

# AUSTRALIAN MUSEUM SCIENTIFIC PUBLICATIONS

Walker, P. H., 1964. Soil and landscape history in the vicinity of archaeological sites at Glen Davis, New South Wales. *Records of the Australian Museum* 26(7): 247–264, plates 25–27. [12 June 1964].

doi:10.3853/j.0067-1975.26.1964.675

ISSN 0067-1975

Published by the Australian Museum, Sydney

nature culture **discover**

Australian Museum science is freely accessible online at  
[www.australianmuseum.net.au/publications/](http://www.australianmuseum.net.au/publications/)  
6 College Street, Sydney NSW 2010, Australia



SOIL AND LANDSCAPE HISTORY IN  
THE VICINITY OF ARCHAEOLOGICAL  
SITES AT GLEN DAVIS,  
NEW SOUTH WALES

*by*

**P. H. WALKER**

**RECORDS OF  
THE AUSTRALIAN MUSEUM**

**Vol. 26, No. 7. Pages 247-264.**

**Plates 25-27. Figures 1-10.**

**SYDNEY**

**12th June, 1964**

**Price, 6s.**

*Printed by Order of the Trustees*

Registered at the General Post Office, Sydney, for transmission by post as a periodical

# Soil and Landscape History in the Vicinity of Archaeological Sites at Glen Davis, New South Wales

By P. H. WALKER

Division of Soils, C.S.I.R.O., Canberra, Australia

Plates 25-27 Figs. 1-10

Manuscript received 22-1-63

## I LOCATION

### (i) Physiography

The archaeological sites are located on the lower slopes of the Capertee River Valley, approximately four miles downstream and to the east of the township of Glen Davis (see figure 1). The Capertee River flows east through a narrow gorge at Glen Davis which is bounded by precipitous scarps of Triassic, Hawkesbury and Narrabeen sandstones over 1,000 feet high (see Plate 25), while at the base the Lithgow coal measures of Permian age are occasionally exposed (see Dept. Nat. Devel. 1957).

The location in which the archaeological sites occur is separated from the main scarp by a minor scarp below which a talus slope, pediment, steep slope and lower slope occur (figure 2). The sites are in rock shelters on the lower slopes and are formed from erratic sandstone boulders which vary from 40 to 150 feet in diameter. The shelters, which are shown in relation to the river in figure 3, are shallow caverns near ground level and the richest finds of implements and other occupational materials are within the cavern or directly at the mouth.

Of the three cave sites which were excavated, only caves 1 and 3 contained deep cave floor deposits; site 2 was very shallow and is not considered in this discussion.

### (ii) Unconsolidated deposits and country rock

The Capertee valley is characterized by several hundred feet of very coarse, bouldery sandstone talus which occurs at the base of the main scarp. It is very intensively weathered, as evidenced by its clayiness and deep, reticulate white and red mottles. The present course of the river is incised into the talus deposits with narrow river terraces above the river bed. The remaining talus deposits above the present level of influence of the main river have been modified by superficial mantle movement and by slight incision of ephemeral streams.

The superficial hillside deposits which cover most of the thick talus vary from shallow sandy sediments with abundant rock fragments randomly scattered through the deposit to sandy, less stony sediments 6 to 8 feet deep on milder slopes about the cave sites. Evidence of past movement of these materials can be seen in the superficial debris piled on the upslope side of sandstone boulders (see figure 4). Under the present environment, however, these deposits are stable and there is little evidence of present day erosion and deposition on hillsides.

The river deposits occur as terraces up to 30 feet above the river bed (figure 3) and are typically of stratified sands with thin bands of interbedded organic debris. The terraces are confined within the river channel so that a steep embankment of talus occurs 6 to 10 feet above the level of the river deposits. The deposits of the ephemeral stream shown adjacent to the caves in figure 3, are thin, stratified and sporadic and entirely confined within the stream channel.

The country rock is a massive Triassic sandstone of highly quartzose mineral composition, and coarse sandy and gravelly mechanical properties (see Dept. Mat. Devel. 1957). It is characterized by strong current bedding such as can be seen in Plate 26.

### **(iii) Cave floor deposits**

The cave floor deposits are loose, unstratified, sandy materials containing fewer rock fragments than surrounding hillside deposits. The nature of deposits in caves 1 and 3 is shown diagrammatically in figures 5 and 6.

The section across cave 1 reveals a loose, sandy deposit which is almost entirely free of rock fragments within the shelter of the cave. The face of the pit was lightly trowelled to expose rock fragments and these are plotted in figure 5. Where the rock fragments made up a large proportion of the deposit the diagram is not a plot of the actual position and amount of fragments. The boundary between the sheltered sediments and the stony deposits outside the cave is abrupt and vertical and coincides with the outer edge of the overhanging cave roof. The rock floor of the cave is very irregular and consists of large angular boulders. There seems little doubt that the body of sandy sediments which is virtually free of rock fragments represents the "cave deposit" as distinct from the general stony hillside deposits and bouldery talus. The occasional sandstone fragments, 4 to 12 inches in diameter, which occur randomly in the cave deposits, are most likely the result of flaking of the cave wall, a current process of weathering of the sandstone.

The sections in cave 3 show a similar arrangement of fragment-free sediment, i.e., cave deposit, within the shelter of the cave (see figure 6) and in each case the rocky cave floor rises towards the ground surface at the front of the cave. The stony deposit, similar to that in cave 1, is evident in the mid- and west-sections but its position in relation to the overhanging rock features of cave 3 is not clear.

### **(iv) Particle size properties of the sediments**

Samples of the deposits were taken from sites shown in figure 3. The sedimentary properties within the particle size range of 0.002-50 mm. are shown in figure 7 as cumulative or summation graphs. These are representative data taken from a greater number of samples, the results of which are discussed in a separate paper.

It is evident from the summation curves that the modal particle size of the Triassic sandstone rock is comparable with the modes of the local unconsolidated sediments in the range 250-800 microns, so that there is no reason to suggest a source of sediment in this locality other than the sandstone rock itself. The modal particle size of the unconsolidated sediments is of a range which is readily transported by wash or wind saltation (Bagnold, 1941) and not of the modal particle size of loess (Zeuner,

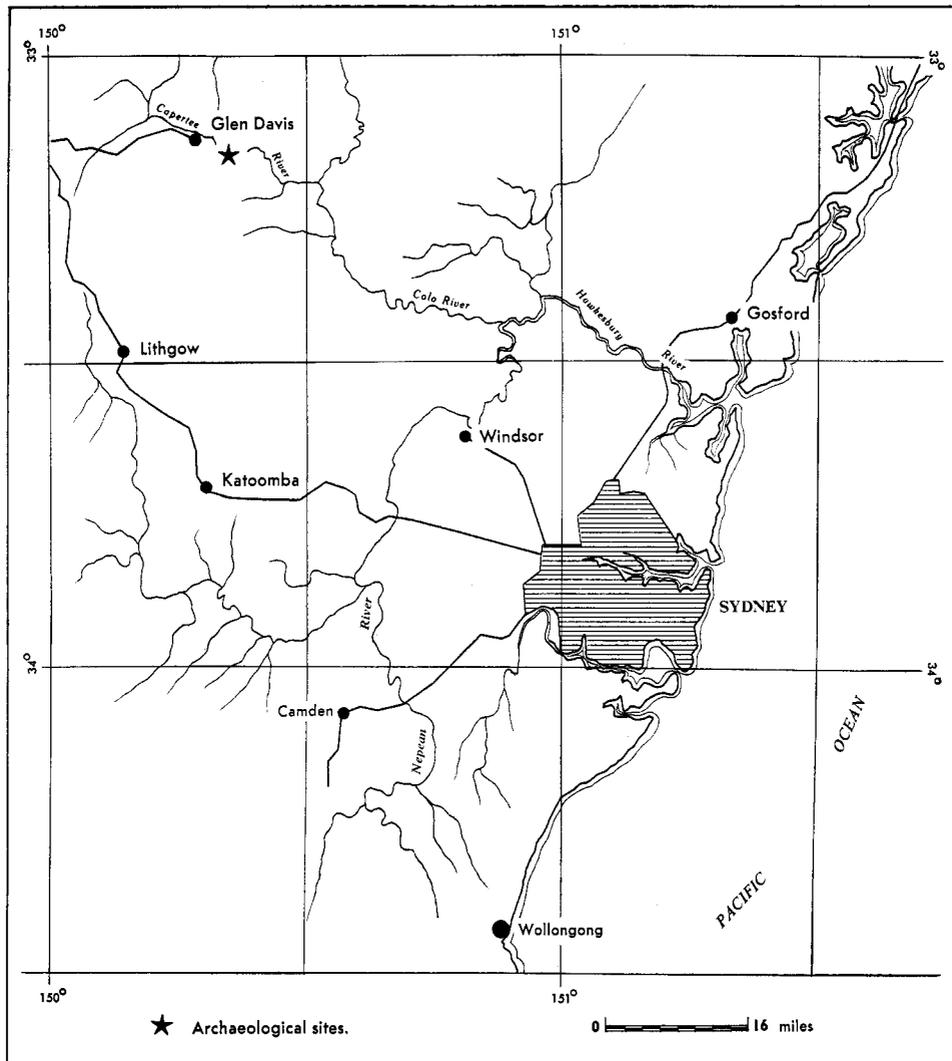


Fig. 1

1945) or parna (Butler and Hutton, 1956). The central slopes of the summation curves show that river and stream deposits are more strongly sorted than other unconsolidated sediments and that cave and hillside deposits have similar, less strongly sorted sediments. It is probable that the cave deposits are derived from adjacent hillside sediment by localized wash and/or wind action.

