

Late-Holocene Volcanics on Tutuila Island, American Samoa: an Archaeological Perspective on Their Chronological and Spatial Distribution

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Abstract

Data on 28 radiocarbon dates and volcanic stratigraphy from 23 archaeological excavations located on the Leone Volcanics to understand the temporal and spatial distribution of late-Holocene eruptive events on Tutuila Island, American Samoa. Some of the underlying lava flows of the Leone Volcanics are at least 2000 years old. A distinctive reddish ash stratum is the most recent clearly identifiable eruptive event, dating to ~AD 650-750. Other possible interpretations from the data reviewed in this report are that: 1) lithified-ash strata are generally thickest near the seaward craters, suggesting that they are the source of the deposits; 2) for all of the excavation locations reported here, where both grey and reddish-ash strata are present, the reddish ash is always above the grey ash. It is inferred that the volcanic event(s) that generated the reddish ash occurred later than those that produced the grey ash; 3) locations with black pyroclastics are closer to the inland craters, suggesting that they are source of this material; 4) at Locations 12 and 16 the black pyroclastics are *below* the reddish-ash layer, while at Locations 5 and 7 the black pyroclastics are *above* the reddish-ash layer, suggesting that at least two eruptive events were responsible for producing the black pyroclastics, at least one before the reddish-ash-producing event(s) and at least one after; 5) if it is correct that the black pyroclastics are from the inland crater and the reddish ash from the seaward craters, then having black pyroclastics both above and below the reddish ash suggests that both seaward and inland craters were active more-or-less contemporaneously; 6) if the soils overlaying the reddish ash are derived from volcanic ash, and if the ash source is the seaward craters, then these craters were the last to erupt – perhaps as recently as AD 1300.

1. Introduction

The Leone Volcanics formed the large protrusion on the southwest of Tutuila Island, including all the gently sloping and near-level land between Nu'uuli and Leone Villages (Figure 1). It has long been recognized that the Leone Volcanics are much younger – Holocene in age – than the Pleistocene shield volcanoes that formed the rest of Tutuila Island some ~1 mya (Natland 1980; Stearns 1944). Based on surface observations, the age of the most recent Leone Volcanics was estimated at less than 2000 years (Keller and Grose 1980). During archaeological investigations in 2004 a distinctive partially lithified reddish volcanic ash layer was discovered in Pava'ia'i Village. Charcoal from below the reddish ash dated to AD 240-540 (Addison, et al. 2006), giving an initial maximum age for the deposition of the reddish ash and the first radiometric dates for the Leone Volcanics. Subsequent charcoal dates from other locations below and above the reddish ash suggested it was deposited 13 to 14 centuries ago (Addison and Asaua 2006).

This report examines 28 radiocarbon dates and associated volcanic stratigraphy from 23 locations (Figure 2) from the villages of Leone, Malaeloa, Futiga, Ili'ili, Pava'ia'i, and Faleniu in an effort to further characterize the spatial and chronological distribution of the reddish-ash layers and other Leone-Volcanics-derived deposits above and below it. These data come from records held at ASPA (American Samoa Power Authority) Archaeology. This report only includes excavation sites with dates relating to the Leone volcanics. The ASPA Archaeology records contain information on many more excavation locations with undated stratigraphy informing on the Leone Volcanics; these could be used to further understand the spatial distribution of different kinds of materials deposited as well as their sequence of deposition, but investigating them is not in the scope of this report.

This report begins with sections containing interpretations pertaining to the chronological and spatial distribution of the Leone Volcanics drawn from the excavated sites used in this report. Sections detailing salient points on each site location follow these interpretive sections. An appendix contains a table with the further information on each excavation location.



Figure 1. Tutuila Island showing location of the Leone Volcanics (white box).

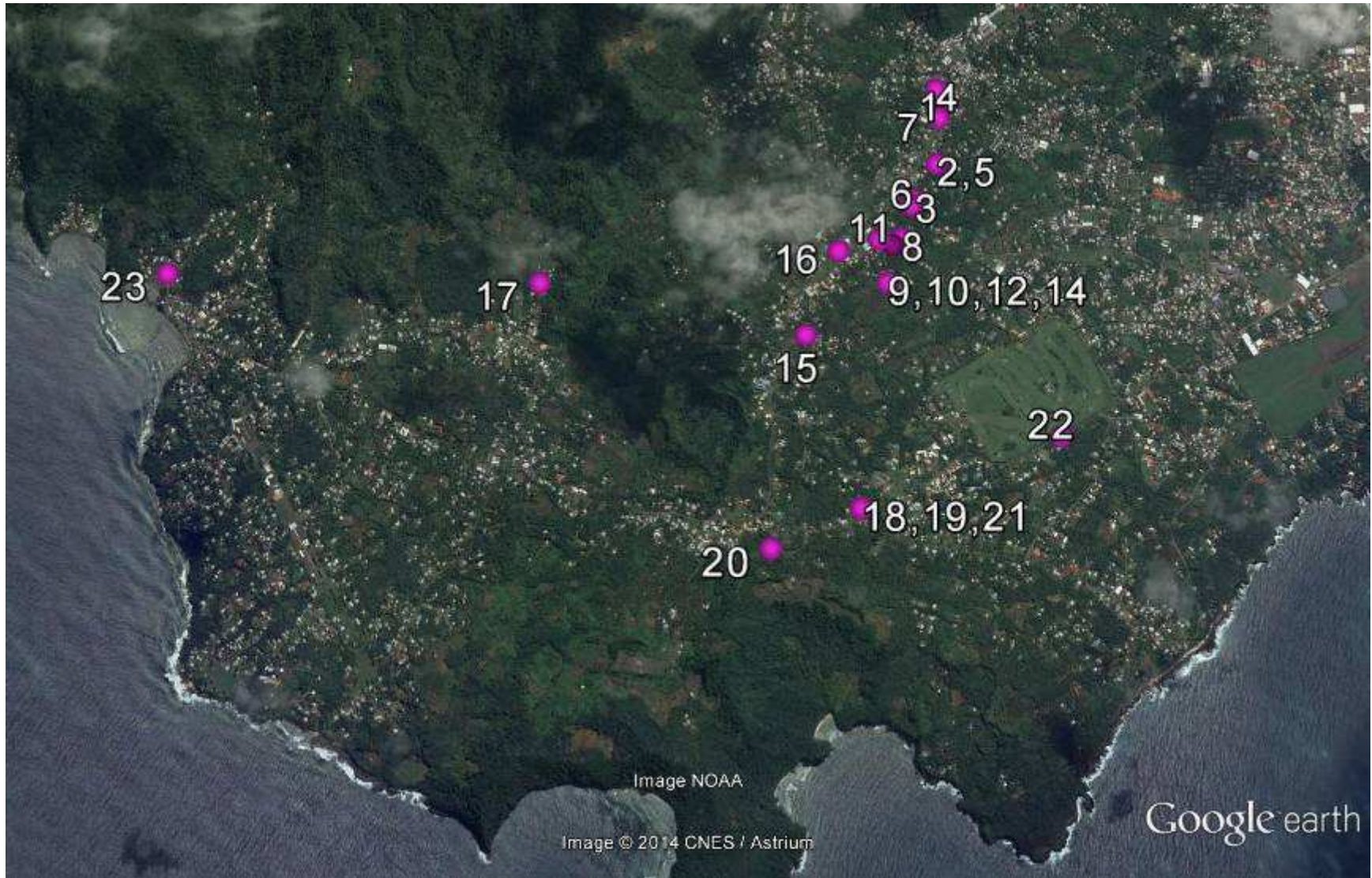


Figure 2. Excavation locations.

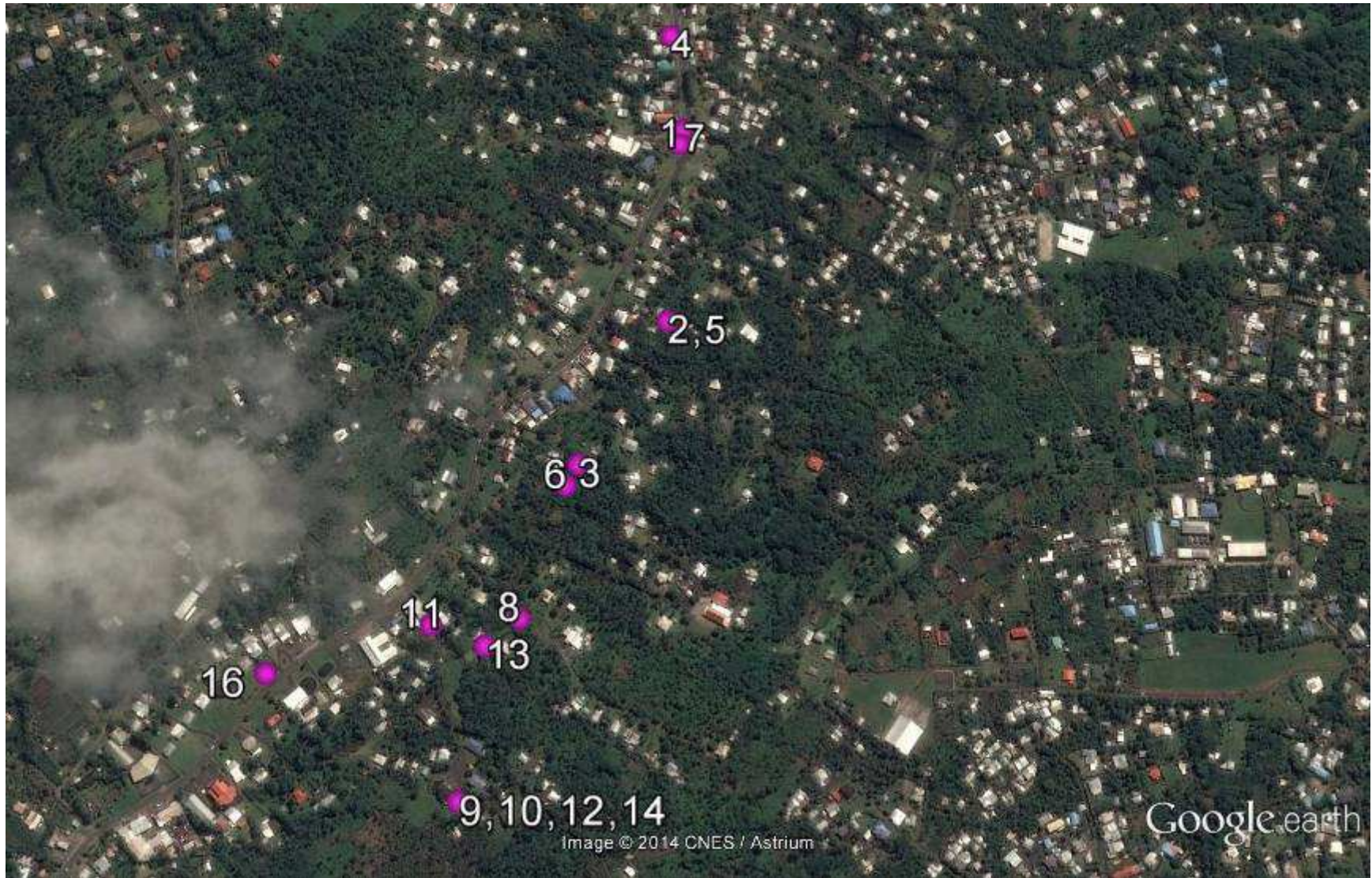


Figure 3. Expanded view of excavation locations in Faleniu and Pava'ia'i Villages.

