Stonehenge
Wiltshire

Limited Test Augering

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Stonehenge: Limited Test Augering

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Summary

As a result of the identification of a number of anomalies in the resistivity survey of Stonehenge, and in the recording of parchmarks within the stone settings, a small number of minimally intrusive auger bores was undertaken in order to attempt to answer specific questions. These questions were formulated both in response to these identifications and in order to resolve various outstanding difficulties in the accurate plotting of old excavation trenches and features required under the aims of the Revised Project Design Specification agreed between Wessex Archaeology and English Heritage for the analysis and publication of the 20th century excavations at Stonehenge (Wessex Archaeology 1993). The Augering was able to resolve a number of these questions: identifying the presence of a Neolithic old ground surface under the bank, and clarifying the nature of several of the parchmark features and one of the resistivity anomalies. Some questions, particularly those relating to the cause(s) of some of the resistivity anomalies remain unresolved in that there was no clear reason for the anomalies from the composition of the auger cores. In addition the composition of the counterscarp bank was established and one new, previously unknown, feature outside the excavated areas was identified.

Acknowledgements

The work was commissioned by Brian Davison, English Heritage, Historic Properties South-West. Wessex Archaeology would like to thank the Manager at Stonehenge, Sharan White, and her staff for their cooperation and assistance with this work. The augering and recording was carried out by Michael J. Allen, Julie Gardiner, and Elaine Wakefield and this report prepared by Michael J. Allen and Julie Gardiner.

Stonehenge: Limited Test Augering

1. Introduction

1.1 As a result of the identification of a number of anomalies in the resistivity survey of Stonehenge (Payne 1994), and in the recording of parchmarks within the stone settings (by Wessex Archaeology, 25 July 1994), it was proposed to undertaken a small number of minimally intrusive auger bores in order to attempt to answer specific questions. These questions were formulated both in response to these identifications and in order to resolve various outstanding difficulties in the accurate plotting of old excavation trenches and features required under the aims of the Revised Project Design Specification agreed between Wessex Archaeology and English Heritage for the analysis and publication of the 20th century excavations at Stonehenge (Wessex Archaeology 1993).

1.2 A proposal and project design was prepared by Wessex Archaeology and submitted for consideration by English Heritage, Historic Properties South-West, on 5 August 1994. The work was commissioned on 9 August 1994 and the fieldwork undertaken on Saturday 13 August 1994, between 5.00 and 9.00 am.

2. Methods

2.1 Augering and probing

2.1.1 The positions of the auger holes were determined from the resistivity plot (Fig. 1) and parchmark plans. In the field individual holes were located by triangulation from fixed points (corners of standing stones, centre of Aubrey Hole markers). The transect line was located by laying a baseline between the northerly corners of the Slaughter stone and Stone 1 and offsetting a line at right-angles to it 9 m from the Slaughter stone to approximately the junction between the northern barrow ditch and the main ditch. The transect auger holes were undertaken initially at 4 m intervals starting at 10 m from the baseline in order to record the sequence of sediments across the boundary of the resistivity `shadow' (as defined in the project design: Figs 1 and 2). In addition (see below) a number of probes was undertaken along this line. All auger holes and probes were taken down to solid chalk where possible or until penetration of sediments above the chalk was halted by the presence of stones or other consolidated material.

2.1.2 Augering was undertaken using a 2.5 cm gouge auger with a 1 m chamber. All sediments were recorded following terminology outlined by Hodgson (1976) where possible. All sediment cores were replaced (except where noted). Probing was undertaken using the same equipment, but used to define the chalk base or occurrence of a stone without the removal of a sediment core.

3. Results

3.1 The auger and probe profiles are described below in relation to the specific questions addressed.

3.2 The soils in the Stonehenge area are mapped as humic rendzinas of the Icknield Association, and it is surrounded on its southern, eastern, and western sides by brown rendzinas of the Andover 1 Association (Jarvis *et al.* 1984).

3.3 Auger profiles: individual auger holes

3.3.1 Auger hole 1: *Question: Is the parchmark noted an excavation or a buried stone of the bluestone circle?* This small mark, which also showed as a resistivity anomaly (not visible on Fig. 1), lay between the trilithon comprised of Stones 57 and 58 and Stone 21, approximately on the arc of the bluestone circle. At the time of recording the parchmarks it was not clear whether this lay within Atkinson's cutting 52 (of which only a small part showed as parchmark). Relocation of the parchmark for the auger survey showed that it did.

0 - 4 cm	Dark yellowish brown (10YR 4/4) humic loam; turf.
4 - 10 cm	Brown (10YR 5/3) calcareous silty loam, very few small chalk pieces (rendzina).
10 - 18 cm	Pale brown to light yellowish brown (10YR 6/3 - 6/4) compact silty loam (thought to be a natural/?unexcavated profile on recording) becoming stonier, including flints.
20 - 22 cm	Encountered very large, non-flint, non-chalk, stone.