Both from the analyses and the more general properties observed in the excavations, the cave deposits appear to be unique deposits in this locality; they are the results of deposition of coarse sandy material in a sheltered environment. The cave sediments occur as islands of relatively stone-free material which have neither the stoniness of surrounding hillside deposits nor the sedimentary stratification and strong particle sorting of river sediments.

## II THE SOILS\*

\*Soil descriptions follow the system of Butler (1955) and the colours are expressed in the Munsell notation, using moist soil.

The soils throughout this locality are very weakly differentiated into surface (A) and subsoil (B) horizons; textures are seldom outside the sand range throughout the profile, and the presence of a pale A<sub>2</sub> horizon and thin bands of clay at depth suggests weak leaching. Field pH determinations ranged from 5.5 to 7.0 with profiles having fairly uniform pH values throughout.

The soil descriptions below are generalized from numerous profile observations, almost all of which are located within the area shown in figure 3. In a later section, a discussion of the soil stratigraphy on hillside and talus slopes is based on the soil layers which are described in this section. Each layer is assigned a letter P, Q, R, S or T and these are shown against the appropriate descriptions below.

### (i) Soil of weathered talus

The surface is a dark (10YR2/1), stony, loose and powdery loamy sand which passes gradually to a reddish (5YR4/4 to 5/6) brittle and powdery sandy loam by 12 inches with frequent sandstone boulders (soil layer T); by 36 inches the profile is bouldery with a more or less continuous matrix of pale (2.5Y7/4) coloured sand which is partially cemented to red (10R3/6) and yellow (10YR6/6) mottled nodules 4 inches in diameter; this zone continues to at least 5 feet. In deep river cuttings, a red (2.5YR4/8) and white (10YR8/1) reticulately mottled, bouldery, plastic clay forms a thick basal weathered zone within the talus deposit, well below the red soil described above.

### (ii) Soils of hillside deposits

These are sandy soils with sandstone rock fragments more or less scattered throughout, but increasing with depth. The surface is 1 to 2 inches of black (10YR2/1) loose and powdery loamy sand, seldom with sandstone fragments (soil layer P); it passes through 12 inches of brown (10YR4/3) loose sand with a few sandstone fragments (soil layer Q) to a pale brown (10YR7/4) subsoil of very weakly cemented sand with increasing sandstone fragments (soil layer Q). Frequently large sandstone boulders up to 2 feet in diameter are encountered within 2 feet of the surface, but where the superficial hillside mantle is deeper, thin bands of red (2.5YR4/6) clay appear in the deep subsoil (soil layer R) and become half an inch thick at 60 inches depth (soil layer S).

### (iii) Soils of river and ephemeral stream deposits

These are sandy materials showing distinctive depositional bedding or stratification which has not been modified by soil forming processes. The profile consists of alternating bands of dark brown (10YR4/2) and pale brown (10YR6/3) loose sand and black (10YR2/1) plant debris.

### (iv) Soils in the floor of cave 1

These soils are shown diagrammatically in figure 8 without reference to the rock fragments which were discussed earlier. The surface is a dark grey (10YR3/1) loose sand, enriched with charcoal fragments both inside and outside the cave (soil layer P). Outside the shelter of the cave, i.e., on the left side of figure 8, the surface

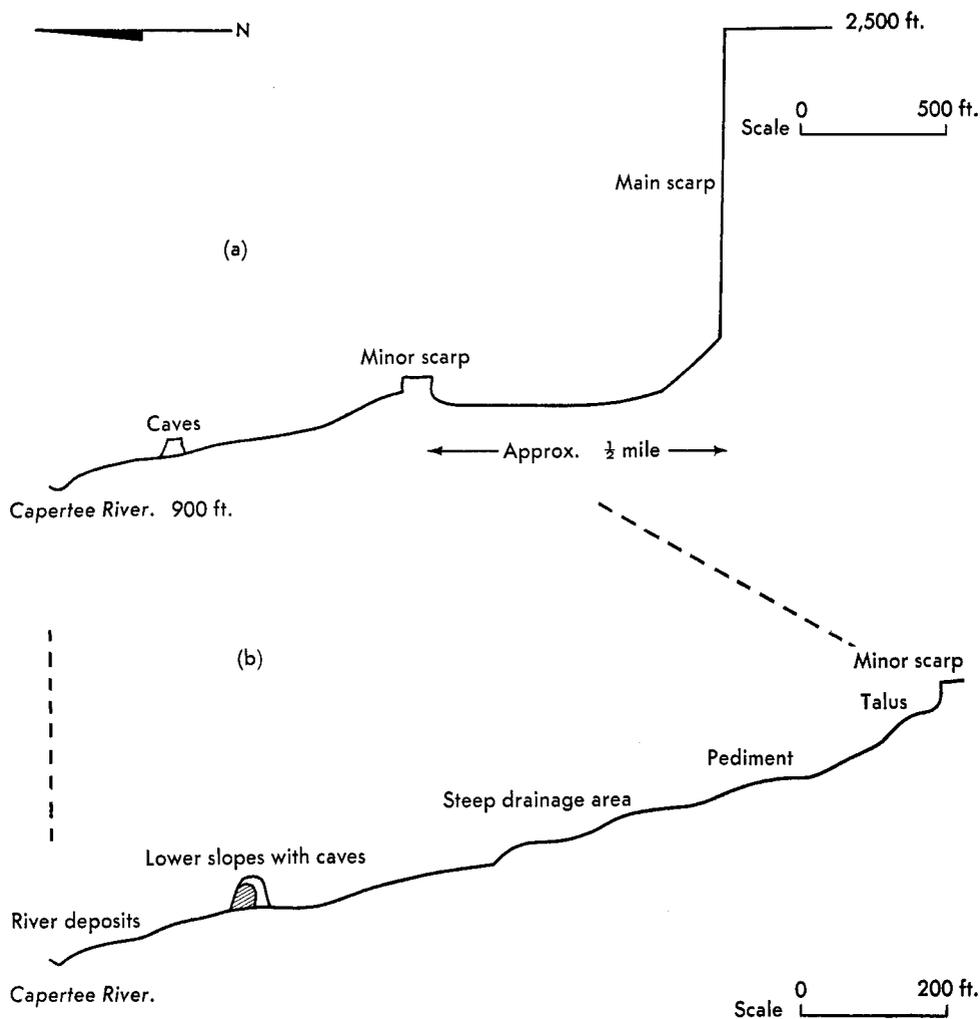


Fig. 2

passes into a pale brown (10YR6/4), loose sand (soil layer Q). These layers of the profile overlie a darkened (7.5YR3/2), charcoal-enriched zone which is partially enclosed by a hardened red (2.5YR4/6) sandy soil; this was considered to be a buried Aboriginal fireplace with an adjacent "burnt" soil zone. To the left of the buried fireplace, the pale brown sandy soil passes at 18 inches into a pale reddish brown (7.5YR6/3) weakly-cemented sand which contains thin (1/16 inch) red (5YR5/6) wavy bands of clay 3-6 inches apart (soil layer R) dipping at a steep angle to the present ground surface and continuous across the face of the excavation. At 40 inches this soil layer passes abruptly into a white (7.5YR8/4) loose sand which contains red (2.5YR4/6) wavy bands of clay, up to 1 inch thick which run horizontally through the soil (soil layer S). Rock fragments in this soil layer are also coated with the red clay which forms a thicker deposit on the upper surface of the fragment than on its lower surface. At 60 inches there is an abrupt change to a zone predominantly

of sandstone boulders; the soil is a brightly mottled red (2.5YR<sub>4/6</sub>) and yellow (7.5YR<sub>6/8</sub>) moderately-cemented sandy loam without clay bands, which continues to the bottom of the excavation (soil layer T). Similar soil material was obtained to a depth of 9 feet, where boring ceased due to impenetrable rock.