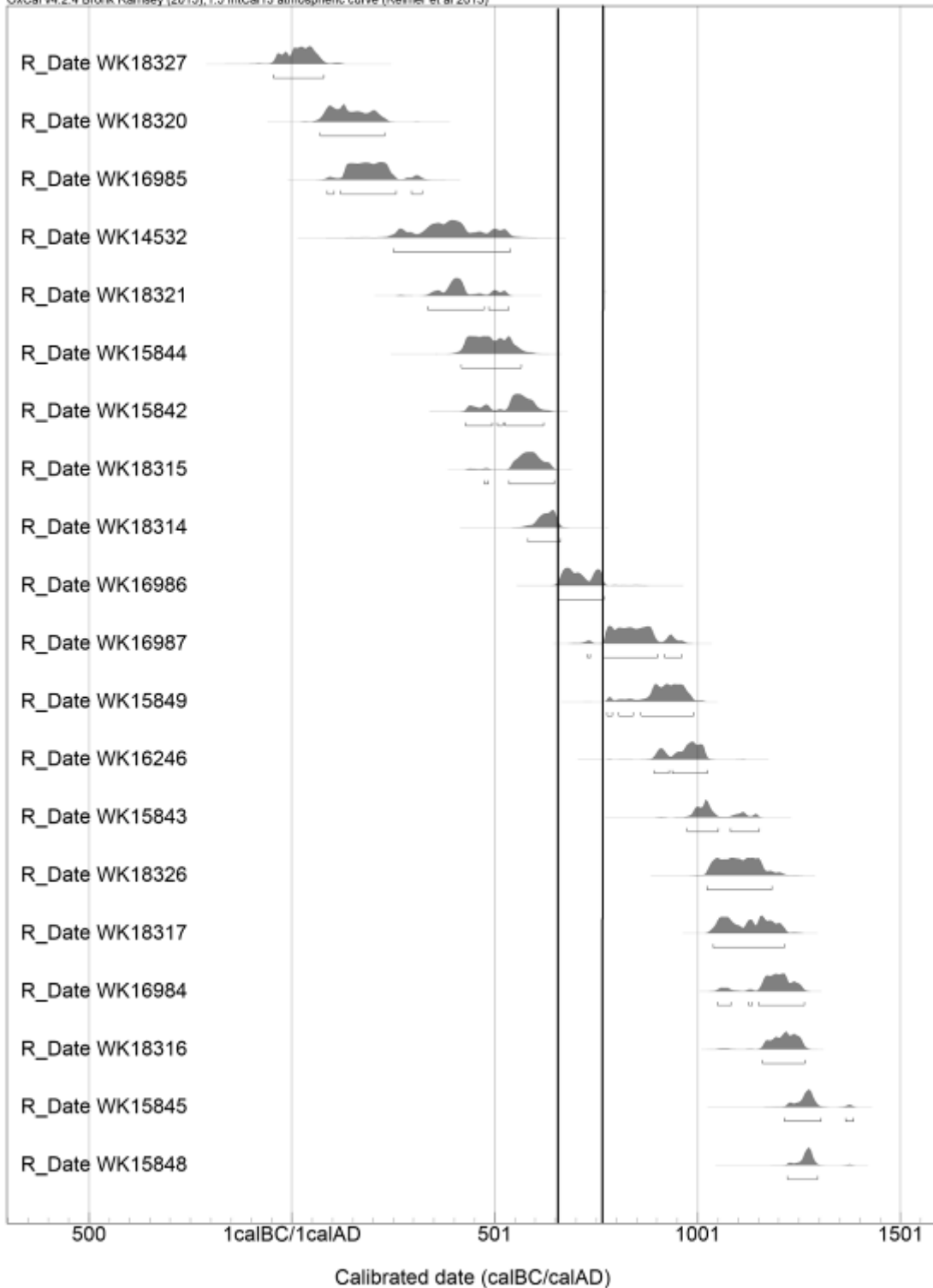


Figure 4. Calibrated date ranges (95.4% probability) from above and below reddish ash. Lines at AD 650 and AD 750 indicate probable reddish ash deposition period and bracketing WK-16986, a date from ambiguous stratigraphic context. Dates after AD 1300 are not included in this figure.

2. Chronology of Tutuila's late-Holocene volcanics

Two kinds of dating are used in this report. Absolute dating refers to radiometric dates, in this case, radiocarbon dates on charcoal (except WK-16989 at Location 21, which comes from a sample of human bone) from cultural contexts. Relative dating refers to dates based on evidence such as stratigraphic superposition, etc. In this report, inferences about the timing of past events (e.g., volcanic activity) are made from both kinds of dates.

2.1. Lava flows >2000 years old

From the available evidence, two things can be said with certainty about the chronology of late-Holocene volcanics on Tutuila. The first is that *some* lava flows from the Leone Volcanics appear to be at least 2000 years old. WK-18327 (Figure 4) from Location 16 (Figure 3) at Pava'ia'i Malae calibrates to the BC/AD boundary (50 BC – AD 80) and is from a cultural deposit directly above a pahoehoe lava flow. The people living at this location 2000 years ago were living on a largely lava landscape of undetermined age, but which was created prior to 2000 years ago.

WK-18320 (Figure 4) from Location 3 in Faleniu Village (Figure 3) calibrates to only slightly later (AD 70-230). At this location, excavation did not continue to lava bedrock; however there are at least ~30 cm of deposits below the dating sample locations. Given the depositional environment and direction of surface-water flow at Location 3, there is a possibility that some of the sediments below WK-18320 could have been deposited from the weathered Pleistocene volcanics on slopes to the northwest, however, given the gentle terrain of this location, it is more likely that these sediments are mostly volcanic-ash derived (i.e., from the Leone Volcanics). The presence of >30 cm of deposits above the lava at this location implies a long enough period between the deposition of the underlying lava flow and WK-18320 for airborne ash to have been deposited and weathered into soil. This supports the idea that, at this location, the lava is >2000 years old.

At Location 1, ~500 m northeast of Location 3, WK-16985 is roughly contemporaneous with WK-18320, calibrating to AD 130-390. This location is slightly closer to the Pleistocene volcanic slopes, hence some of the ~60 cm of deposits below WK-16985 could have been deposited by slope wash. However, these sediments, in two distinct stratigraphic layers, are probably largely volcanic-ash derived. At this location, the lava appears to have been deposited well before 2000 years ago. Addison and Asaua (2006) report WK-15324 (AD 10-220), from nearby Kokoland (~400 m northeast of Location 1) and in similar stratigraphic context above the Leone Volcanics lava flows, supporting the inference of these lava flows being at least 2000 years old. Also in Kokoland, an uncalibrated date of 2154 +/- 38 is reported from below "red consolidated ash" (Winterhoff 2007:207); apparently lava bedrock was not reached in this excavation, but this date also gives a minimum age for lava deposition.

It should be noted that the evidence reviewed above comes only from the Pava'ia'i and Faleniu area. Lava flows outside this area remain of undetermined age.

2.2. Reddish ash deposited ~AD 650-750

The second inference about the chronology of Tutuila's late-Holocene volcanics that can be made with confidence is that the reddish-ash layer was deposited around AD 650-750 (Figure 4). At Location 2, WK-18314 (AD 580-665) and WK-18315 (AD 530-650) are from cultural features stratigraphically below the reddish ash and reflect a maximum age for the deposition of the reddish-ash layer. These two dates are the most recent dates currently known from below the reddish ash.

WK-16987 (AD 810-990) from Location 4 comes from above the reddish ash. This date is currently the earliest date above the reddish ash and serves as a minimum age for the deposition of the reddish-ash layer. WK-16986 (AD 670-810) from Location 7 is from an ambiguous stratigraphic position, and its calibrated date range spans the period between the earliest date above (WK-16987) and the latest dates below the reddish ash (WK-18314 and WK-18315) (Figure 4).

2.3. Post-reddish-ash volcanic deposits

The dating of the reddish-ash layer is relatively straightforward; it is distinctive in color and texture and easy to recognize. It is uncomplicated to interpret dates below and above it that bracket the reddish ash and hence provide a date for its deposition. The overlaying sediments are mostly silty loams or silty clay loams (although variously described – see caveat in Section 4), many are inferred here to be volcanic-ash derived soils – that is, volcanic ash deposits that have weathered into soils. At most locations these have been culturally modified through domestic, agricultural, and other human activities.

Absolute dates for these sediments come from either discrete cultural features (e.g., fire pits) or from other culturally derived charcoal dispersed in strata. Interpreting these dates in reference to the volcanic events that presumably deposited the ash parent material from which these soils formed is not uncomplicated. One way is using the principle of stratigraphic superposition – the idea that strata above postdate strata below. This can be complicated by the fact that, at most locations, strata above the reddish ash are similar to each other, often with indistinct boundaries between the strata. Where there are discrete cultural features that are capped by overlaying stratum, we can infer that the upper stratum postdates the cultural feature. In the case of most of the locations reported here, the upper strata are inferred to be volcanic-ash derived. Using cultural features in this way – to date the most recent volcanic-ash-deposition events – relies on the excavators having recognized and recorded strata accurately, and more importantly that they recognized and clearly recorded to “top” of the cultural feature, hence the old ground surface from which it was originally dug – in the field, this is not always easy. Soils over most of the Leone Volcanics are relatively shallow and there has been up to 2000 years of cultural disturbance and mixing; often such disturbance is difficult to see when

examining stratigraphic profiles in the field. With these caveats, below are some thoughts on locations where the dates may relate to the most recent volcanic events on Tutuila.

At Location 1, the stratigraphic position of WK-16984 in relation to the reddish-ash layer is somewhat ambiguous, but it is clearly overlain by Layer IV, presumably a volcanic-ash-derived soil. Its calibrated age range (AD 1170-1280), may therefore relate to a later volcanic ash deposition event from which Layer IV was derived.

At Location 4, WK-16987 is clearly capped by Layer II. Its calibrated age range (AD 810-990), may relate to a later volcanic-ash-deposition event from which Layer II is inferred to have been derived. This date is also the earliest date from *above* the reddish ash.

At Location 9, Layers I and II are likely volcanic-ash-derived soils, the deposition date of which is unknown, but it is likely that their deposition dates to after AD 900-1150 (WK-16246). The nearly level topography and directions of water flow at Location 9 make it unlikely that sediments there have much contribution via slope wash from the Pleistocene-derived sediments on slopes roughly 500 m away.

At Location 12, WK-15848 (AD 1220-1380) is from a cultural feature in Layer II clearly capped by Layer I. As at the other adjacent excavations, the nearly level topography and directions of water flow here make it unlikely that Layer I had much contribution of sediments by slope wash from the Pleistocene-derived slopes. Thus, if the ~40 cm of sediments in Layer I are volcanic-ash derived, their deposition was after AD 1220-1380.

Stratigraphy and radiocarbon dates from four locations suggest possible dates for the most recent volcanic events on Tutuila. The most recent of these dates (WK-15848) suggests the possibility of volcanic-ash-deposition events after ~AD 1300 (Figure 5).