ANSWER: The auger probably encountered the buried stump of a bluestone. Examination of Atkinson's plans for cutting 52 indicate that he found a bluestone stump (Stone 41d) at `0.5' below datum' (height of datum unknown). The plan suggests that the stone was not in its original position. The auger detected a hard non-flint, non-chalk, stone at *c.* 21 cm below present ground surface. Although offset from the position of Stone 41d on the cutting plan (by about 50 cm), it is quite possible that the stone was moved at the time of backfilling the excavation trench and it seems very likely that this is the stone encountered. It is interesting that the buried stone should show so clearly as a parchmark when the cutting does not, though other cuttings nearby were clearly definable.

3.3.2 Auger hole 2: A distinct parchmark within a rather more amorphous mark. This could not be relocated on 13/08/94 following disappearance of parchmarks.

3.3.3 Auger hole 3: *Question: Does the high resistivity represent a buried stone?* This auger hole was positioned in the approximate centre of a roughly circular area of particularly high resistivity of *c.* 3 m diameter between the X and Y hole circles, 7.5 m from Stone 30 of the trilithon circle. The anomaly lies within the area of Hawley's trenching and there is nothing marked on his plan.

0 - 8 cm	Stone-free humic loam, downland turf.
8 - 18 cm	Brown (10YR 4/3) stone-free silty loam. Typical brown rendzina profile.
18 - 28 cm	Loose, but firm dark greyish brown (10YR 4/2) calcareous silty loam with common medium to large flints and few chalk pieces, burnt and small worked flint including core fragment noted.
at 28 cm	becoming chalkier,
30 cm	Chalk.

ANSWER: The high resistivity does not indicate a buried stone but the result is ambiguous. The anomaly undoubtedly lies within an excavated area and there is no obvious explanation from the auger core as to why high resistivity should be encountered here. The stony horizon maybe locally more flinty than elsewhere but it is not clear whether this could be the cause.

3.3.4 Auger hole 4: *Question: Does the high resistivity represent a buried stone?* As with auger hole 3, this auger hole was positioned in the approximate centre of a roughly circular area of particularly high resistivity of *c.* 2 m diameter between the X and Y hole circles, 7.2 m from Stone 1 of the trilithon circle. The anomaly lies within the area of Hawley's trenching and there is, again, nothing marked on his plan.

0 - 8 cm	Stone-free humic downland turf
8 - 23 cm	Brown (10YR 4/3) silty loam soil with flints, becoming chalkier with depth. A small fragment of sarsen and one of dolerite were recorded.
23 - 28 cm	The chalky matrix looks like weathered chalk natural until near the base.
28 - 32 cm	Stony (chalk), but not excessively so; may not be natural.
32 cm	Chalk.

ANSWER: As for auger hole 3

3.3.5 Auger hole 5: *Question: Does the high resistivity indicate a buried stone?* This auger hole was positioned to investigate a large high resistivity anomaly, approximately 5 m in diameter, situated immediately to the north-west of the southern barrow. The anomaly appears to straddle the edge of Hawley's cutting 10 and 7 and is certainly within an excavated area.

0 - 20 cm	Unconsolidated, loose humic loam calcareous brown rendzina turf.
22 - 25 cm	Very light grey (10YR 6/2) highly calcareous silty loam with small and medium chalk pieces - probably a rabbit hole and the soil is very loose in the vicinity.
25 - 32 cm	Highly silty 'powdery' calcareous chalk soil.
32 cm+	Light grey (10YR 7/2) highly calcareous silty loam with channels of darker, brown (10YR 5/3 - 10YR 4/3) soil indicating earthworm activity.

ANSWER: the high resistivity does not represent a buried stone. The anomalously high resistivity reading could not be accounted for from the limited augering exercise conducted.

3.3.6 Auger hole 6: *Question: Is the low resistivity anomaly a previously unrecorded feature?* This auger hole was positioned 1.5 m from Stone 52 between it and Stone 6 to investigate a large, roughly circular area of unusually low resistivity *c.* 4 m in diameter. Part of this general area was excavated by Atkinson *et al.* in 1954 (Cutting 46) and in 1964 (Cutting 13) but there is no record of any excavations within 2 m of Stone 52. The anomaly seems to straddle the excavated and unexcavated area though it lies mostly within an apparently unexcavated area. It was considered that it may represent a previously unrecorded deep feature such as a pit or stone hole and the auger hole was positioned within the unexcavated area.

0 - 5 cm	Calcareous downland turf; stone-free humic loam.
5 - 13 cm	Pale brown (10YR 6/3) stone-free calcareous silty loam.
13 - 17 cm	Pale brown (10YR 6/3); as above but becoming stonier, non-calcareous but will not adhere to auger chamber.
at 17 cm	Clinker recovered (sample retained).