The soil within the shelter of the cave, i.e., on the right-hand side of figure 8, is very clearly separated from the soil outside it which has just been described. An abrupt vertical boundary separates the two bodies of soil and coincides with the boundary between stone-rich and relatively stone-free sediments. Apart from the buried fire-place, most of the soil within the cave is a very fragile sand and powders more readily than other soil material in the locality. The dark grey (10YR<sub>3/1</sub>) loose, sandy surface is of variable thickness and is rich in charcoal fragments (soil layer P); it passes into a pale brown (7.5YT<sub>6/4</sub>) sand which is very loose, powdery and contains numerous faunal channels a quarter of an inch in diameter. Between 36 and 48 inches the soil becomes a reddish-coloured (5YR<sub>5/8</sub>) loose sand with slight white (10YR<sub>8/2</sub>) mottling and there is evidence of thin (1/16 inch) clay banding toward the back of the cave. At 76 inches there is an abrupt change to a red (2.5YR<sub>4/6</sub>) and yellowish (5YR<sub>5/8</sub>) mottled, cemented sandy loam, relatively stone-free and containing a profuse network of branching channels three-quarters of an inch in diameter (soil layer T); this zone of soil is continuous across the base of the excavation and is connected to the material below 60 inches on the left-hand side of figure 8, which has a comparable morphology. By 84 inches the whole section becomes very bouldery and is considered to be the talus zone.

The occurrence within cave 1 of a unique soil developed within a unique deposit indicates that the cave environment is unique in this locality. It will be noticed, however, that while the upper 5 or 6 feet of the excavation provides a contrast in adjacent soils inside and outside the cave, the basal soil material, except for stoniness, is similar across the excavation. Since artifacts are virtually absent from this basal soil and occur thickly through the loose sandy layers above it, it is probable that the differences between soils inside and outside the cave are largely the result of human occupation of the sheltered environment.

#### (v) Soils in the floor of cave 3

The soil properties of the east and west sections of cave 3 (figures 9a and 9b) differ considerably. The east section is similar to soils outside the cave and has a dark grey (10YR<sub>3/1</sub>), loose, sandy surface (soil layer P), which passes to a loose pale brown (10YR<sub>7/4</sub>) sand (soil layer Q); at 24 inches, thin (1/16 inch) horizontal bands of red (5YR<sub>4/6</sub>) clay appear and these become progressively thicker with depth down the profile to 66 inches where they are half an inch wide and still horizontal. This soil passes abruptly into a red (5YR<sub>5/6</sub>), weakly-cemented sandy loam which forms the matrix of the basal, bouldery talus zone (soil layer T).

Adjacent to the cave wall in the west section, the soil has a thick, darkened (10YR<sub>3/1</sub>) (soil layer P), very loose and sandy surface which is rich in charcoal fragments; at 15 inches the surface soil passes into a light brown (10YR<sub>6/3</sub>-10YR<sub>7/4</sub>) very fragile sand with frequent faunal cavities (1/8-inch diameter). At 36 inches most of the profile in the west section changes abruptly to a stony layer, characterized by densely-packed, subrounded sandstone fragments up to 10 inches in diameter; in the upper part of this stony layer and immediately at its junction with the overlying soil, localized darkening (10YR<sub>5/2</sub>) occurs together with another concentration of charcoal fragments, indicating the occurrence of a buried fire-place. Through the layer of stones, reddish (5YR<sub>6/6</sub>) clayey bands occur (soil layer S) and at 6 feet the