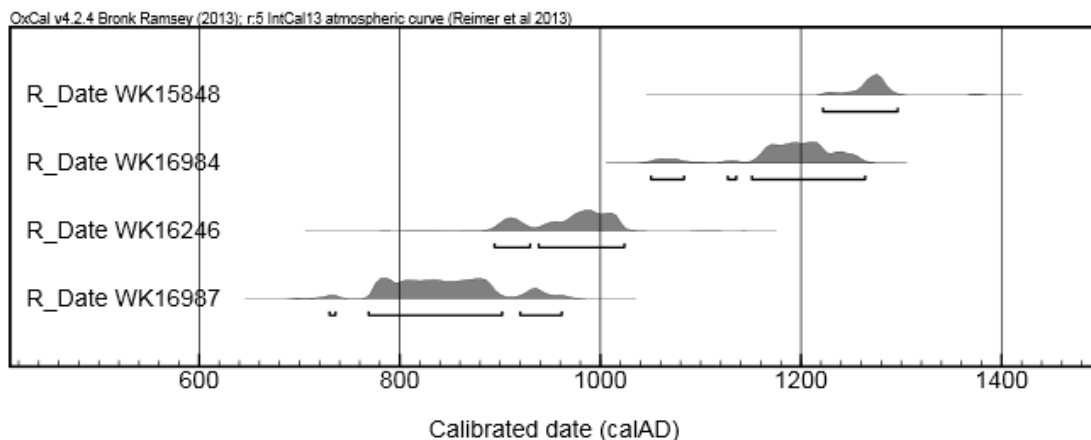


Figure 5. Calibrated date ranges (95.4% probability) for possible post-reddish-ash volcanic events.

The last paragraph of the next section contains some inferences about the relative age and sources of the various kinds of pyroclastic deposits described in this report.

3. Spatial distribution of Tutuila late-Holocene volcanics

The Leone Volcanics are underlain by lava flows. Above the lava are deposits inferred to derive from airborne volcanics – ash, cinder, or soil derived from weathered ash.

Addison’s visual inspection of the craters of the rift zone suggests that the inland craters (e.g., Olotele and Olovalu) produced mostly cinder and that the more seaward craters (e.g., Fogama’a and Fagatele) produced mostly ash. Below are some observations from archaeological excavations pertaining to the sources and relative ages of different kinds of airborne volcanic material.

Generally, east of the rift zone the locations farthest from the seaward craters have no thick lithified ash deposits. The stratigraphy in these locations is generally silty loam or silty clay loam overlaying lava, however, the relatively thin, partially lithified, reddish-ash deposit is present. This contrasts with the general stratigraphy closer to the seaward craters and to the west of the rift zone, where thick deposits of lithified ash (grey or brown) are common (see Figure 7 for the distribution of grey-ash deposits at the excavation locations discussed in this report). This spatial distribution may be related to the direction of the prevailing winds on Tutuila – i.e., from the southeast. Thus, if the seaward craters are the origin of the volcanic-ash deposits, they would be expected to be thicker near the craters and downwind of them. Some observations on specific locations follow.

At Location 5, the ~5-cm-thick layer of “tiny black rocks” directly above the reddish ash may be volcanic lapilli originating from the cinder-producing inland craters. Location 5 is ~2 km northeast of Olovalu Crater and ~2 km southeast of Olotele Crater (Figure 6). It is unclear why a similar deposit was not noted at the adjacent Location 2 and other nearby excavation locations (although note the “layers of hard/loose black ash” at Location 7, ~300 m away).

At Location 7, it is unclear if the ~40-cm-thick layer of black volcanic ash directly above the reddish-ash layer is related to the “tiny black rocks” directly above the reddish ash at Location 5. Note that no black pyroclastic material was noted at Location 1, which is adjacent to Location 7.

At Location 8, a layer of “loose orange ash” rests directly on the lava bedrock. Above it are two layers of brown soil overlain by the partially lithified reddish-ash layer. This lower orange ash was not noted at any other location.

At Location 10, the reddish-ash layer is unusually thick (>80 cm). The reason for this is unclear – perhaps this area was a low spot in the pre-ash topography into which the reddish ash was transported by wind or water from the surrounding area. Also unusual at this location is a 10-20 cm thick layer of “dark brown loose ash” *within* the reddish-ash layer. The adjacent Location 14 also has a layer of “dark brown loose ash,” however, it was not noted at Locations 9 and 12.

Location 12 is anomalous in being relatively far from the seaward craters and yet having a 60-cm thick layer of lithified grey ash below the reddish ash. It is also anomalous in having two layers of lava separated by a 5-cm thick layer of “loose black cinders.” The black cinders may be from the same volcanic event that deposited the black pyroclastics at Locations 5 and 7. It is possible that the 20-cm thick layer of “loose rough a’a” is not a lava flow (20 cm seems unusually thin for an *in situ* a’a flow) and is part of cultural feature (i.e., that the rocks are manuports placed there by people).

At Location 16, the 120-cm of “black ash” layers below the reddish ash may in fact be deposits of small volcanic cinders from nearby Olotele or Olovalu Craters.

At Location 17 in Malaeloa, west of the rift zone, the reddish-ash layer is directly underlain by the lithified gray ash that underlies the whole area west of the rift zone.

Locations 18, 19, and 20 are relatively close to the seaward craters. At Locations 18 and 19, there are thick layers of “hard ash,” however, the color was not noted and excavations there were relatively shallow. At the adjacent Location 21, the excavation was deeper and the colors of lithified ash were noted. Here, there is a thick (70 cm) layer of “reddish orange compacted ash rock” underlain by >40 cm of “grey compacted ash rock.” Given the stratigraphy at Location 21, it can be inferred that the “hard ash” at Locations 18 and 19 are also reddish ash. This is also consistent with the stratigraphy at Location 20 (the location closest to the seaward craters), where the soil strata are underlain by reddish ash of unknown thickness.

Location 22 has a 10-cm layer of “black sand” directly overlaying the lava bedrock. This is reminiscent of the variously described black pyroclastic deposits noted for Locations 5, 7, 12, 16, and 22.

3.1. Inferences about sources and relative ages of Leone Volcanics pyroclastic deposits

A few summary inferences can be made about the relative age and sources of the deposits that are the subject of this report.

- 1) The reddish- and grey-ash strata are generally thickest near the seaward craters. This suggests that they are the source of these deposits.
- 2) For all of the excavation locations reported here, where both grey- and reddish-ash strata are present, the reddish ash is always above the grey ash. It is inferred that the volcanic event(s) that generated the reddish ash occurred later than those that produced the grey ash.
- 3) Locations with black pyroclastics are closer to the inland craters (Figure 6). It is inferred that they are source of this material.

4) At Locations 12 and 16 the black pyroclastics are *below* the reddish-ash layer. At Locations 5 and 7 the black pyroclastics are *above* the reddish-ash layer. There is no reddish-ash layer at Location 22. These facts suggest that at least two eruptive events were responsible for producing the black pyroclastics, at least one before the reddish-ash-producing event(s) and at least one after.

5) If it is correct that the black pyroclastics are from the inland craters and the reddish ash from the seaward craters, then having black pyroclastics both above and below the reddish ash suggests that both seaward and inland craters were active more-or-less contemporaneously.

6) If the soils overlaying the reddish ash are derived from volcanic ash, and if the ash source is the seaward craters, then these craters were the last to erupt – perhaps as recently as AD 1300.

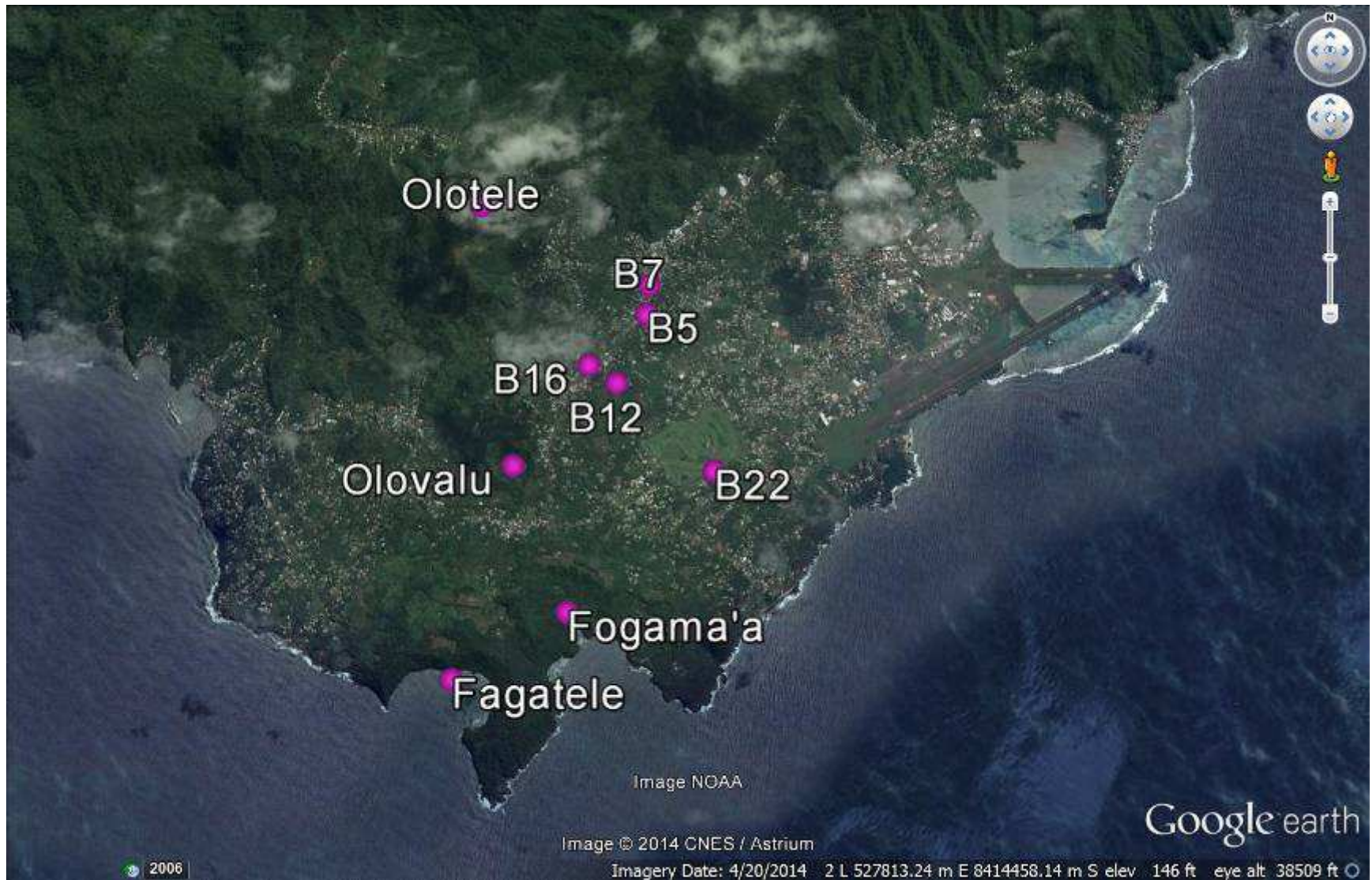


Figure 6. Locations with black pyroclastic deposits.