ANSWER: This may be an unrecorded excavation. Clinker was deposited as backfill in most of Atkinson's excavations some time after the end of his 1964 season, presumably at the same time that gravel was laid elsewhere. There is no record of any archaeological work carried out less than 2 m from Stone 52 and the Ministry of Works plan *Stones re-erected, straightened or moved and replaced since 1900* (undated but post-1964) shows no disturbance to this trilithon. Wessex Archaeology will try to clarify this point with Professor Atkinson.

3.3.7 Auger hole 7: *Question: Is the low resistivity in the counterscarp bank an unrecorded feature?* Auger hole 7 was positioned to investigate a slot-shaped area of low resistivity within the area of the counterscarp bank. Cremation deposits are recorded by Hawley

within the main bank and it was considered that this might be an unrecorded excavation of his to look for similar deposits in the counterscarp.

0 - 25 cm	Humic loam grassland turf over brown/dark brown (10YR 4/3) silty loam with rare small chalk pieces.
25 - 30 cm	Compacted chalky deposit with common small and medium chalk pieces - the counterscarp bank.
at 33 cm	as above but few flints
at 38 cm	Large to medium chalk lumps, possible chalk natural. Unable to penetrate further with gouge auger.

ANSWER: question unresolved but composition of counterscarp bank determined. There was no indication of an archaeological feature here. However, the anomaly as it appears on the resistivity plot is long and narrow with its long axis aligned at approximately 90° to the bank. There is a lack of permanent reference points in this part of the monument and the position of the auger hole was triangulated from the Station Stone (93) and the concrete disk marking the position of Aubrey Hole 32, both of which are over 25 m from the anomaly. With the upstanding bank and ditch intervening, accurate surveying in relation to the anomaly cannot be guaranteed and it is possible that the auger hole missed it entirely (though probably not more than 50 cm in any direction).

3.3.8 Auger hole 8: *Question: Does the parchmark indicate laid gravel beneath the turf or former excavations?* This auger hole, close to the centre of the monument, was positioned over a ragged but clear parchmark which, it was considered, might represent the excavation known to have been undertaken by George Villiers, Duke of Buckingham, in the early 1620s, the position of which has never been properly established. This excavation is known to have been an irregular pit `about the size of two sawpits'. However, clear parchmarks in other areas of the monument clearly represent spreads of gravel laid down before or during 1964 (they are marked on the Ministry of Works plan *Stones re-erected, straightened or moved and replaced since 1900*) and it was therefore considered desirable to determine whether this parchmark might also represent laid gravel.

0 - 6 cm	Downland grass turf; stone-free humic loam.
6 - 18 cm	Pale brown (10YR 6/3) silty loam with few very small subrounded chalk pieces. Calcareous rendzina.
18 - 24 cm	Becoming darker, yellowish brown (10YR 5/3) silty loam with common small chalk pieces, very dry and compact, probably a disturbed profile.
24 cm+	Stone encountered (not large) but prevented further augering.

ANSWER: No gravel present, probably backfill but not one of Atkinson's trenches (which showed as parchmarks). This may represent the excavation backfill of the Duke of Buckingham's excavation.

3.3.9 Auger hole 14: Not undertaken: considered unnecessary as the buried soil was sampled in auger hole 15.

3.3.10 Auger hole 15: *Question: Is there an identifiable buried land surface beneath the bank? and what implications does this have for the preservation of archaeological contexts within unexcavated areas?* This hole was positioned in the approximate centre of the remaining bank in the north-west quadrant of the monument in an area not known to have been disturbed.

0 - 9 cm	Stone-free humic loam, calcareous downland turf.
9 - 21 cm	Chalky rubble comprised medium (and larger) chalk pieces within a calcareous silty loam matrix. Bank material.
21 - 28 cm	Stone-free pale brown (10YR 6/3) fine calcareous silty loam. Relict buried old ground surface (Ah).
28 - 31 cm	Brown (10YR 5/3) silty (clay) loam, rare very small chalk pieces, sharp boundary. Buried old ground surface (A)
31 cm	Chalk lumps.
at 36 cm	Chalk and compacted chalk rubble, probably weathered natural regolith.

The Neolithic buried soil was sampled from the gouge auger (Photo 1). Contiguous samples were taken from the core at:

- 20 - 23 cm
- 23 - 25 cm
- 25 - 28 cm
- 28 - 31 cm

ANSWER: The relict buried soil exists under the bank but further analytical work may be required to determine the preservation/truncation or reworking of this context. The auger hole certainly revealed a stone-free layer with the appearance of a buried soil, which here would be of Middle-Late Neolithic date. This is a significant finding as excavations by Atkinson and Evans did not record a buried old land surface. Samples removed are too small for mollusc analysis (due to the narrow diameter gouge auger employed - Photo 1), but may be suitable for pollen extraction and analysis.