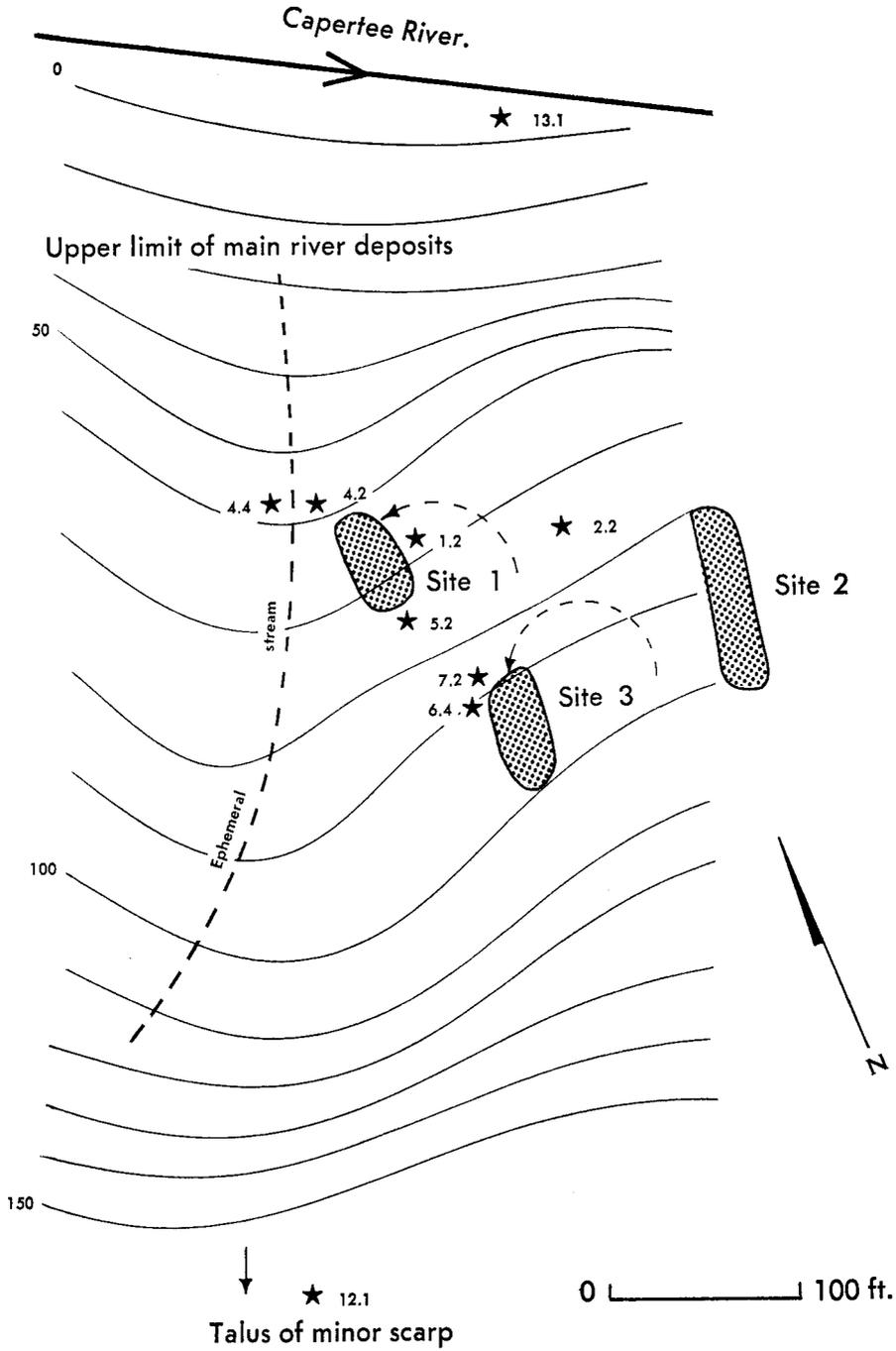


Fig. 3

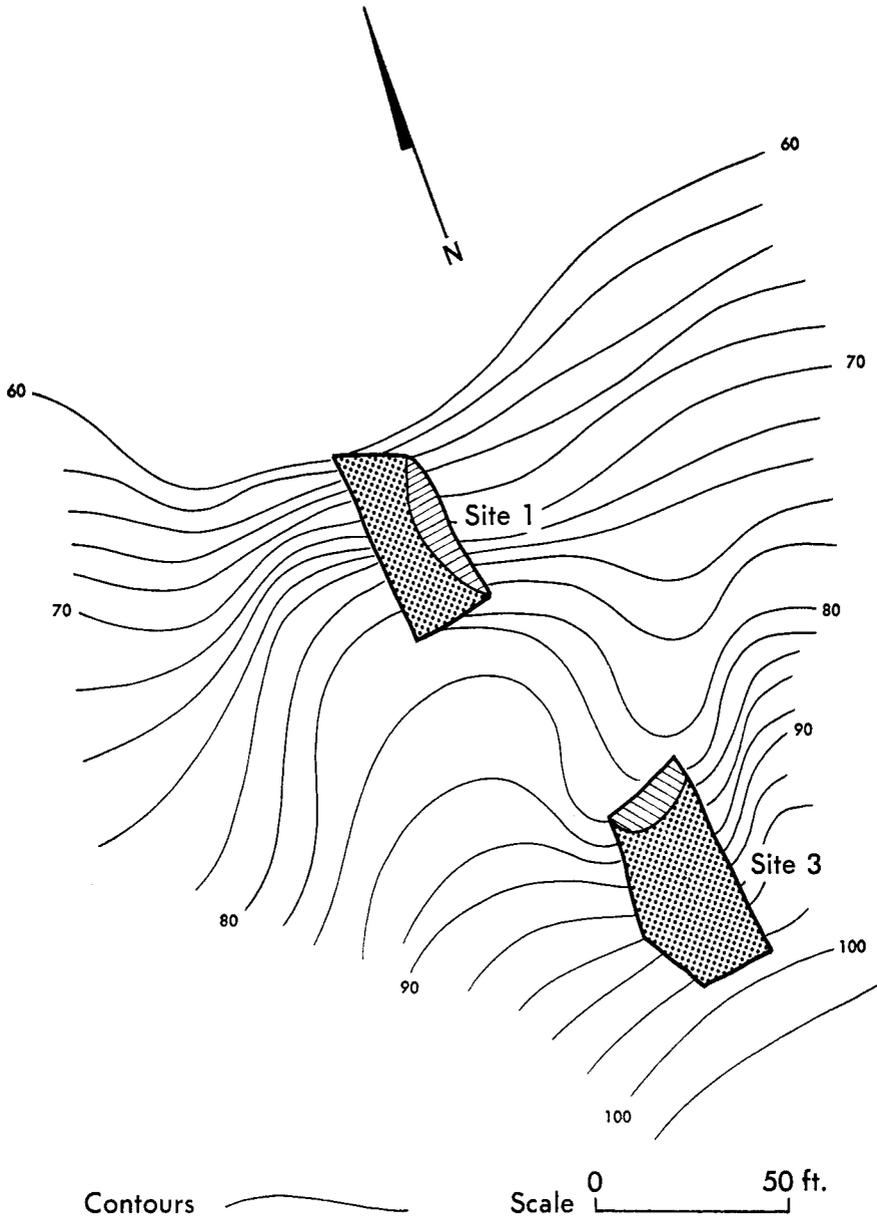
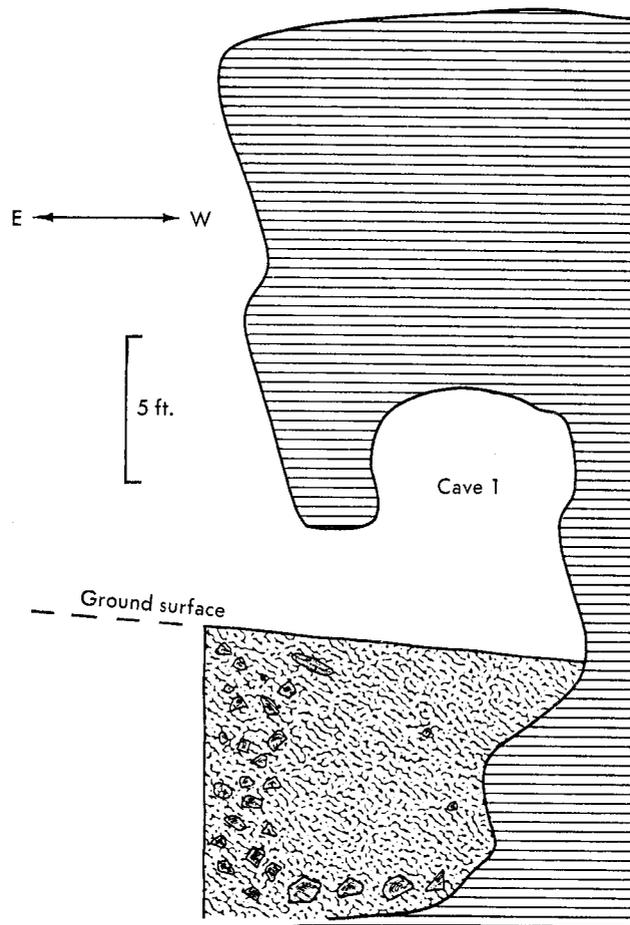


Fig. 4

soil passes abruptly into the basal bouldery zone which has a matrix of red (5YR5/6) weakly-cemented clayey sand (soil layer T). At the back of the cave in the west section, sandy material continues to depth uninterrupted by the stony layer; this material contains similar clay bands to the adjacent stony soil. Towards the mouth of the cave the upper profile is similar to that of the east section but the bouldery zone occurs closer to the surface so that the soil material with clayey bands is not evident in the accessible part of the profile. Some of the soils of cave 3, particularly those in the west section, show similar features of occupation to cave 1 and the contrast between sheltered cave soil and sediment and more exposed situations is equally as great. It is also significant that, as in cave 1, virtually no implements were found in the basal red soil of cave 3 among the talus boulders.



### III SOIL HISTORY

#### (i) Soil layering

Evidence of uncomfortable contacts between some of the soil layers is seen in the deposits just outside the shelter of cave 1. Layer P, the slightly organic sandy surface layer, is continuous with the thicker organic zone within the cave. A greater part of the dark coloration and depth of layer P within the cave is due to copious amounts of charcoal from Aboriginal fire-places. Layer Q is generally conformable with layer P and there is usually a diffuse boundary between them. The soil material in layer Q is sandy, loose, and single-grained, and together with the surface layer P, probably represents a single pedological system *PQ*.

The upper boundary of layer R is sharply separated from layer Q, but lies conformably in relation to P and Q. A clear break between layers Q and R also occurs where a patch of blackened earth and baked soil separates them, indicating a phase of human occupation subsequent to the deposition of layer R and prior to Q. No indication is given of the length of human occupation insofar as it may indicate a period of general surface stability in the locality. Layer R contains long, thread-like bands of clay which dip at a steep angle to the present soil surface; they confirm