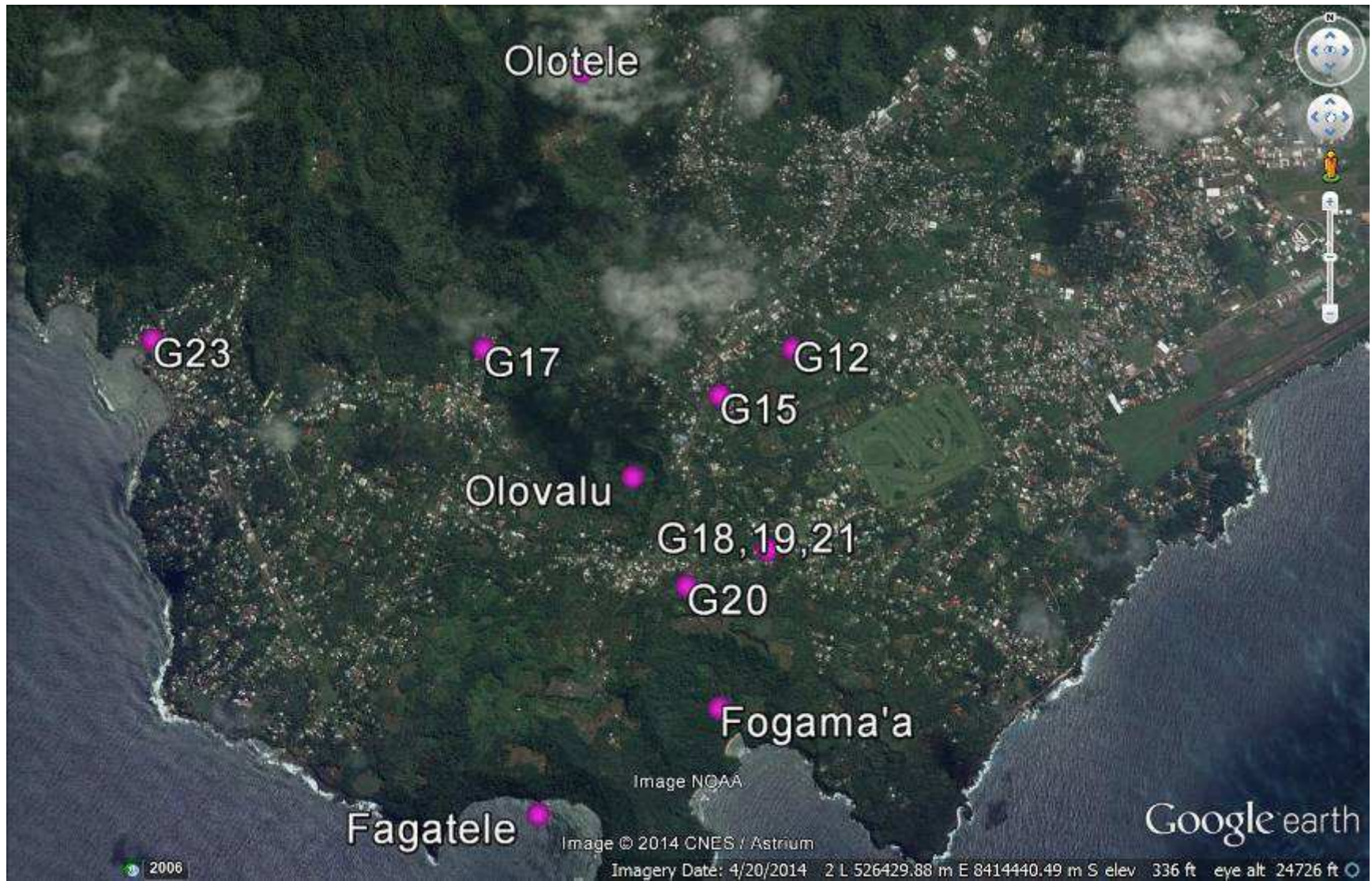


Figure 7. Locations with grey-ash deposits.

4. Observations on deposits by location

This section contains descriptions of sediments at each excavation by location number as listed in the Appendix (Table 1) and shown on Figure 2 and Figure 3. Calibrated date ranges are graphically portrayed on Figure 4. Note that the stratigraphic descriptions were made in the field by various personnel, none of whom had formal geological or sedimentological training; thus, the descriptions of strata in the sections below and in the Appendix (Table 1) vary between observers and are limited by the training of the individuals making them.

4.1. Location 1

Located in Faleniu Village, Location 1 has the reddish-ash layer with ~90-100 cm of sediments below it that are underlain by an a' a flow of unknown thickness. There are ~110 cm of sediments above the reddish ash, however, these include a massive cultural rock construction and the depth of deposits at this location is not therefore directly reflective of sediments derived from airborne volcanics.

At this location, WK-16985 (AD 130-390) is stratigraphically clearly below the reddish-ash layer. The stratigraphic position of WK-16984 is less clear, but given its calibrated age range (AD 1170-1280), it is here interpreted as being deposited after the reddish-ash deposit and is consistent with other dates clearly stratigraphically above the reddish ash.

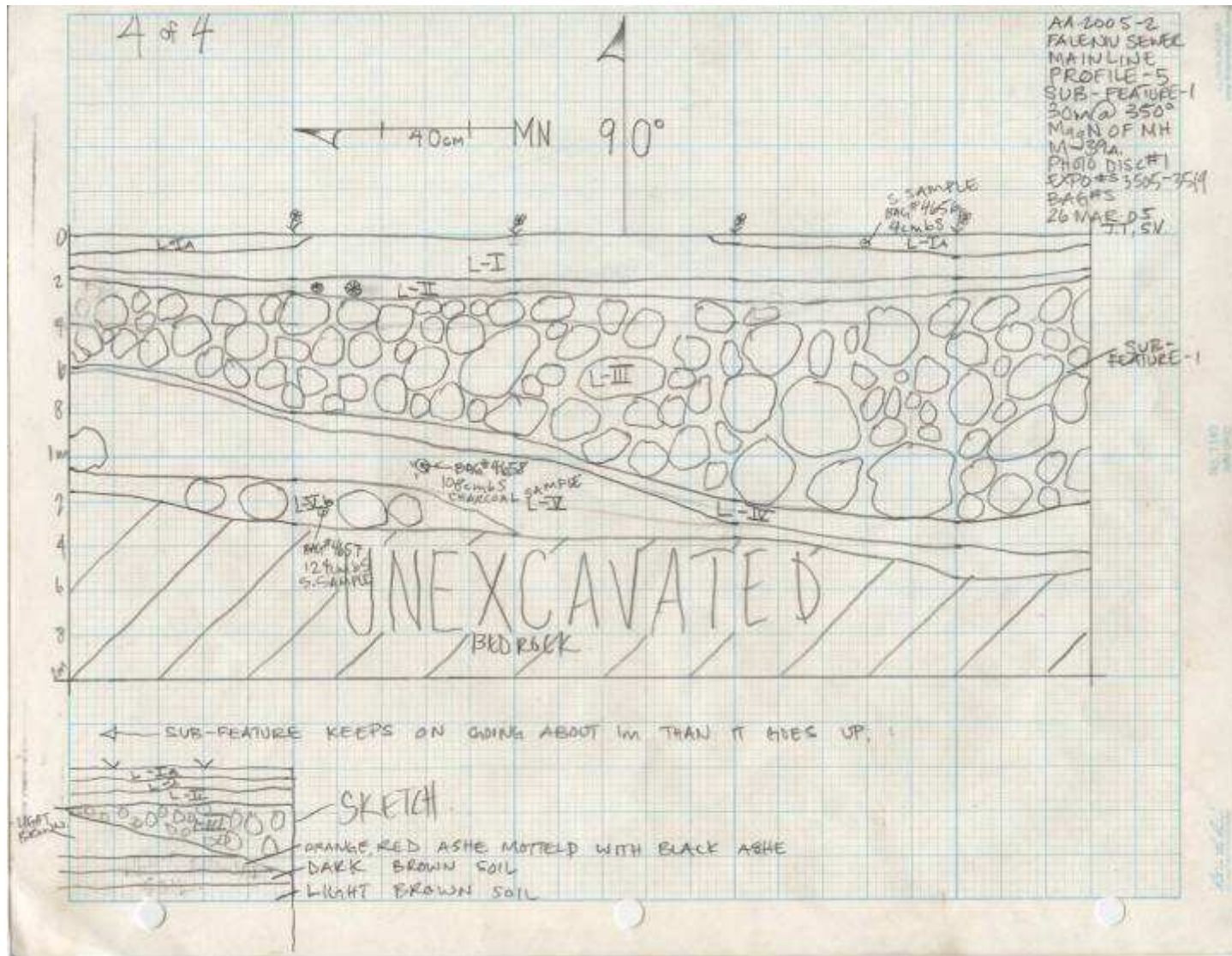


Figure 9. Profile of Location 1. WK-16984 comes from the location in Layer V marked "BAG #4658".

4.2. Location 2

Located in Faleniu Village, Location 2 has a reddish-ash layer with ~30 cm of sediments below it, which are underlain by pahoehoe and a' a flows of unknown thickness. The ~60 cm of sediments above the reddish-ash layer are likely volcanic-ash-derived soils.

WK-18316 (AD 1160-1270) is stratigraphically above the reddish-ash layer, and therefore clearly postdates the deposition of the reddish ash. However, this date cannot be unambiguously associated with the subsequent ash deposits that overlay the reddish ash because the cultural feature from which this dating sample was obtained could have been dug into existing deposits. WK-18314 (AD 580-665) and WK-18315 (AD 530-650) are from cultural features stratigraphically below the reddish ash and reflect a maximum age for the deposition of the reddish-ash layer. These two dates are the most recent dates from below the reddish ash.

4.3. Location 3

Located in Faleniu Village, Location 3 has the reddish-ash layer with at least 50 cm of sediments below it (lava-flow bedrock was not reached at this location). The 35 cm of sediments above the reddish-ash layer are likely volcanic-ash-derived soils. WK-18320 (AD 70-230) comes from below the reddish ash.

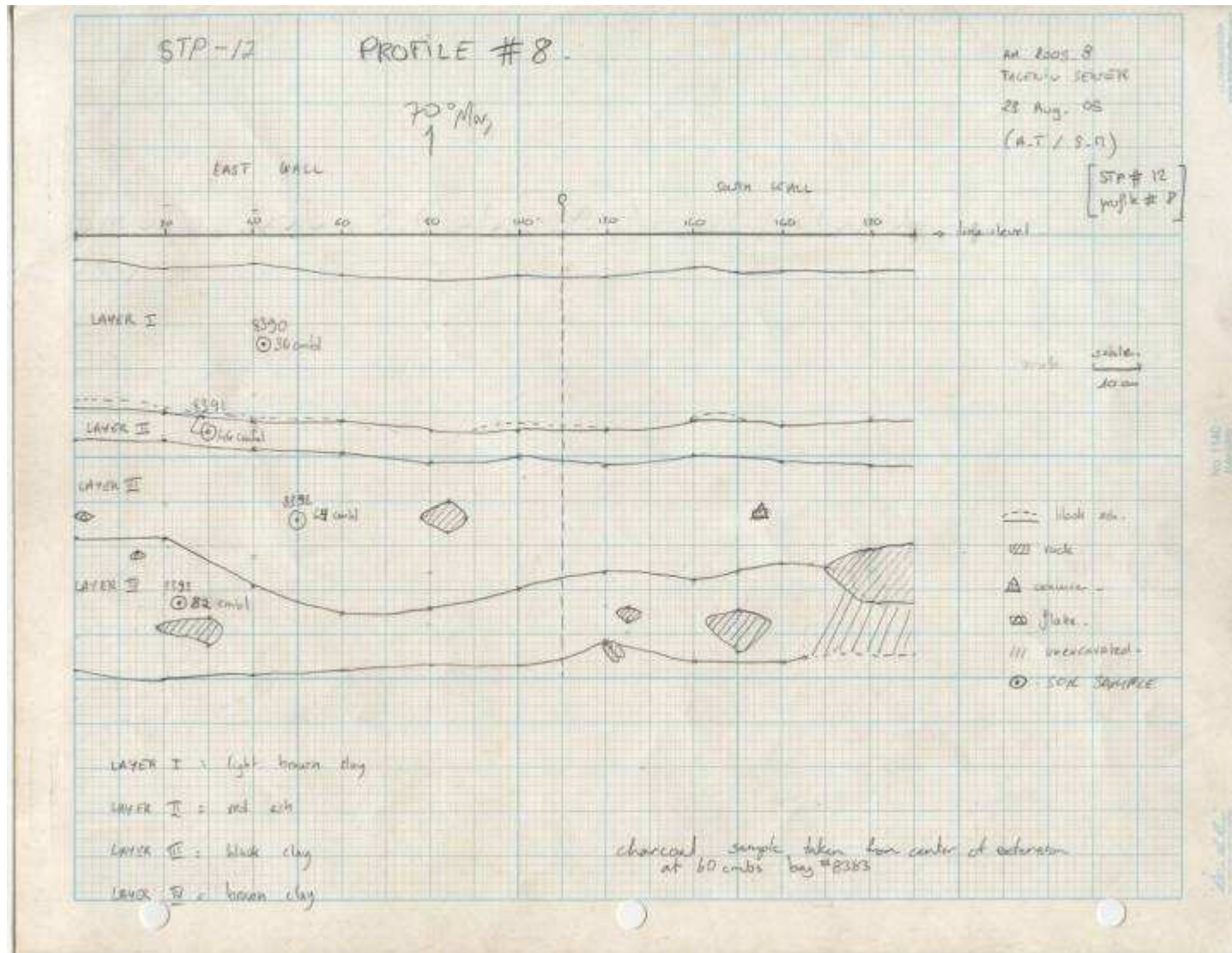


Figure 11. Profile of Location 3. WK-18320 comes from 60 cm below surface in an extension to this excavation that was not profiled.