3.4 *The Auger Transect*

3.4.1 Auger holes 9-18, probes 19-24: *Question: what does the large triangular area of low resistivity 'shadow' which seems to enclose the stone settings represent?* The location of the auger transect is described in Section 2.1 above. Holes 9-11 should have lain beyond the resistivity shadow the apparent edge of which crossed the transect line at approximately 16 m from the baseline, with holes 12 and 13 lying within. The edge of Hawley's excavations crossed the transect line at approximately 10.5 m from the baseline, so that hole 13 should have lain within the excavated area. Further auger holes and probes were undertaken to clarify the results of the holes 9-13 and to determine the lateral extent of the feature indicated by auger hole 11 along the line of the transect.

Auger hole 9: 22.5 m along transect

0 - 8 cm	Turf; dark brown (10YR 4/3 - 3/3) humic loam.
8 - 16 cm	Less humic, brown (10YR 3/3) almost stone-free silty loam; rendzina profile.
16 cm	Chalk.

Auger hole 10: 22 m along transect

0 - 8 cm	Turf; dark brown (10YR 4/3 - 3/3) humic loam.
8 - 13 cm	Less humic, brown (10YR 3/3) almost stone-free silty loam.
13 cm	Chalk

Auger hole 11: 18 m along transect

0 - 8 cm	Turf; dark brown (10YR 4/3 - 3/3) humic loam.
8 - 28 cm	Pale brown (10YR 6/3) almost stone-free (rare very small and small chalk pieces, rare small flints) highly calcareous silt loam.
28 - 39 cm	Pale brown (10YR 6/3) silty loam, apedal with many to common small and medium chalk pieces, occassional flints.
39 cm	Chalk.

Auger hole 12: 14 m along transect

0 - 8 cm	Turf, dark brown (10YR 4/3 - 3/3) humic loam
8 - 19 cm	Brown to pale brown (10YR 5/3 - 6/3) stone-free humic silt loam.
19 cm	Chalk

Auger hole 13: 10 m along transect

0 - 8 cm	Turf, dark brown (10YR 4/3 - 3/3) humic loam with good small crumb structure.
8 - 16 cm	Brown to pale brown (10YR 5/3 -6/3) stone-free humic silt loam.
16 cm	Chalk - compacted and nodules; could be dumped or natural.

Auger hole 16: 23.5 m along transect

0 - 8 cm	Turf; dark brown (10YR 4/3 - 3/3) humic soil.
8 - 18 cm	Less humic, brown (10YR 3/3) almost stone-free silty loam; rendzina profile.
18 cm	Chalk.

Auger hole 17: 6 m along transect

0 - 8 cm	Turf; dark brown (10YR 4/3 - 3/3) humic loam.
8 - 16 cm	Less humic, brown (10YR 3/3) almost stone-free silty loam.
16 - 25 cm	Very chalky soil with many chalk pieces, becoming stonier.
27 cm	Chalk

Auger hole 18: 18.5 m along transect

0 - 8 cm	Turf; dark brown (10YR 4/3 - 3/3) humic loam.
8 - 28 cm	Pale brown (10YR 6/3) almost stone-free (rare very small and small chalk pieces, rare small flints) highly calcareous silt loam.
28 - 37cm	Pale brown (10YR 6/3) silty loam, apedal with many to common small and medium chalk pieces, occasional flints.
38 cm	Chalk.

Probe 19:	19 m along transect
18 cm	Chalk

Probe 20:	18.75 m along transect
18 cm	Chalk

Probe 21:	18.6 m along transect
20 cm	Chalk

Probe 22:	17 m along transect
25 cm	Chalk

Probe 23:	16.8 m along transect
19 cm	Chalk

Probe 24:	0 m along transect (Photo 2)
15 cm	Chalk

ANSWER: the auger and probe transect profile could not distinguish between the area within the resistivity shadow and that outside, nor between either of these areas and the excavated trench, other than that the backfill within the excavated area was less compact

than that outside it. The transect did however locate, and record, a previously unrecorded feature 1.5 m across on the transect line between 17 m and 18.5 m.

4. Discussion

4.1 The simple auger survey was able to resolve some, but not all of the questions posed by the project design. The location and confirmation of previous unrecorded excavations suggested by parchmarks recorded by Wessex Archaeology on July 25 1994 were possibly confirmed in the centre of the monument (possible excavations by the Duke of Buckingham in the early 17th century), and apparently unrecorded 20th century excavations adjacent to Stone 52 which were backfilled with clinker.