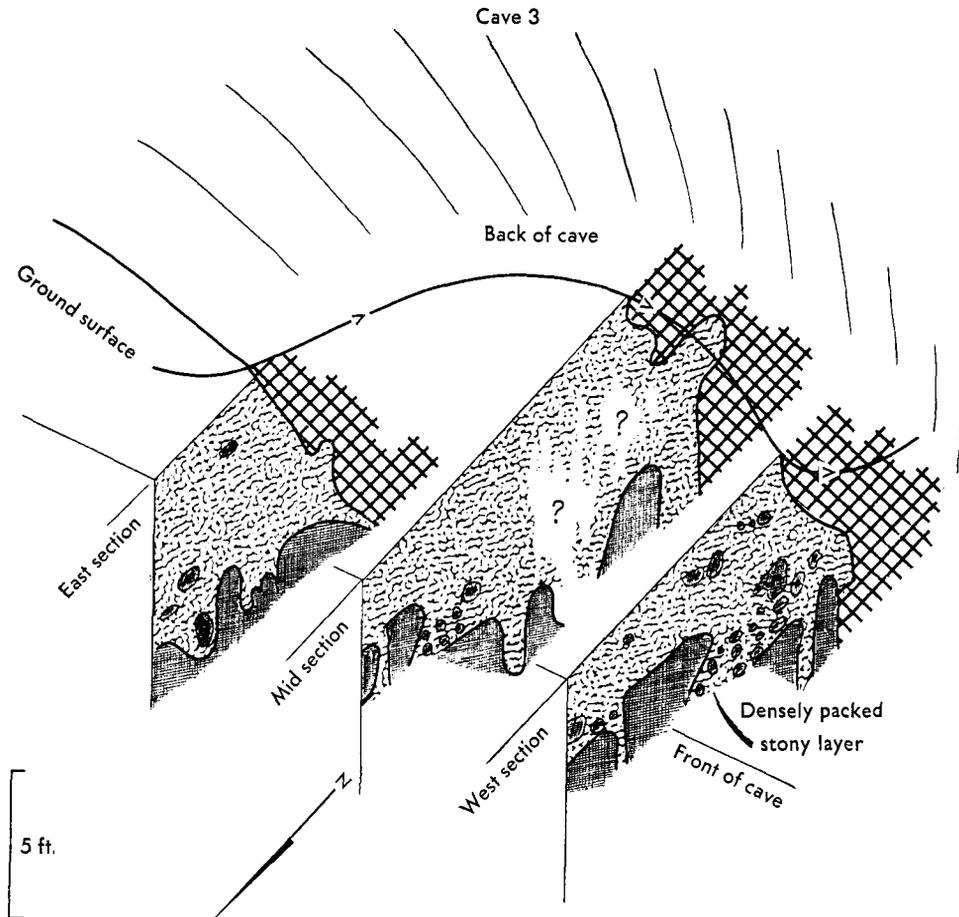


Fig. 6

the presence of an unconformity between layers Q and R and indicate deposition of materials to form layer R and segregation of clay prior to deposition of material in soil PQ. Layer S is also abruptly separated from layer R by an unconformable soil contact; the soil materials are much more strongly segregated in S, and the thick bands of clay have horizontal orientation in contrast with the thin, dipping clay bands within layer R. The evidence suggests that the sediments of layer S were deposited, stabilized and subsequently weathered prior to the deposition of the sediments of layer R. Soil layer T is not abruptly separated from S outside cave 1, but within the shelter of the cave there is a very sharp boundary between layer T and the cave soil above it. Soil T has attributes of the talus soil and is virtually free of artifacts (McCarthy, private communication).

Unconformable contacts between the younger soil layers is also evident in the cutting made by an ephemeral stream adjacent to the caves (figure 3). The uppermost materials are a slightly organic surface which grades into a single-grained sand; a thick gravel layer separates this zone from the layer beneath and the boundary between them is steeply dipping and iron-stained. Below this boundary the soil is a

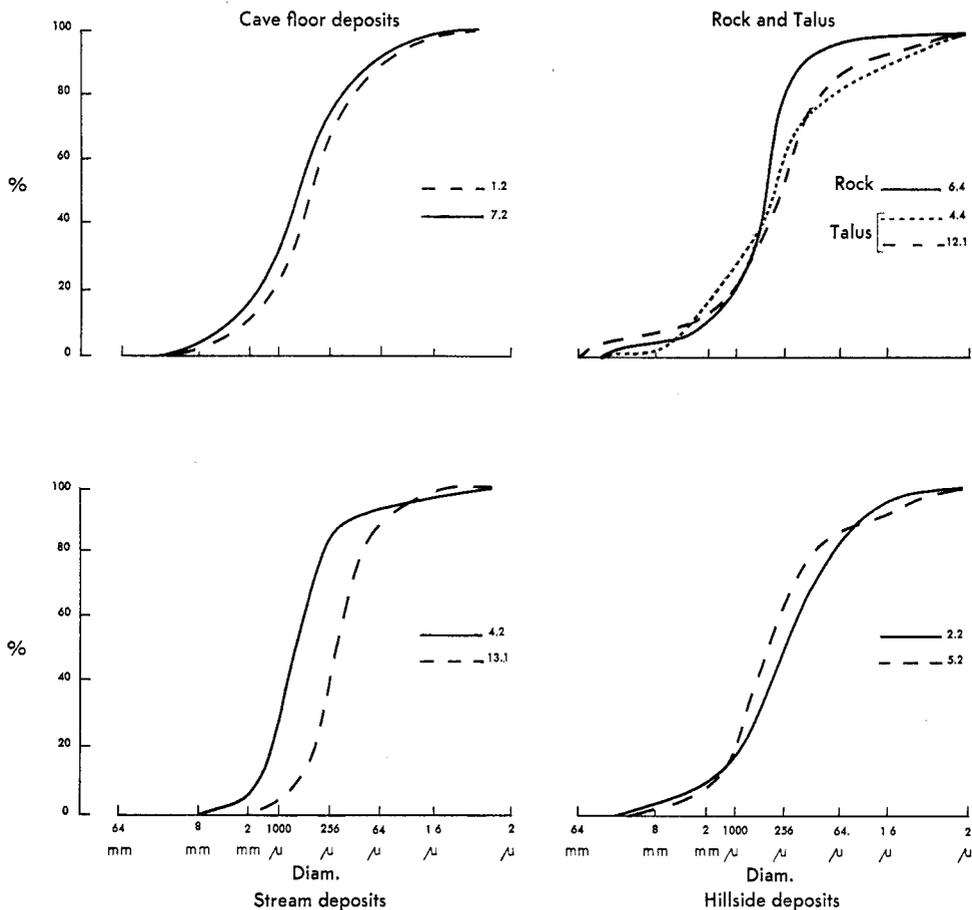


Fig. 7

slightly cemented sand with thin wavy, thread-like bands of clay oriented parallel to the general surface. In this case the gravelly layer marks the boundary between soils with the morphology of soil *PQ* and layer *R* adjacent to cave 1.

The soils adjacent to and within cave 3 do not show the unconformities so evident in cave 1. This may be explained in part by the orientation of cave 3 in relation to the megalith; its position is more sheltered from hillside erosion than cave 1. The eastern section of cave 3 has the same soil materials as the section outside the shelter of cave 1. There is a slightly organic surface (layer *P*) passing into a sandy zone (layer *Q*) with thin bands in the soil below (layer *R*) which increase in thickness with depth (layer *S*); the basal layer is a red, more clayey, soil amongst very coarse talus boulders (layer *T*). In this case, however, there are no evident soil unconformities and, apart from the great sedimentary difference between the basal talus and overlying sandy materials, the complexities of erosion, deposition and soil formation that were evident in cave 1 cannot be interpreted here. The western section of cave 3 shows a similar occupational soil to cave 1; in this case however a very distinct stone line occurs at the base of the occupational soil and separates it abruptly from the soil below which contains thick bands of clay in a stony soil (layer *S*). Once again the red soil of layer *T* is encountered within the very coarse basal talus deposit.

#### (ii) Discussion of soil events

The soils above layer *T* at cave 1 provide a marked contrast between relatively uniform undifferentiated materials inside the cave and materials with distinct clay segregation outside. The shelter of the cave would be expected to afford considerable protection against the direct effects of leaching which are evident outside the cave; in addition, the more or less continuous disturbance of cave deposits by man, together with the accretion of charcoal and other organic material, would tend to mask the evidence of soil formation. The presence of clayey material and segregations within layer *T* inside the cave indicate, however, that soil development does take place in the sheltered environment when man is absent from the site. The high permeability of the sediments is no doubt sufficient to permit the movement of colloids with seepage water which would encroach on sheltered sites. It is likely, therefore, that disturbance and accretion due to human occupation have been major factors in minimizing soil differentiation of layers corresponding to *PQ*, *R* and *S* within the cave, while in exposed sites these layers were weathered and clay was translocated to form bands of accumulation.

The sequence of events was similar within cave 3 except that organic accretion due to human occupation only occurs in layers corresponding to *PQ* and *R*. Layers *S* and *T* within the shelter of the cave have comparable properties to soil layers *S* and *T* in exposed sites.

The sequence of events outside the caves has been represented by soil layers *PQ*, *R*, *S* and *T*. Only two of these, the surface soil *PQ*, which is the general surface profile over hillsides in this locality, and the widespread talus soil *T*, clearly relate to particular surfaces of stability. The latter is the basal soil layer in the archaeological sites while the former is the product of present stability of the superficial hillside mantle which overlies the talus. The soil material between *PQ* and *T* in the stratigraphic sequence is characterized by distinctive clay bands in a sandy matrix. Similar bands of clay have been described in some sandy soils of the United States (Wurman, Whiteside and Mortland 1959; Bartelli and Odell 1960; Robinson and Rich 1960). They are considered to be the result of periodic precipitation of clay which is translocated from