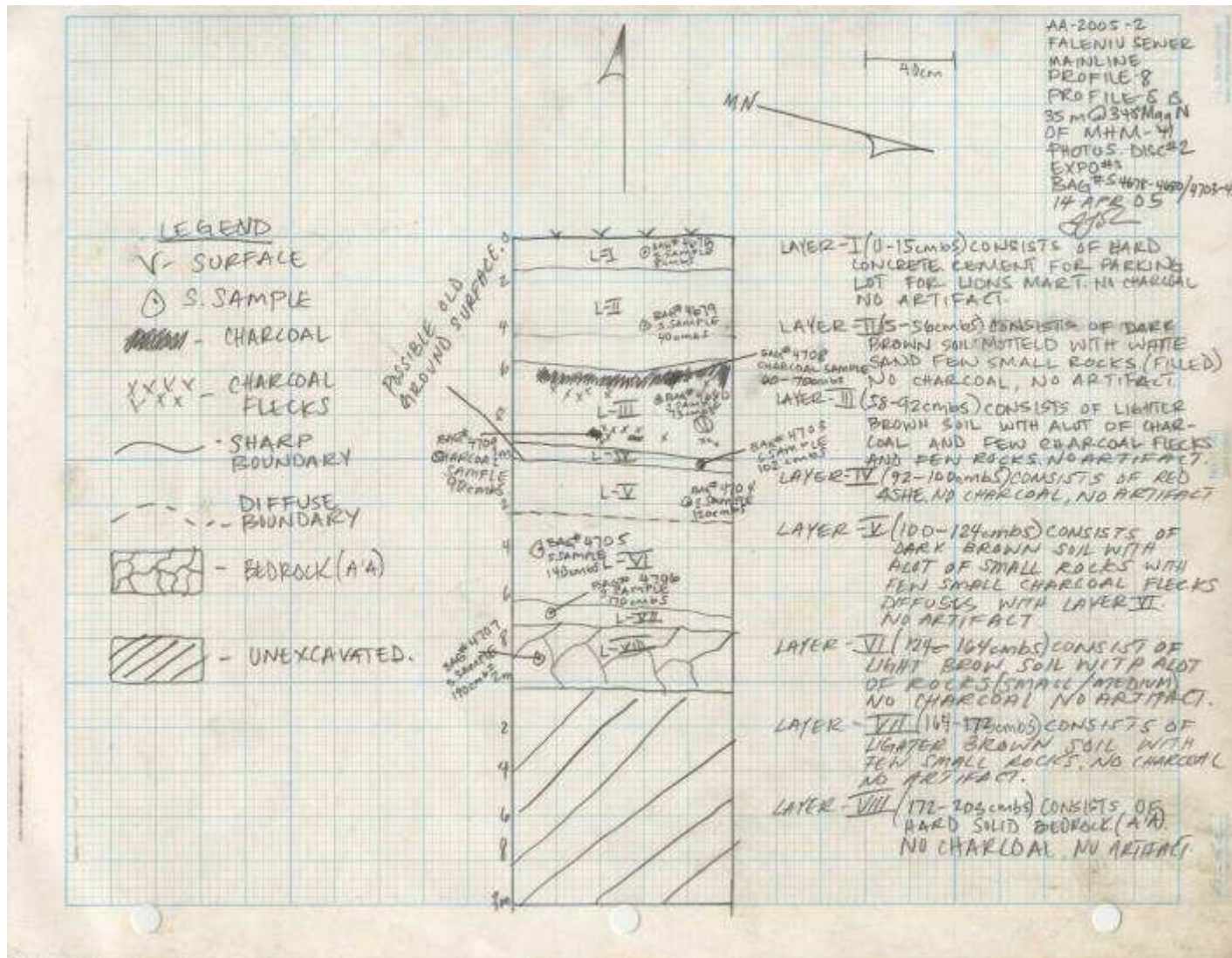


Figure 12. Profile of Location 4. WK-16987 comes from Layer III at the location marked "BAG #4708".

4.4. Location 4

Located in Faleniu Village, Location 4 has a reddish-ash layer with at least 80 cm of sediments below it, which are underlain by an a'ā flow of unknown thickness. There are ~80 cm of likely volcanic-ash-derived soils above the reddish-ash layer.

WK-16987 (AD 810-990) comes from above the reddish ash. This date is the earliest date above the reddish ash and serves as a minimum age for the deposition of the reddish-ash layer.

4.5. Location 5

Located in Faleniu Village, Location 5 has a reddish-ash layer with at least 40 cm of sediments below it (lava-flow bedrock was not reached at this location). The 50 cm of sediments above the reddish-ash layer are likely volcanic-ash-derived soils. The 5-cm layer of “tiny black rocks” directly above the reddish-ash layer may be an airborne volcanic deposit; note that no similar deposit was encountered at the nearby Location 2. WK-18317 (AD 1030-1220) come from above the reddish ash and the “tiny black rocks.”

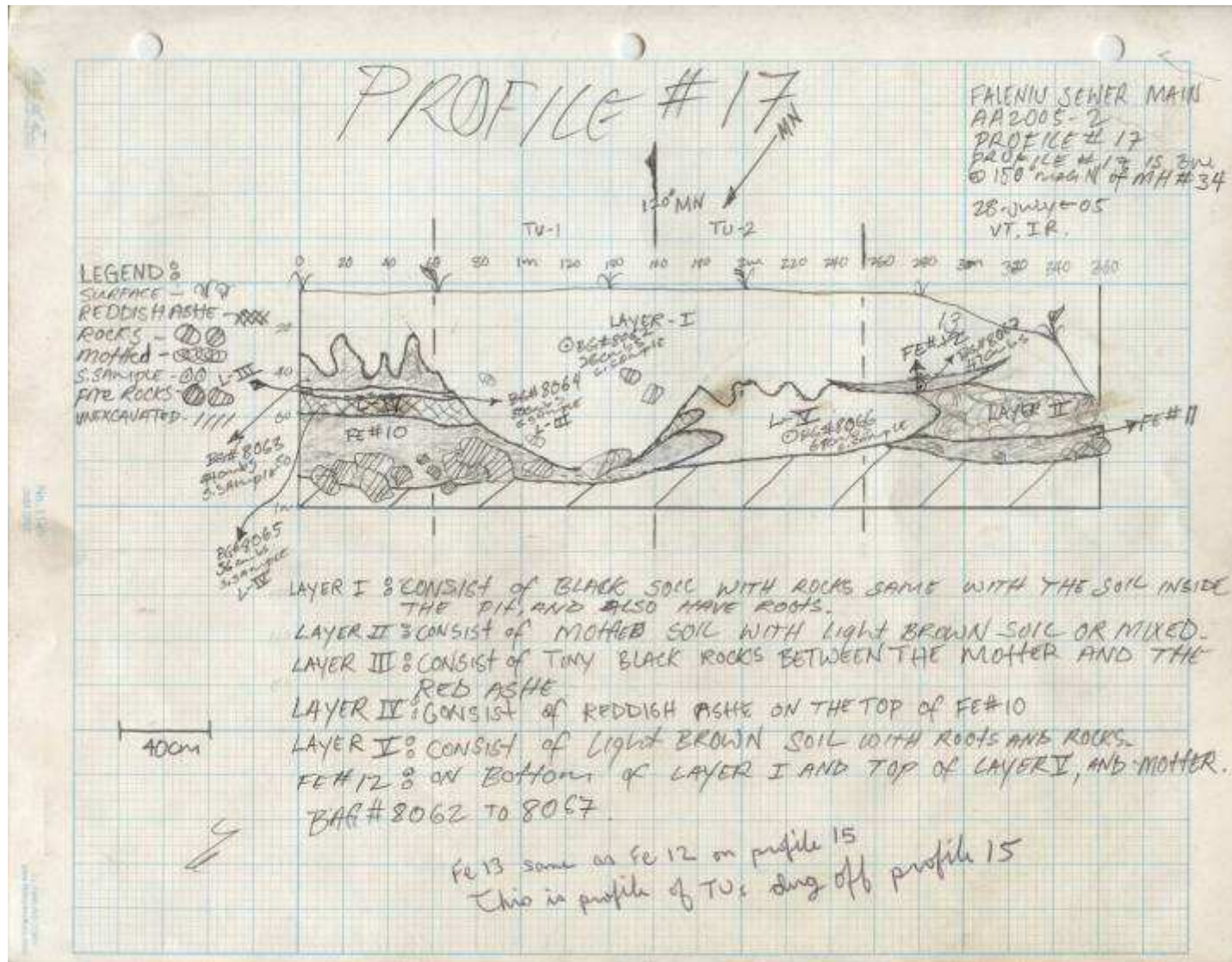


Figure 13. Profile of Location 5. WK-18317 comes from Feature 13 in Layer I at the location marked "BG #8067".