4.2 One small and very definite parchmark probably marks the position of buried Stone 41d within Atkinson's cutting 52. Although the auger was only 2.5 cm diameter it was possible to determine that the stone was not chalk or flint and that it was massive. The fact that the stone showed clearly but the larger trench did not is of interest in terms of the formation of parchmarks.

4.3 Augering of the bank to determine the presence and preservation of a buried land surface, not recorded in previous excavations, was successful. Contiguous samples were removed from the gouge core. This is a most important finding. In considering future research at the Monument it is recommended that thought be given to the obtaining of a molluscan sequence from the old land surface by means of keyhole excavation.

4.4 The augering was least successful in attempting to isolate and determine the cause for other resistivity anomalies. An area to the north of the southern barrow was heavily rabbit disturbed but no other evidence for high resistivity could be found (auger hole 5) and, similarly, an area of low resistivity in the counterscarp bank could not be resolved (auger hole 7). However, augering did enable the confirmation and recording of the composition of this latter feature. Two further areas of high resistivity between the X and Y hole circles, in areas previously excavated, could not be accounted for. Perhaps most disappointing was that the transect of eight auger holes and six probes across the large area of the resistivity shadow in the north-east sector of the monument failed to distinguish any differences in the soil profiles which could account for this bizarre phenomenon. The suggestion made by Payne in the geophysical report that this area is a result of long term trampling seems plausible, there being no other physical explanation. The augering of this transect, however, was not entirely without its rewards. An unrecorded feature of at least 1.5 m diameter and 0.39 m depth was found, though its nature and extent could not be further determined within the scope of the work. The results of this work will be passed back to the Ancient Monuments Laboratory for their consideration.

4.5 The information recovered by this minimally intrusive sampling exercise has helped resolve some problems and add to the record of past excavations and archaeological features and the existence and preservation of specific contexts within the monument. It has also identified at least one research question for consideration at a later date, namely the ground cover situation at the time of constuction of the bank and ditch, information potentially obtainable via a molluscan sequence through the old land surface. The work also poses further questions concerning the causes of high resistivity anomalies but, in one example at least, confirms the presence of backfilled material in a low resistivity area where no excavations are recorded.

5. The Archive

5.1 All auger holes and probes will be assigned Wessex Archaeology context numbers withi the sequence used for the main Stonehenge archive currently under compilation by Wessex Archaeology. A full auger log record, copies of the site notebook and black and white and colour photographs will be incorporated into the main Stonehenge archive for deposition with the Salisbury and South Wiltshire Museum.

6. References

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Wessex Archaeology 1993, The Twentieth Century Excavations at Stonehenge: Proposals for the Completion of an Accessible Research Archive and the Reporting of the Previously Unpublished Results