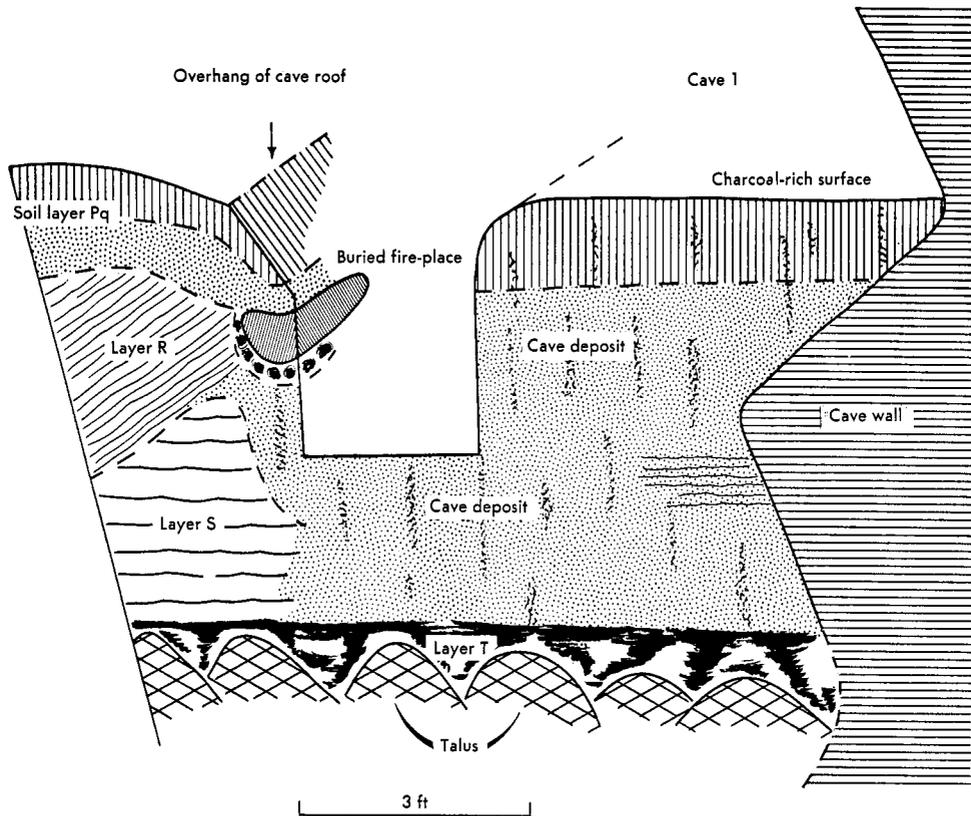
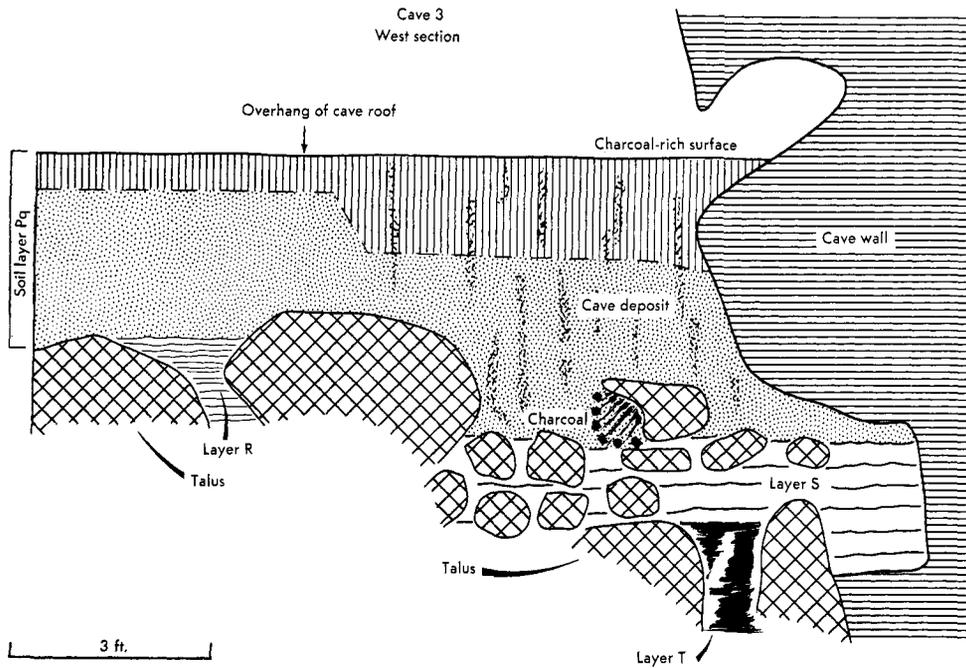
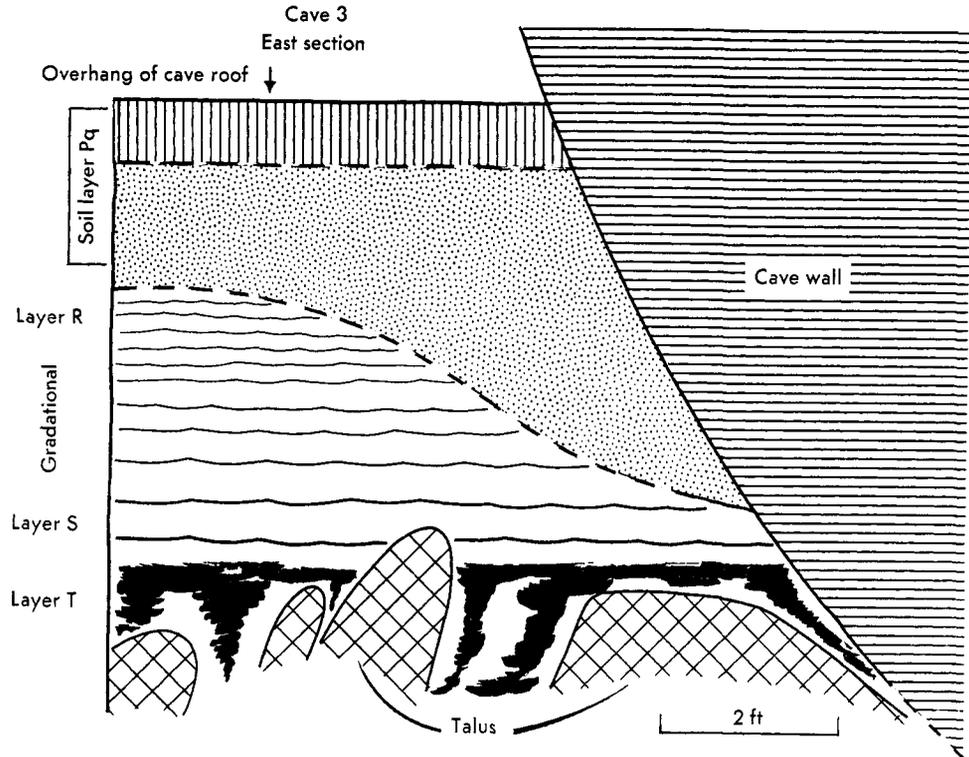


Fig. 8

the subsoil of the upper profile to the genetic C horizon below; Robinson and Rich (op. cit.) also found that the clay bands were aligned with the depositional bedding of unconsolidated deposits. The clay bands within the sandy soil layers R and S at Glen Davis cannot be readily related to those observed in American soils; their position below the shallow, single-grained sandy soil *PQ* to which they are not genetically related is not analogous to the situation proposed for the American soils, where the clay bands are derived from an overlying subsoil of accumulation. In the Glen Davis soils either the overlying subsoil is not an essential part of the system and new clay bands accumulate with each new layer of sediment, or else a B horizon was originally present for each of the layers R and S and has been removed by erosion prior to the development of soil *PQ*.

The presence of parallel-horizontal clay bands of gradually increasing thickness with depth in cave 3 suggests that the processes of deposition of sandy sediment and the development of clay bands has progressed steadily at the site, whereas at the same time unconformities developed at cave 1. Not only is there a marked difference in the angle of inclination of the clay bands in layers R and S at cave 1, but there is also an abrupt boundary between the layers; the thickness of the clay bands changes equally abruptly from thin ( $1/16$  inch) in layer R to thick (1 inch) in layer S. The evidence at cave 1 indicates a pause in the continuity of sediment deposition and



