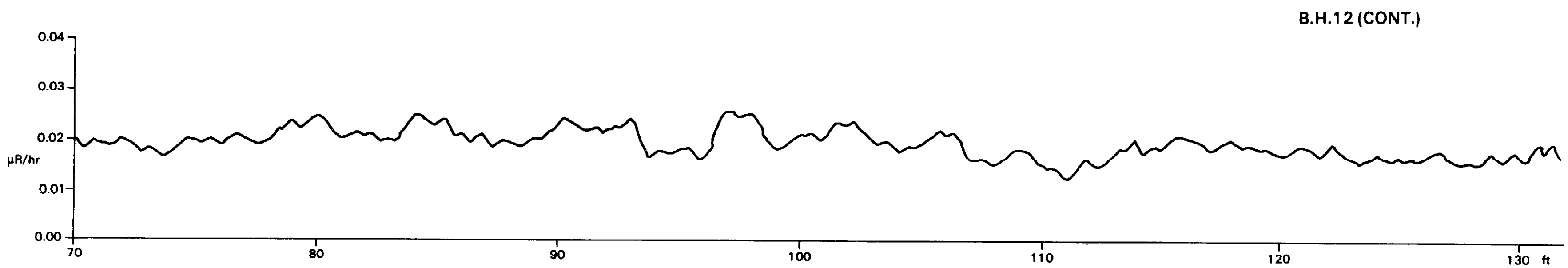




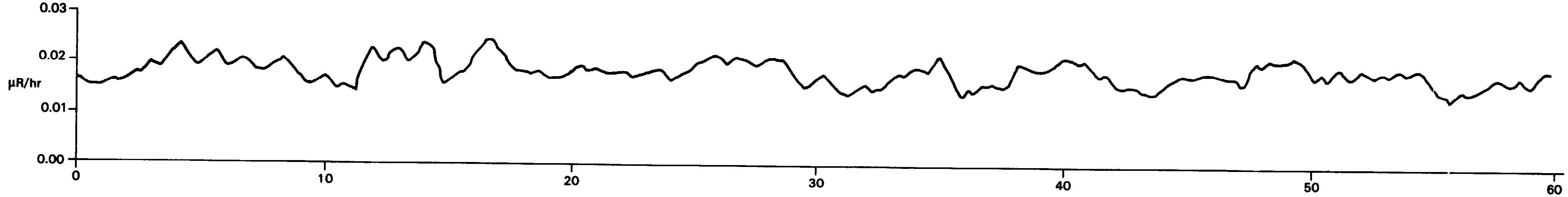
QUOIT RADIOMETRIC LOGS



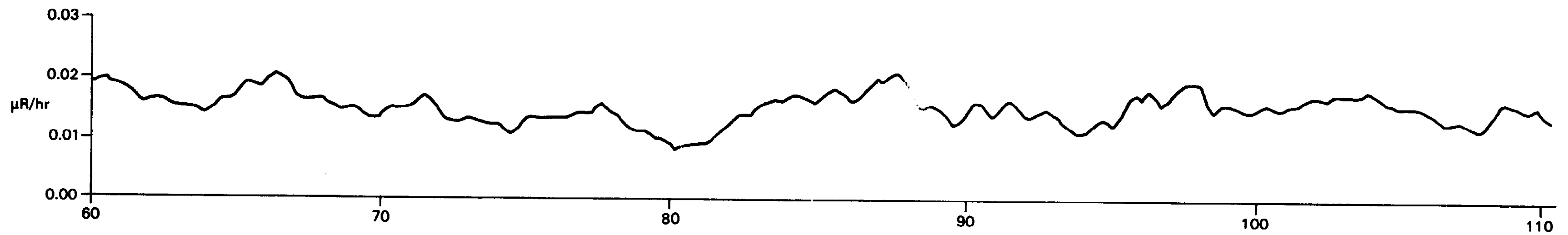