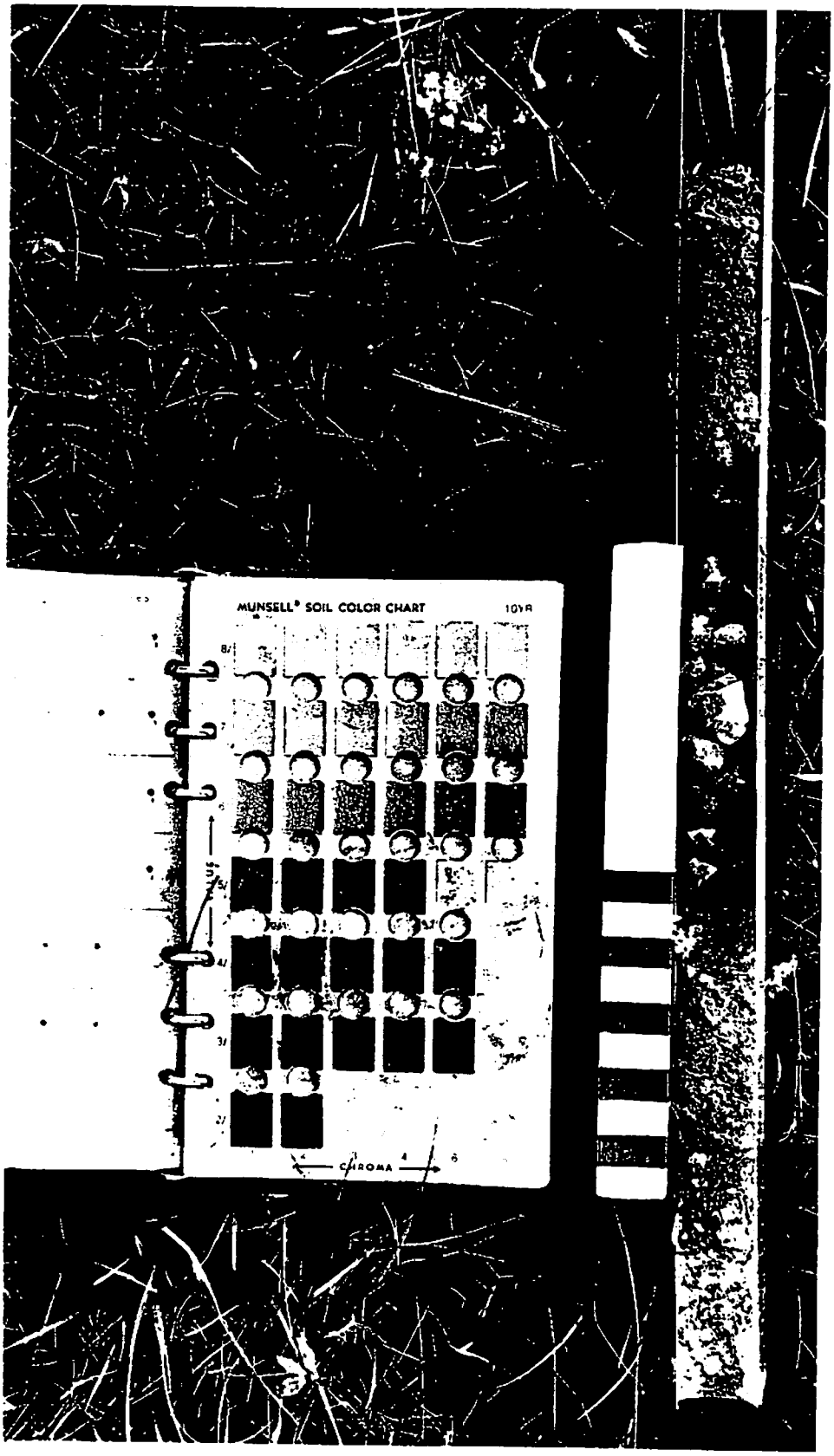


Photo 1. Auger hole 15: auger proile showing the modern turf, bank, and Neolithic buried soil beneath the bank.