Figs. 9a (top) and 9b

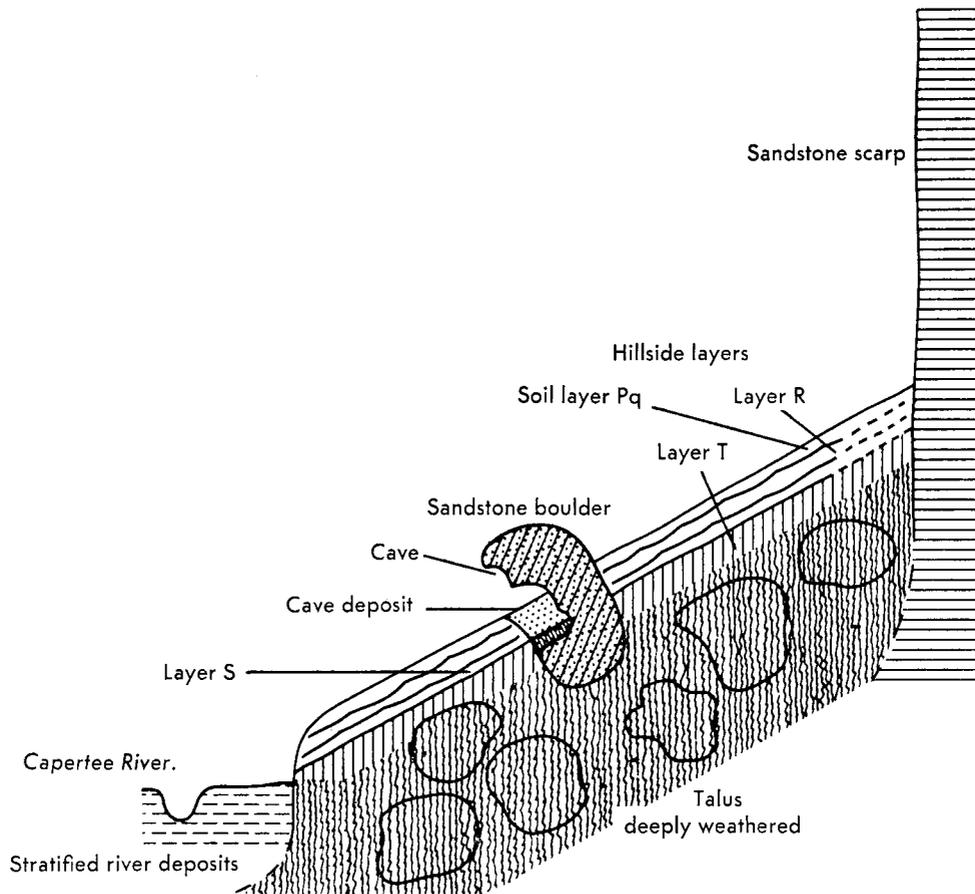


Fig. 10

therefore in the replication of clay bands also, so that soil layer S may represent a phase of localised ground surface stability and soil development in the past, similar to the regional phases of stability described by Butler (1959). There is insufficient evidence to prove layers R and S as parts of separate soil systems; therefore in the following section, while reference is made to R and S as separate entities in the stratigraphic sequence, it is not assumed that they are parts of separate soils, and therefore similar to the periodic soil phenomena described by Butler (*op. cit.*).

The soil history in the vicinity of the archaeological sites can be elaborated further by considering the relationships of the terrace soils of the Capertee River and the deposits in lateral streams to the soil layers described above. The stratified river terrace deposits are found superimposed on the hillside soil *PQ* and therefore are younger than it. The deposits in the ephemeral stream are also stratified and they overlie the truncated soil *PQ* and therefore are younger than it. Both the main river deposits and the ephemeral stream deposits and their soils represent the latest minor phase of erosional activity which may well be related to clearing and depletion of the vegetative cover since the advent of the white man to Australia.

### (iii) Soil chronology

The sequence of sedimentary and soil events described above is the basis of a tentative soil and landscape chronology in Table 1. At least two of the layers, viz., *PQ* and *T*, have developed as a result of periodic landscape events which are similar in principle to the *K*-cycles of Butler (1959). Each *K*-cycle commences with a phase of groundsurface instability during which hillsides are eroded and lose part or all of their soil mantle. In the final stages of instability the sediment in transit across the hillside becomes progressively less mobile until eventually it is stable and soil development starts afresh within the new hillside deposit. A repetition of these landscape and soil events will give rise to a sequence of soil layers, the oldest of which are buried.

At Glen Davis the oldest soil exposed in the archaeological sites is represented by the very coarse talus deposit and its red and sometimes yellow mottled soil (layer *T*). This soil forms a base layer above which young hillside deposits and soils developed. The materials of layer *S* were deposited next and were characterized by a coarse sandy and stony mantle over the talus hillside; this deposit was subsequently leached to form thick clay bands. Within cave 1 the deposit contemporaneous with layer *S* was almost entirely devoid of stone and the first clear evidence of human occupation of the caves is recorded. Subsequent erosion, deposition and leaching gave rise to the sandy and somewhat less stony layer *R* over the hillside and then followed the last cycle of erosion, deposition and soil formation which gave rise to soil *PQ*. Human occupation of the caves continued throughout these later landscape and soil events and the final phase of river deposition and sedimentation along lateral ephemeral streams brings the chronology to the present day. The sequence of soil layers and cave deposits is shown diagrammatically in figure 10.

The history of the Capertee River Valley is of much greater antiquity than the chronology outlined here. The prolonged period of valley incision which gave rise to the precipitous sandstone gorges of 1,500 feet depth probably dates from the general late Tertiary uplift of eastern Australia which caused all eastern streams to incise their courses. Subsequent to the early lateral corrosion of the river, the retreat of the valley sides has been accomplished by rockfall from the sheer sandstone scarps. The talus so formed is very deeply and intensively weathered, as evidenced by the reticulately mottled red and white clay at the base of the deposits. It is evident then that the hillside and cave events described here are minor surface disturbances of relatively short duration compared with the overall development of the valley.

## ACKNOWLEDGMENTS

The author wishes to thank Mr. F. D. McCarthy, Curator of Anthropology, Australian Museum, Sydney, for his help in the field and for suggestions made during the preparation of this paper; Dr. D. S. McIntyre, C.S.I.R.O. Division of Soils, Canberra, undertook the sedimentary analyses, and Mr. B. E. Butler, of the Division of Soils, suggested improvements to the manuscript.