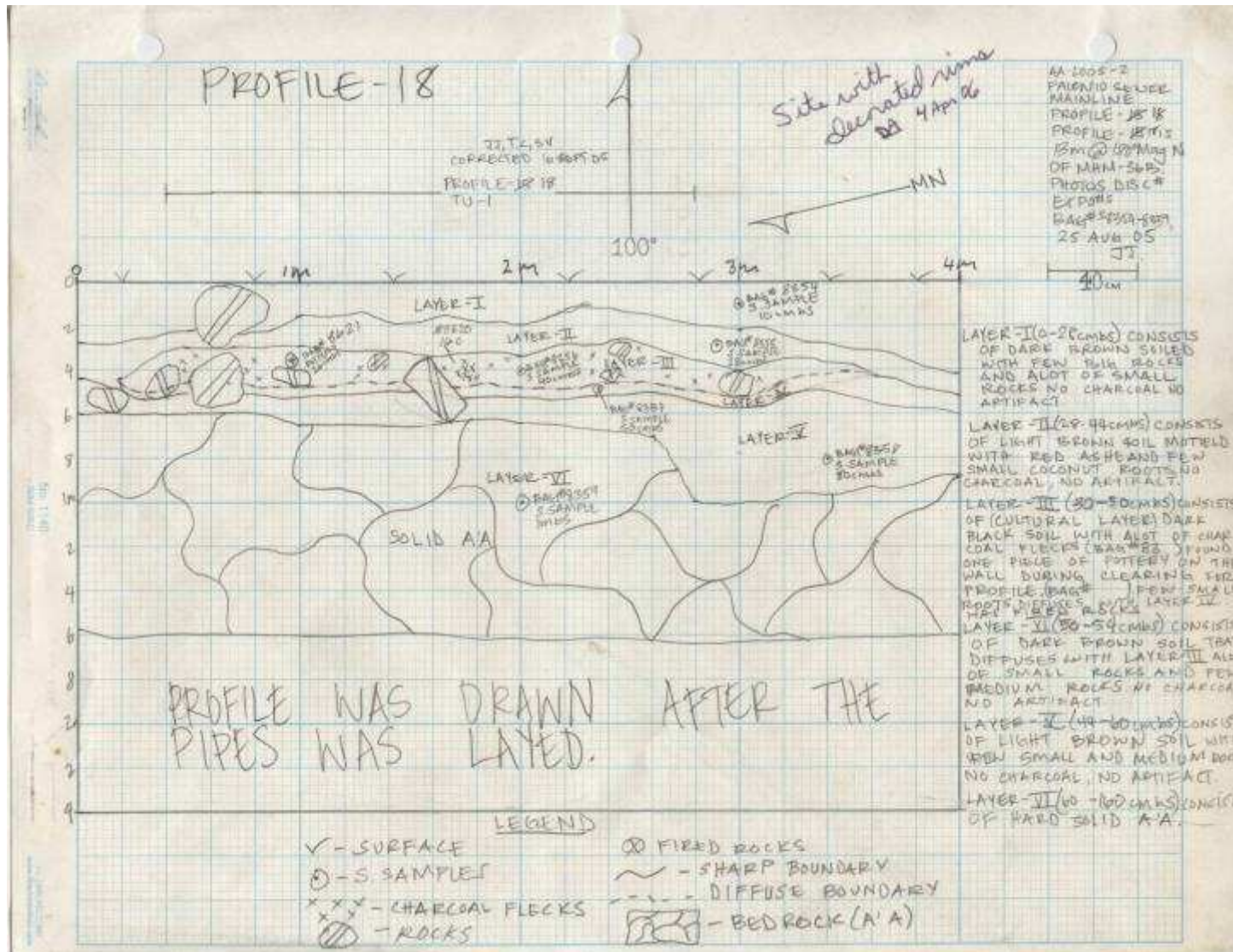


Figure 14. Profile of Location 6. WK-18321 was taken from Layer III at the location marked "#8620".

4.6. Location 6

Located in Faleniu Village near Location 3, Location 6 has a reddish-ash layer (but mottled with brown soil) and with ~20 cm of sediments below it that are underlain by an a'a flow of unknown thickness. The ~20 cm of sediments above the reddish-ash layer are likely volcanic-ash-derived soils. WK-18321 (AD 330-240) comes from below the reddish ash.

4.7. Location 7

Located in Faleniu Village near Location 1, Location 7 has a reddish-ash layer with ~40 cm of sediments below it that are underlain by an a'a flow of unknown thickness. The sediments above the reddish ash include recent (and perhaps also prehistoric) cultural modifications, and as with Location 1, the depth of deposits at this location is not therefore directly reflective of sediments derived from airborne volcanics. A ~40 cm thick layer of black volcanic ash directly above the reddish-ash layer was not encountered at the adjacent Location 1, but it is reminiscent of the "tiny black rocks" directly above the reddish ash at Location 5, some 300 m away.

WK-16986 (AD 670-810) is from an ambiguous stratigraphic position, and its calibrated date range spans the period between the earliest date above the reddish ash (WK-16987, AD 810-990) and the latest date below the reddish ash (WK-18314, AD 580-665). It is not clear therefore how WK-16986 relates to the dating of the deposition of the reddish-ash layer.

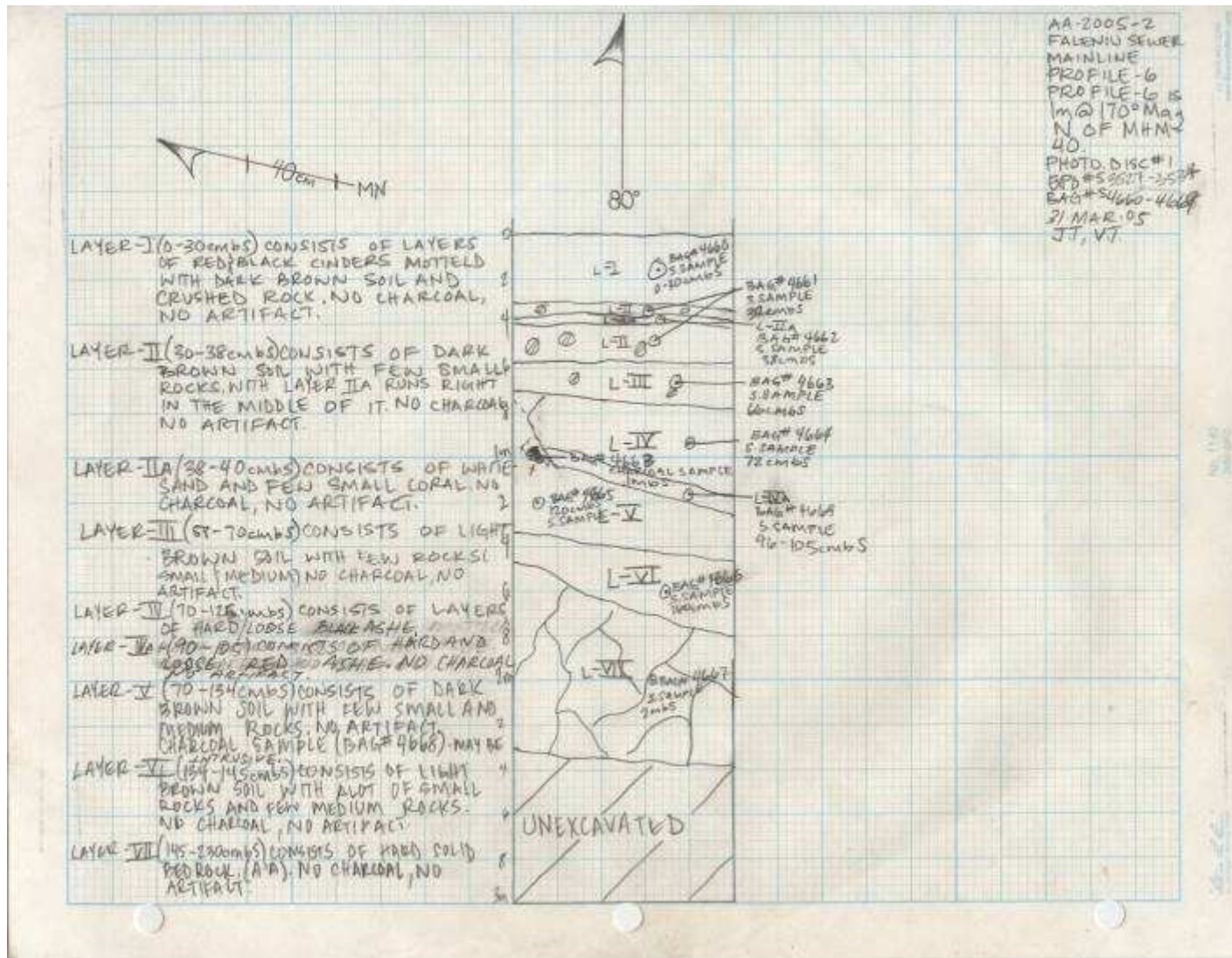


Figure 15. Profile of Location 7. WK-16986 is from Layer V at the location marked "BAG #4668".

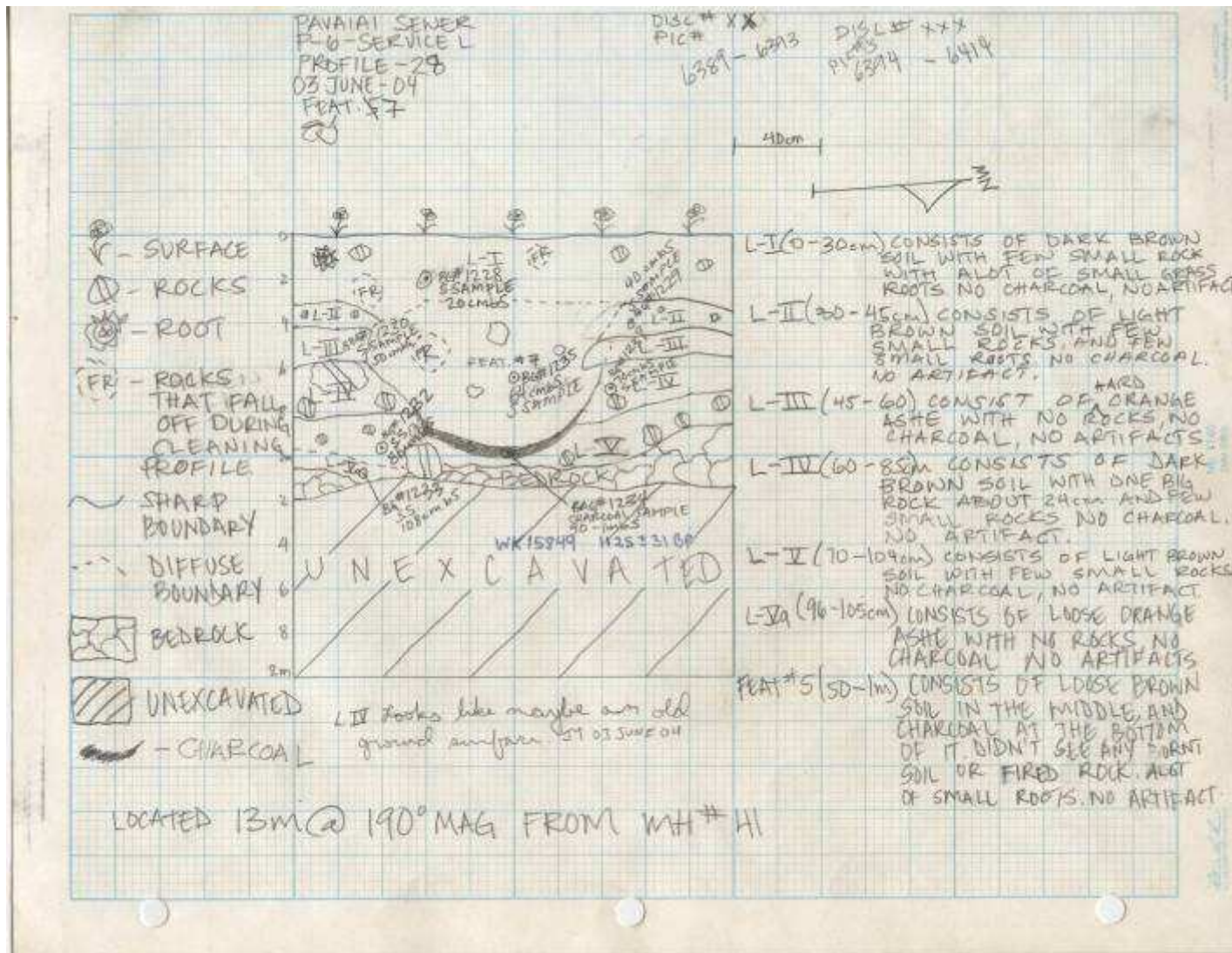


Figure 16. Profile of Location 8. WK-15849 is from the bottom of Feature 7 at the location marked "BAG #1234".