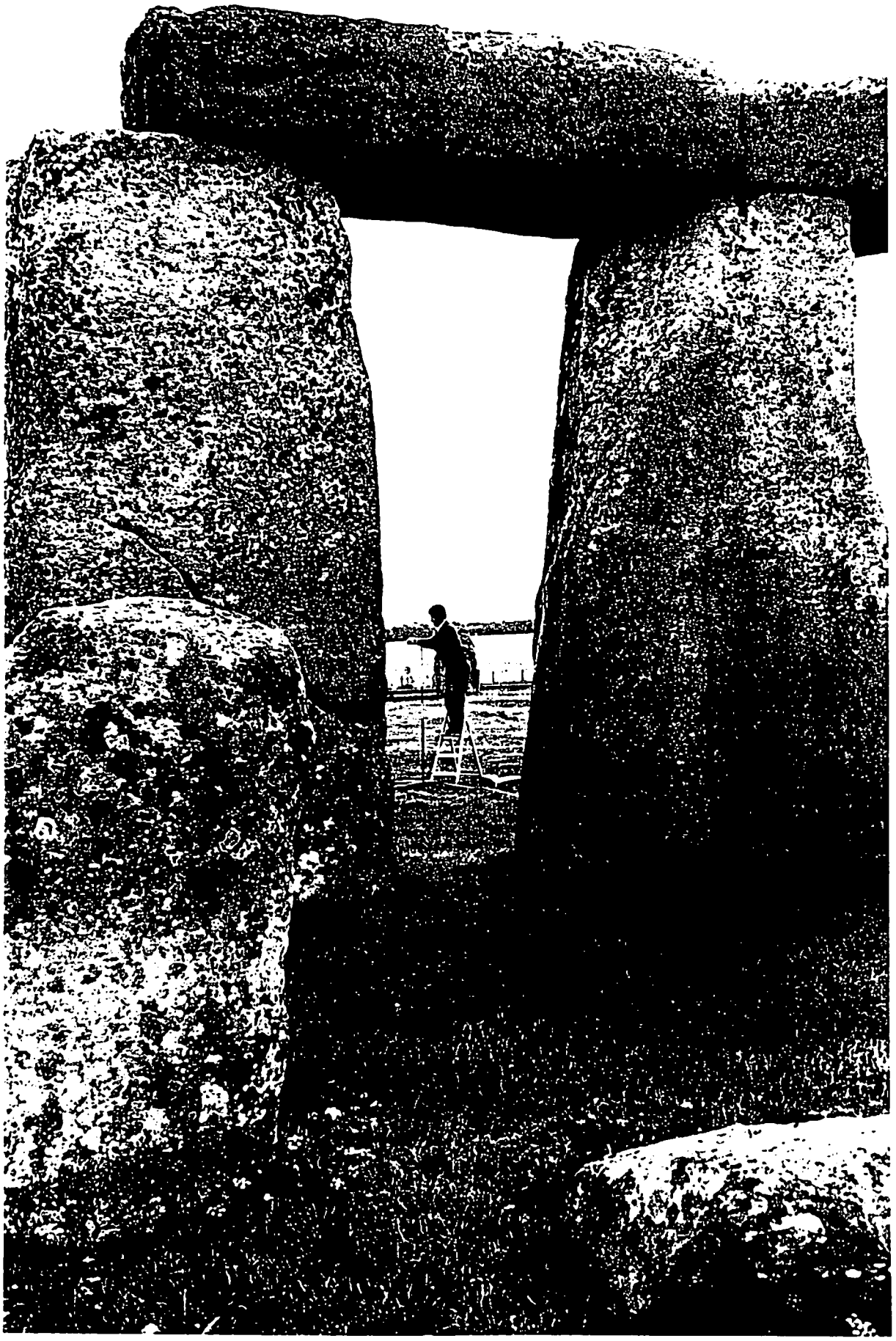
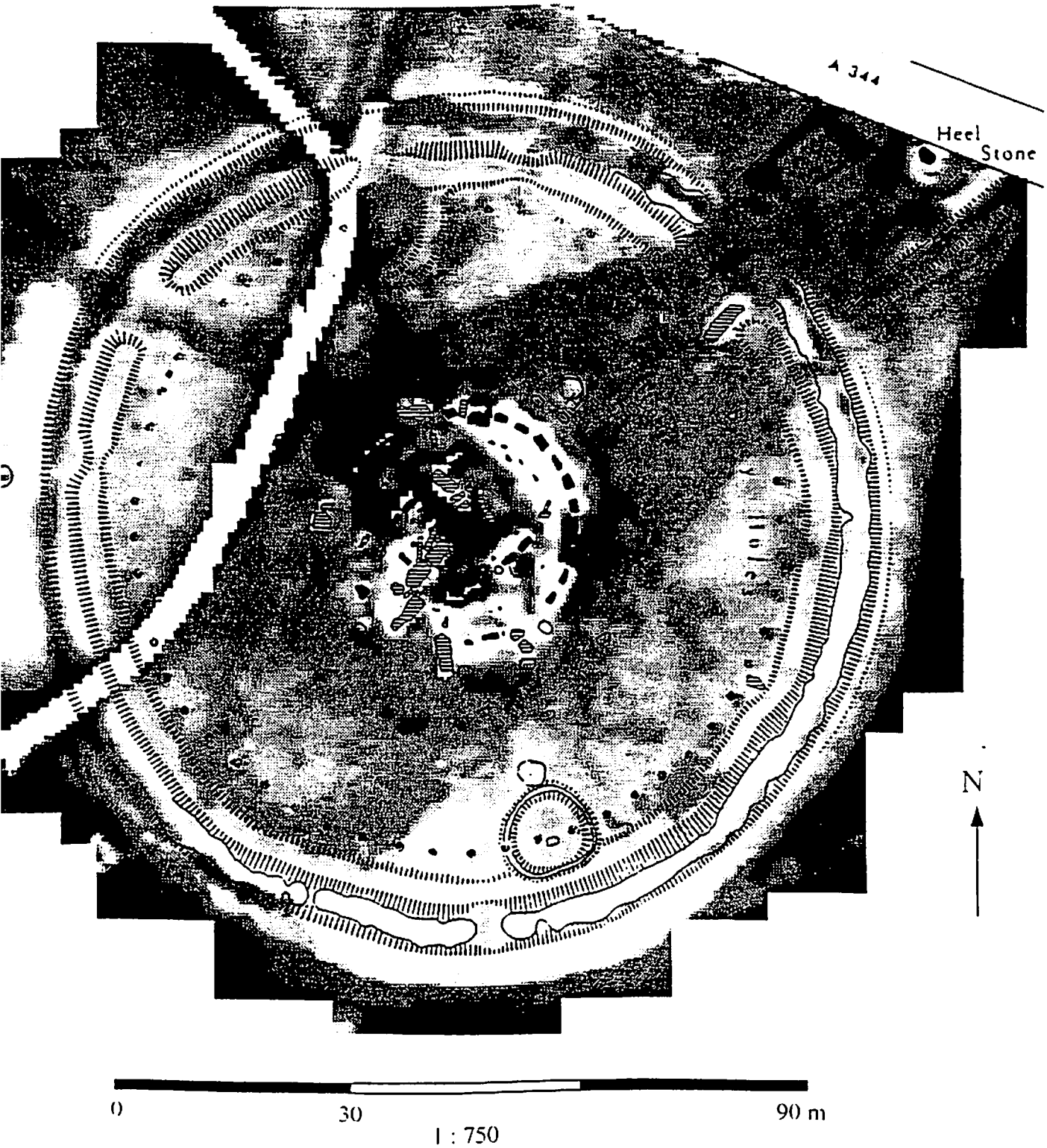


Photo 2. Augering in process at Stonehenge on 13 August 1994 using a 2.5 cm gouge auger with a 1 m long chamber.