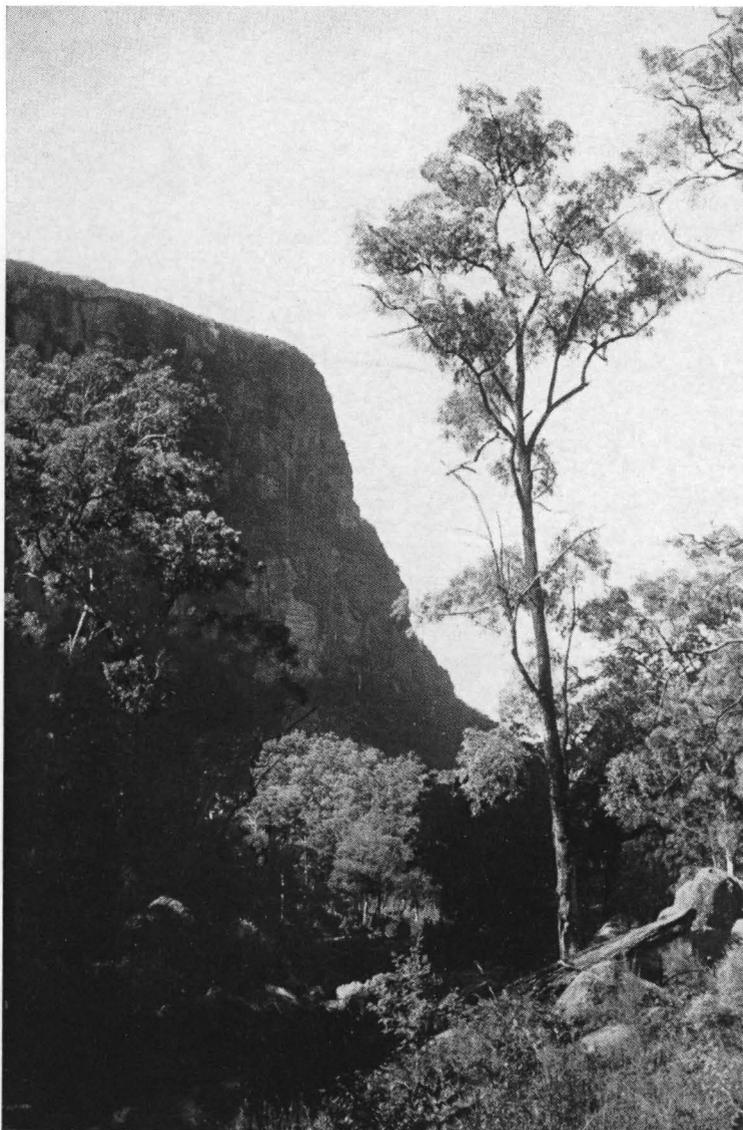
## REFERENCES

- Bagnold, R. A. (1941).—The Physics of Blown Sand and Desert Dunes. Methuen and Co. Ltd., Lond.
- Bartelli, L. J., and Odell, R. T. (1960).—Field studies of a clay-enriched horizon in the lowest part of the solum of some Brunizem and grey-brown podzolic soils in Illinois. *Soil Sci. Soc. Amer. Proc.* 24: 388-90.
- Butler, B. E. (1955).—A system for the description of soil structure and consistence in the field. *J. Aust. Inst. Agr. Sci.* 21: 239-49.
- Butler, B. E. (1959).—Periodic phenomena in landscapes as a basis for soil studies. C.S.I.R.O. Aust. Soil Publ. No. 14.
- Butler, B. E., and Hutton, J. L. (1956).—Parna in the Riverine Plain of south-eastern Australia and the soils thereon. *Aust. J. Agric. Res.* 7: 536-53.
- Department of National Development (1957).—Sydney—4 mile geological series. Sheet 1156-5, Australian Nat. grid. Explanatory notes No. 6.
- Robinson, G. H. and Rich, C. I. (1960).—Characteristics of the multiple yellowish-red bands common to certain soils in the south-eastern United States. *Soil Sci. Soc. Amer. Proc.* 24: 226-30.
- Wurman, E., Whiteside, E. P., and Mortland, M. M. (1959).—Properties and genesis of finer textured subsoil bands in some sandy Michigan soils. *Soil Sci. Soc. Amer. Proc.* 23: 135-43.
- Zeuner, F. E. (1945).—The Pleistocene Period. Its Climate, Chronology and Faunal Successions. Ray Soc. Lon. 322 pp.

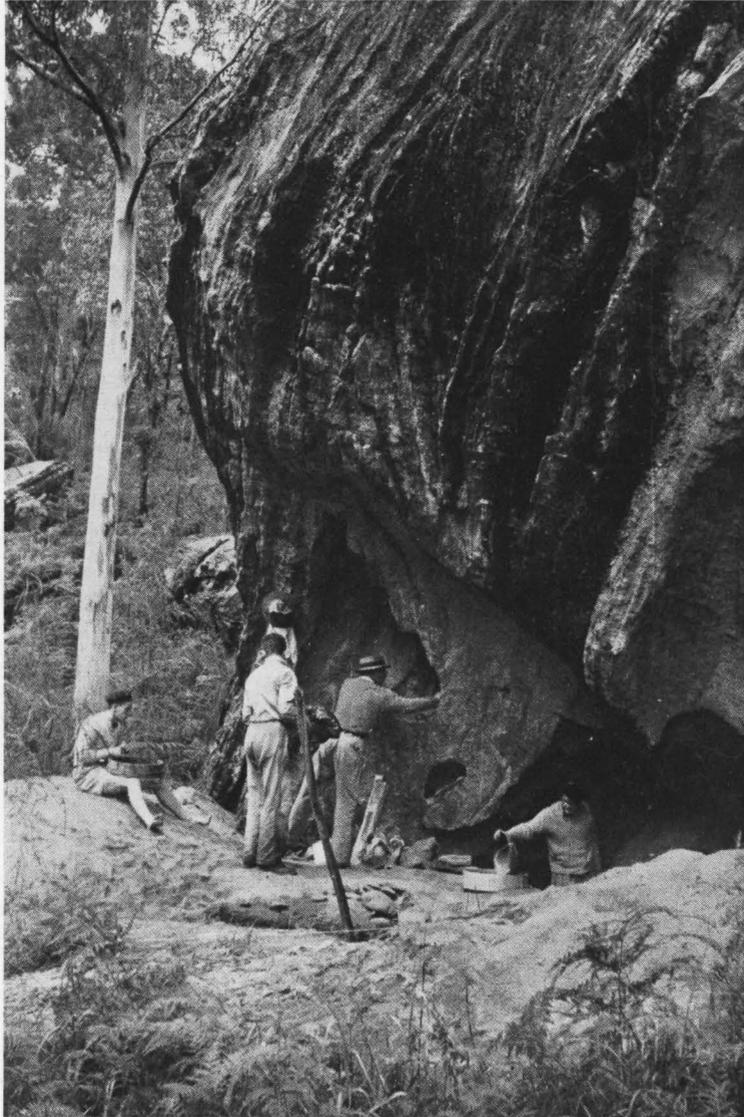
**Table 1**

A tentative chronology of soil, landscape and occupational events in the vicinity of the archaeological sites

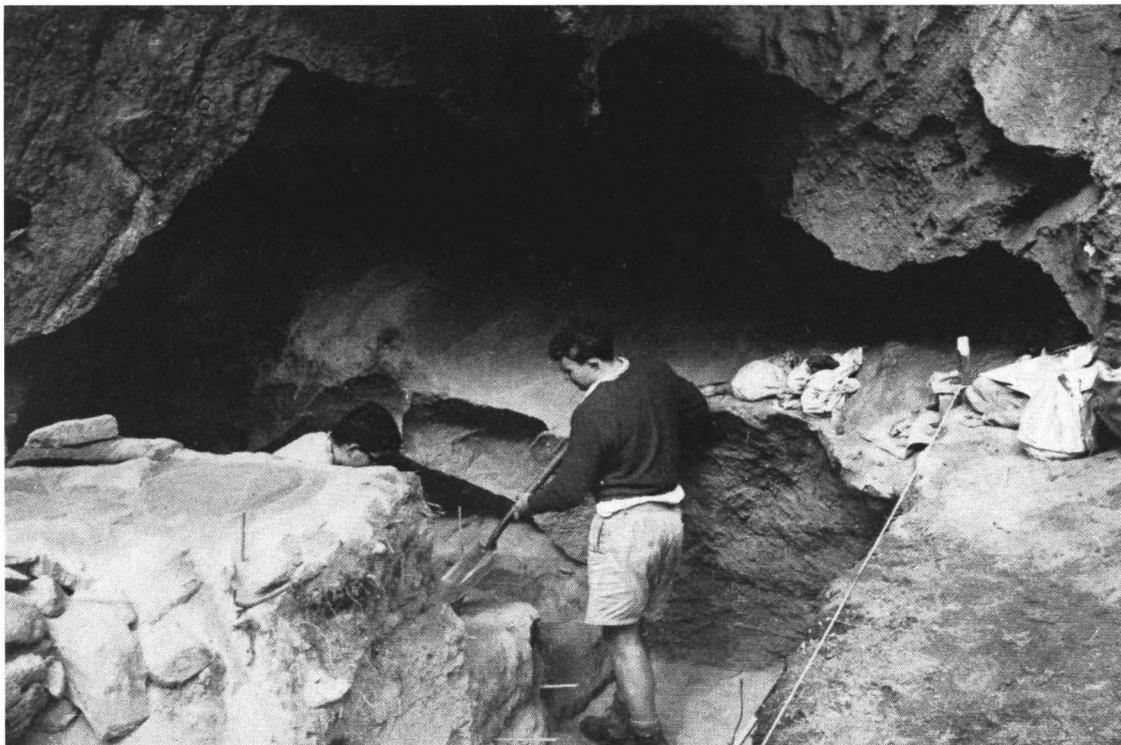
Major Periods	River Phases	Hillside Phases	Cave Phases	Cave Occupation
Present ^   Late history of Capertee.	Deposition of stratified sediments along main river and ephemeral stream courses. ^	Generally stable.	Some fretting and flaking of cave roof.	
		Deposition of sandy hillside mantle and development of soil layer PQ (loose sandy soil).	Deposition of sandy sediment with very few rock fragments; copious charcoal deposited.	Evidence of occupation strong; fire-places, etc.
^   Early history of Capertee valley.	Continued entrenchment into talus.	Deposition of sandy and stony hillside mantle and development of soil layer R (thin clay bands).	Deposition of sandy sediment with very few rock fragments; charcoal and burnt soil.	Evidence of occupation strong; fire-places, etc.
	Stream entrenched into talus.	Deposition of sandy and stony hillside mantle and development of soil layer S (thick clay bands) above red talus soil T.	Deposition of sandy sediment in cave 1 and stony sediment in the western part of cave 3; charcoal not readily visible.	Occupation evident in occasional artifacts.
Late Tertiary.		Late talus build-up and weathering to red soil T.	Deposition of sandy sediment in cave 1 above talus to form red and yellow soil layer T.	No occupation. ^
		Build up and intense weathering of talus giving red and white plastic clays.		Pre-man. 



The Capertee River, showing the bouldery lower slopes and the precipitous sandstone scarp



Cave 3, showing the scale of the sandstone boulder and cave.



The archaeological excavation at Cave 3, showing the depth of cave deposit and the numerous smaller cavities within the main cave. The string in the foreground lies along the line of the west section of the cave (see figures 6 and 9).