4.8. Location 8

Located in Pava'ia'i Village, Location 8 has a reddish-ash layer (described by the excavators as “hard orange ash”) with ~45 cm of sediments below it. Interestingly, at this location there is a ~10-cm-thick layer of “loose orange ash” directly overlaying the lava bedrock, the thickness of which is unknown. The 40 cm of sediments above the reddish-ash layer are likely volcanic-ash-derived soils.

WK-15849 (AD 780-1000) is from a cultural pit dug from Layer I through the reddish-ash layer, hence postdating the deposition of the reddish ash. Interestingly, Layer II, which is described as a “light brown soil” is between the reddish ash (Layer III) and Layer I. This suggests that, after the deposition of the reddish ash and before the digging of the pit, there was enough time for the deposition and weathering of Layer II into a “soil.” Layer I is also likely a volcanic ash-derived soil, the deposition date of which is unknown, but the possibility exists that its deposition dates to *after* WK-15849 (AD 780-1000).

4.9. Location 9

Located in Pava'ia'i Village, Location 9 has a reddish-ash layer with ~15 cm of sediments below it underlain by a pahoehoe flow of unknown depth. There are 60 cm of sediments above the reddish-ash layer that are likely volcanic-ash-derived soils. This is Location 2 reported in Addison et al. (2006).

WK-15842 (AD 430-640) is from below the reddish-ash layer and hence predates it. WK-16246 (AD 900-1150), from the same excavation and ~9 m away, is from a cultural pit likely dug from Layer II through the reddish-ash layer, hence postdating the deposition of the reddish ash. Similar to Location 8, Layer III, which is described as a “sandy clay loam” is between the reddish ash (Layer IV) and Layer II. Again, this suggests that, after the deposition of the reddish ash and before the digging of the pit, there was enough time for the deposition and weathering of Layer III into a “sandy clay loam.” Layers I and II are also likely volcanic ash-derived soils, the deposition date of which is unknown, but the possibility exists that their deposition dates to *after* WK-16246 (AD 900-1150).

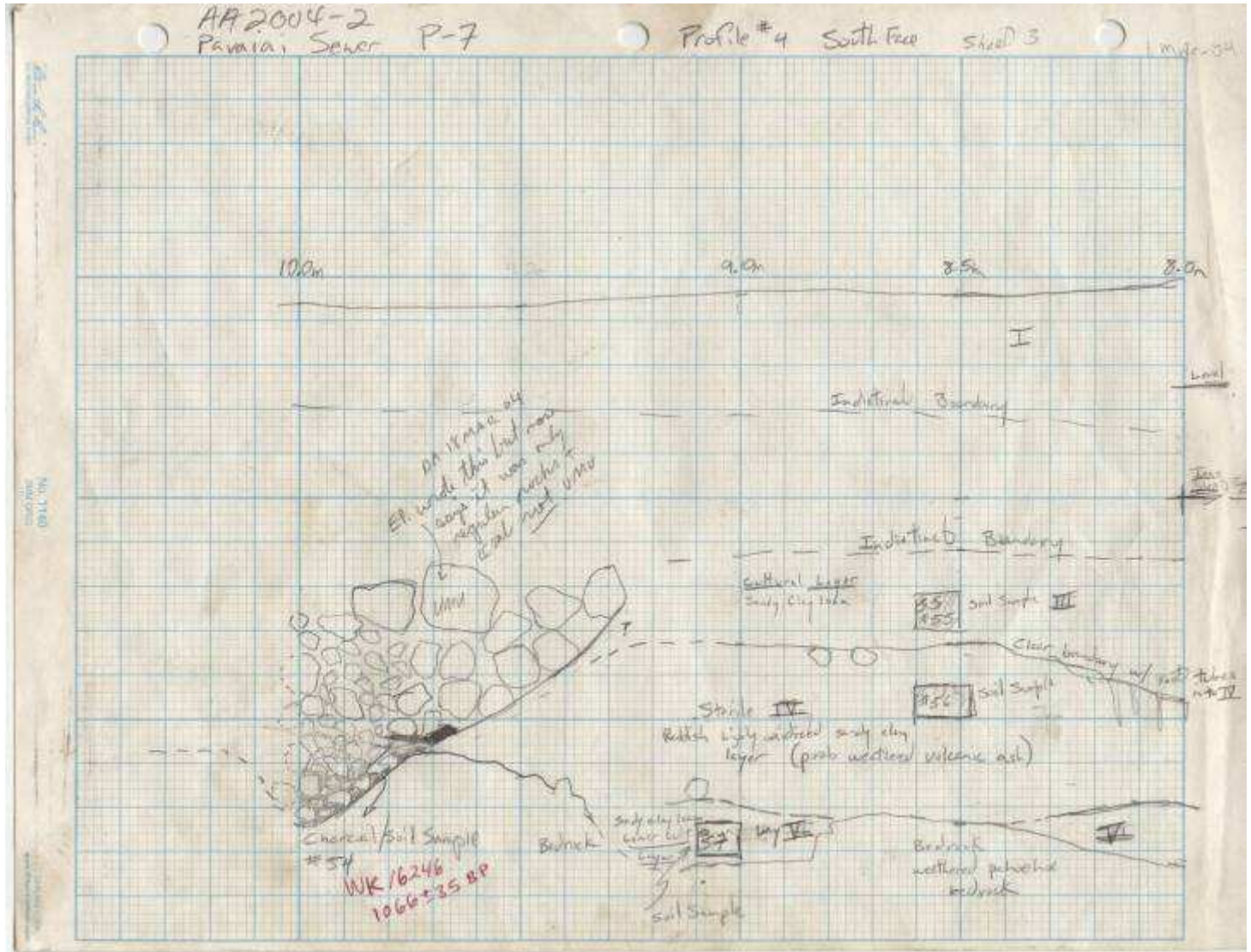


Figure 17. Profile of Location 9. WK-16246 comes from the bottom of the pit feature at the location marked "#54".

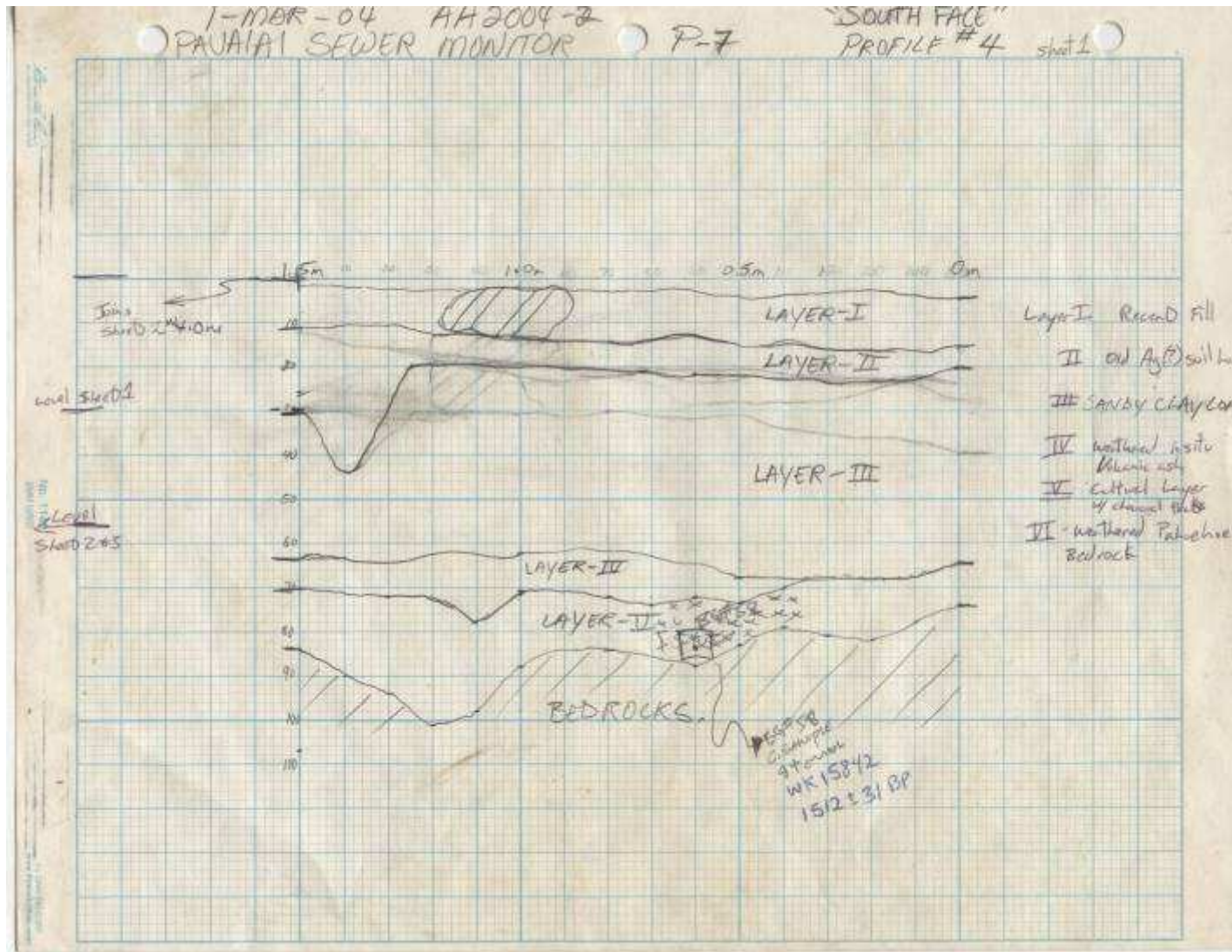


Figure 18. Profile of Location 9. WK-15842 was taken from Layer V at the location marked "BG #58".