Figure 1

STONEHENGE Resistivity Survey



Resistivity survey in relation to general plan of Stonehenge (RCHME 1979)

KEY :
- Pit
- Standing stone
- Fallen stone
- Stone hole

AMLab 94

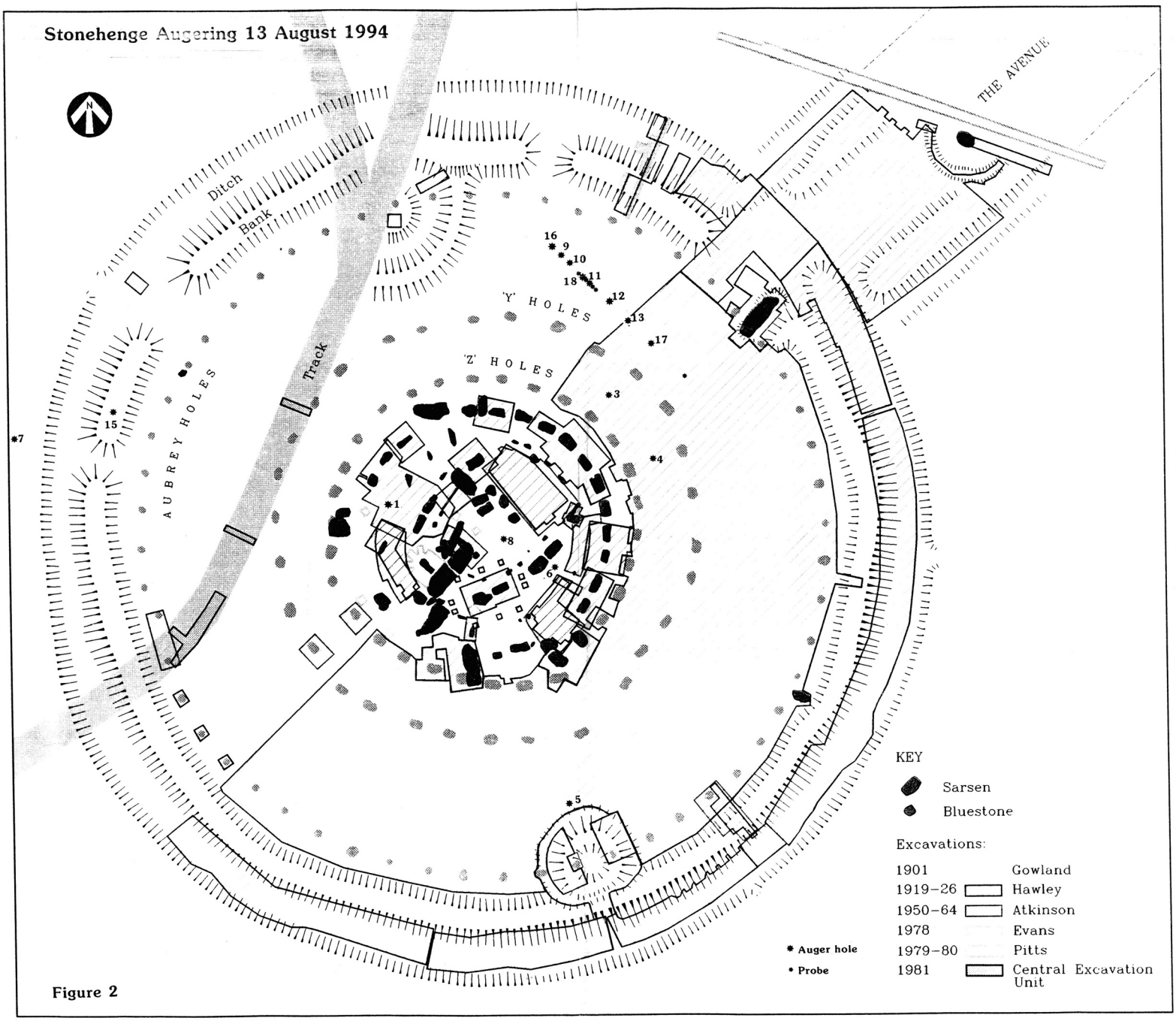

Stonehenge Augering 13 August 1994
THE AVENUE
Ditch
Bank
Track
AUBREY HOLES
'Y' HOLES
'Z' HOLES
1
2
3
4
5
6
7
8
9
10
11
12
13
15
16
17
18
KEY
Sarsen
Bluestone
Excavations:
1901 Gowland
1919–26 Hawley
1950–64 Atkinson
1978 Evans
1979–80 Pitts
1981 Central Excavation Unit
* Auger hole
• Probe

Figure 2

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