QUOIT RADIOMETRIC LOGS

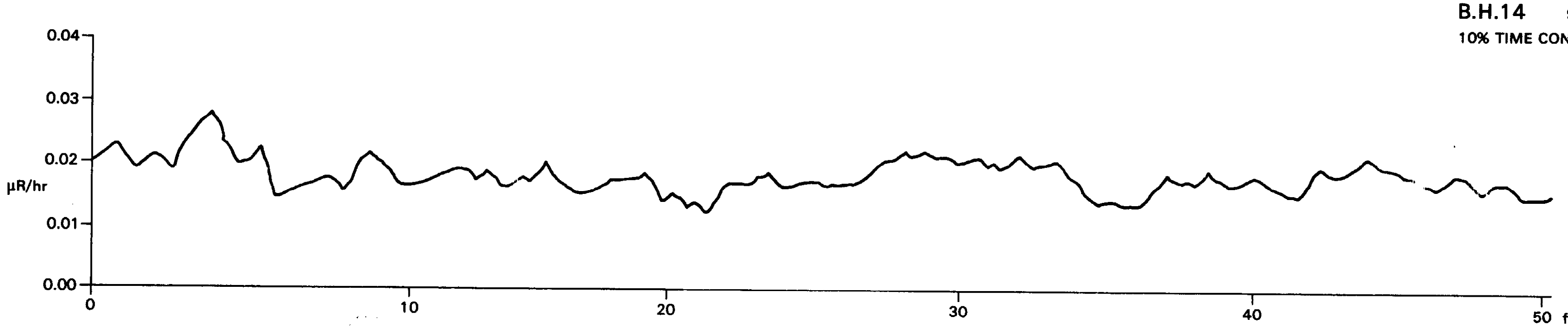
B.H.13 50°
10% TIME CONSTANT

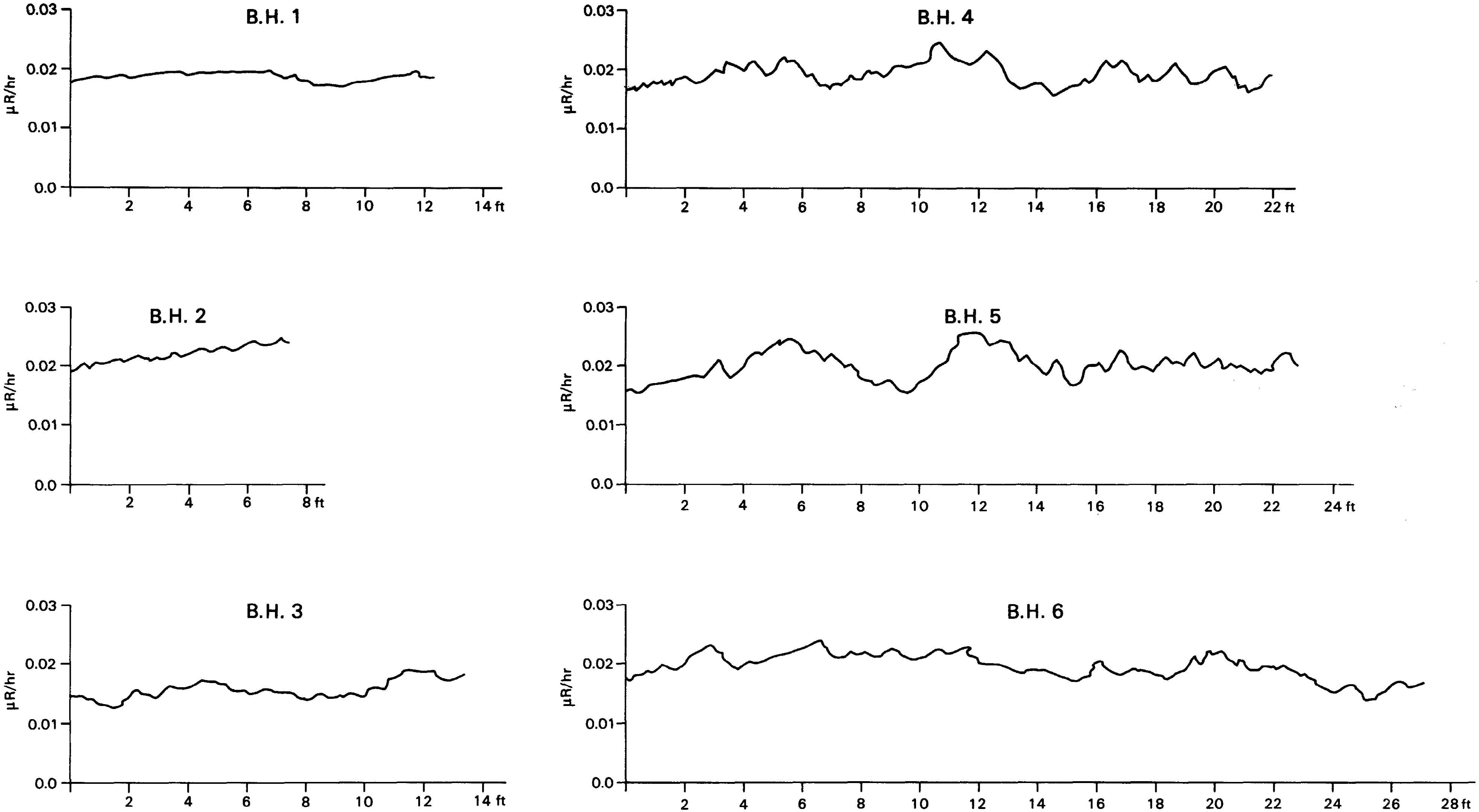


B.H.13 (CONT.)

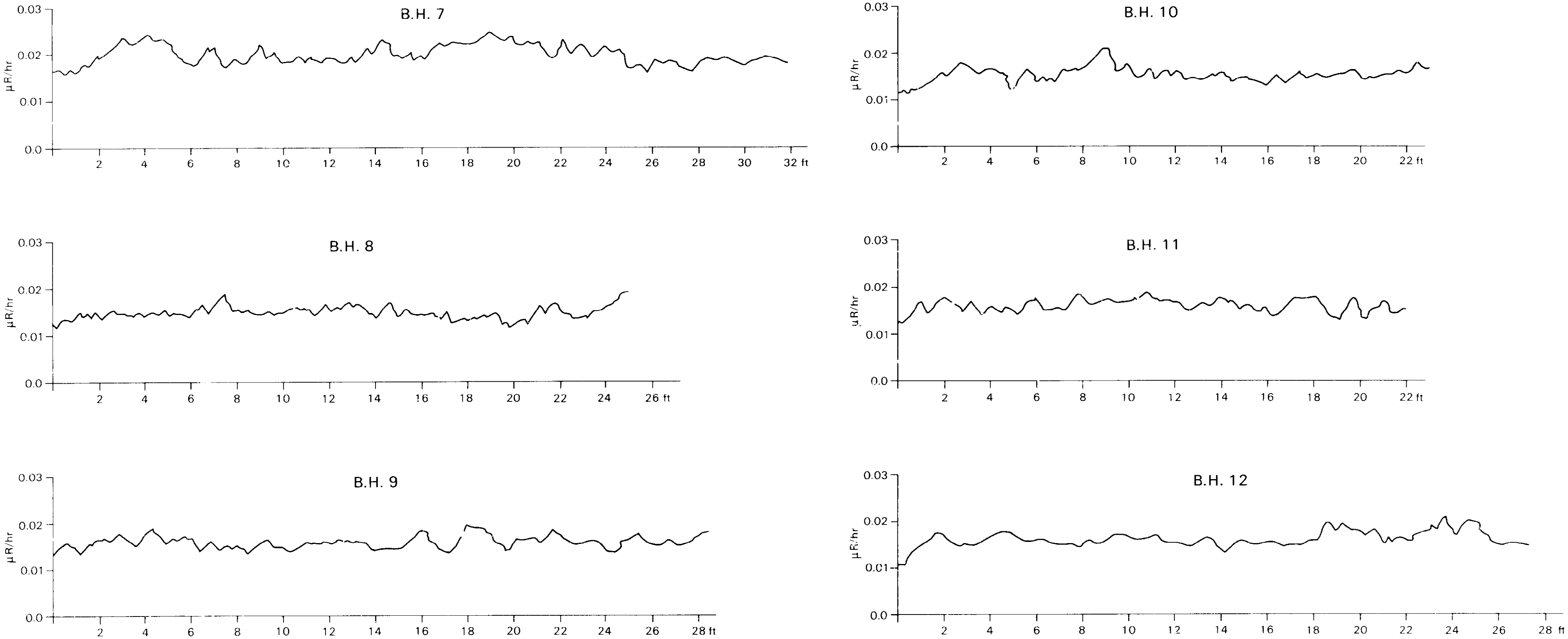


B.H.14 90°
10% TIME CONSTANT





HIGHER TRENOWETH RADIOMETRIC LOGS



HIGHER TRENOWETH RADIOMETRIC LOGS