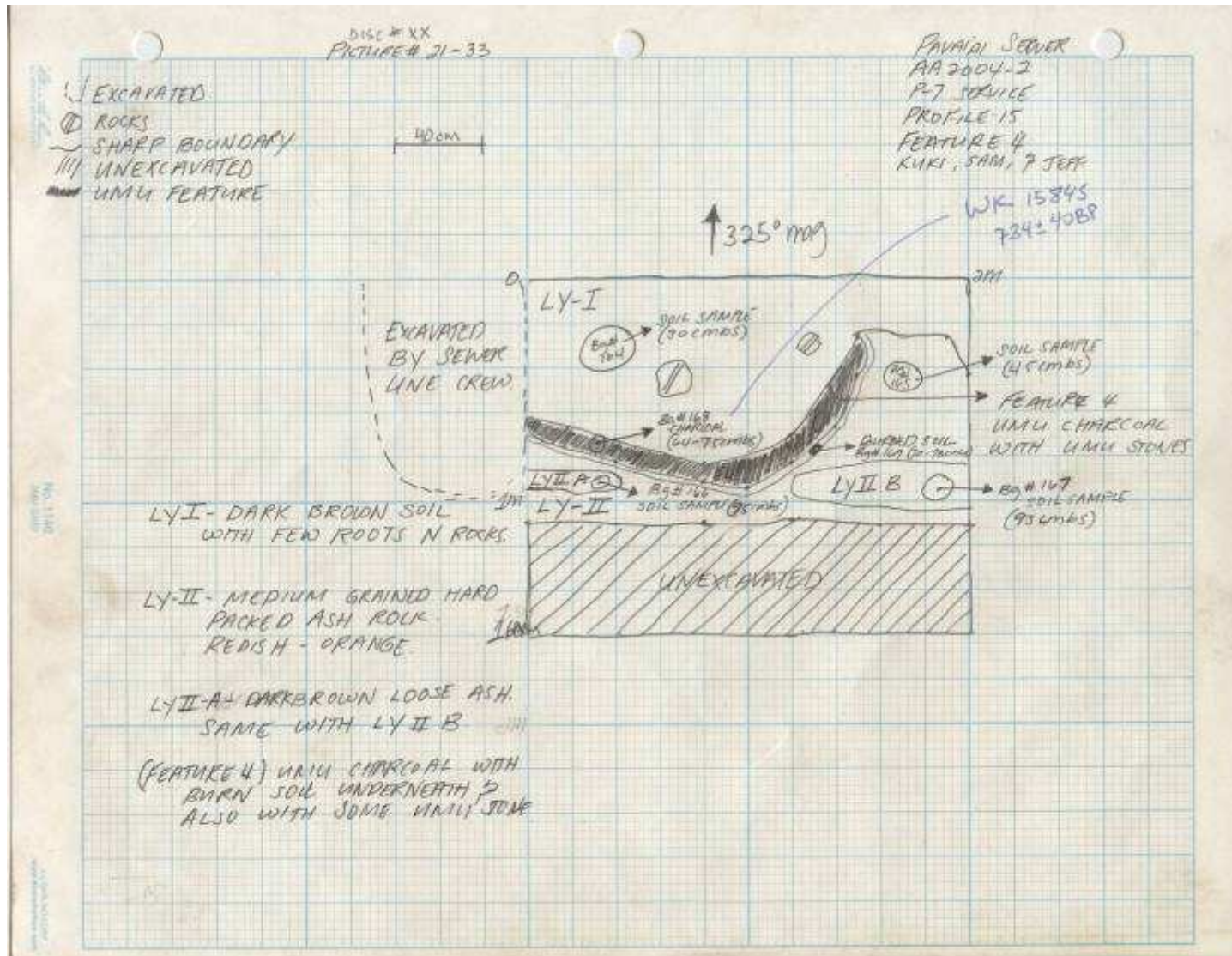


Figure 19. Profile of Location 10. WK-15845 comes from the bottom of the pit feature at the location marked "Bg #168".

4.10. Location 10

Located in Pava'ia'i Village near Location 9, Location 10 has a reddish-ash layer, and excavation did not continue below it. At this location, there is a ~20-cm thick layer of "dark brown loose ash" within the hard reddish-ash layer (compare with the "dark brown loose ash" at Location 14). This suggests the possibility that the reddish ash was deposited by at least two eruptive events. The ~80 cm of sediments above the reddish-ash layer are likely volcanic-ash-derived soils.

WK-15845 (AD 1210-1390) is from a cultural pit likely dug from Layer I into the reddish-ash layer (Layer II) and the "dark brown loose ash" of Layer IIA/B. This date therefore postdates the deposition of the reddish ash.

4.11. Location 11

Located in Pava'ia'i Village, Location 11 has a layer described by the excavators as "brown soil mixed with red ash." A date (WK-15844) from the underlying layer calibrates to AD 420-600. This is Location 1 reported in Addison et al. (2006).

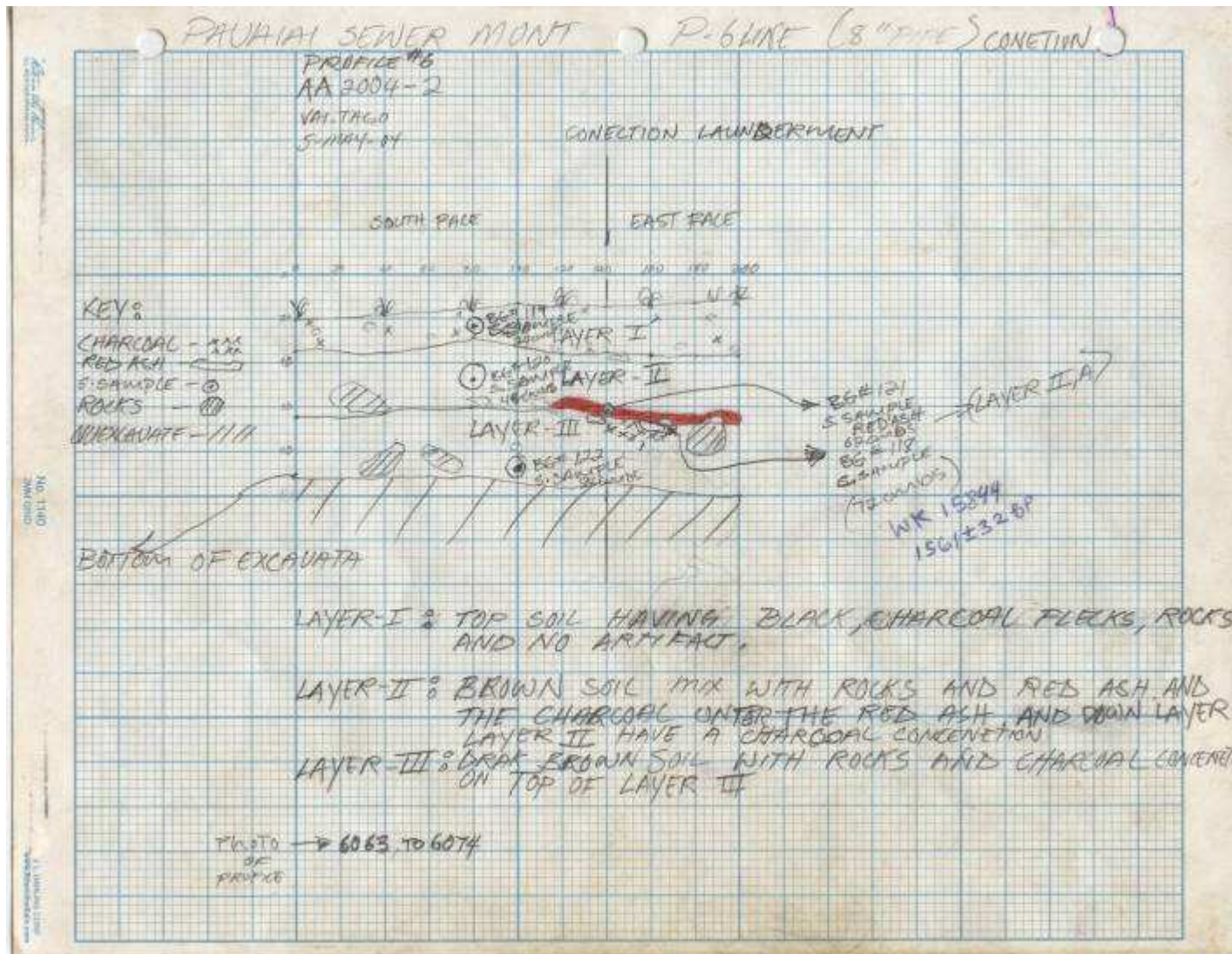


Figure 20. Profile of Location 11. WK-15844 comes from Layer III at the location marked "BG #118".

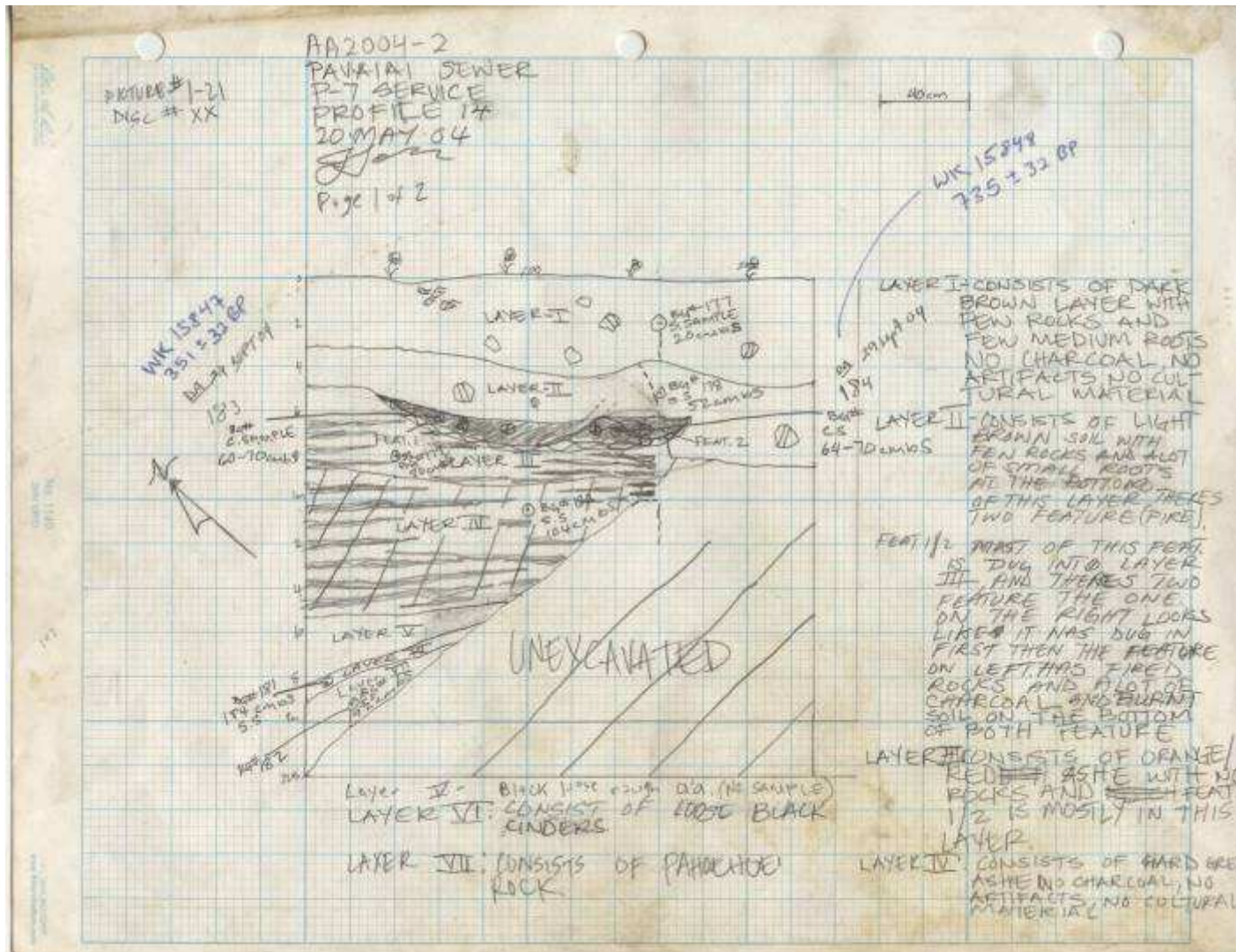


Figure 21. Profile of Location 12. WK-15848 comes from Feature 2 at the location marked "BG #184". WK-15847 was taken from Feature 1 at the location marked "BG #183".

4.12. Location 12

Located in Pava'ia'i Village near Locations 9 and 10, Location 12 has a complicated volcanic stratigraphy. The reddish-ash layer is underlain by ~60 cm of "hard grey ash" followed by ~20 cm of "loose rough a'a." This seems unusually thin for an *in situ* a'a flow, and this may be a cultural deposition. It is underlain by "loose black cinders," which are probably a natural deposition. This is followed by pahoehoe continuing to unknown depth.

WK-15848 (AD 1220-1380) is from above the reddish ash, hence postdating its deposition.

4.13. Location 13

Located in Pava'ia'i Village, Location 13 is the site where the reddish ash was first recognized and dated (Addison, et al. 2006). WK-14532, from below the red ash, calibrates to AD 240-540. This is Location 3 in Addison et al. (2006).

LEGEND

CHARCOAL

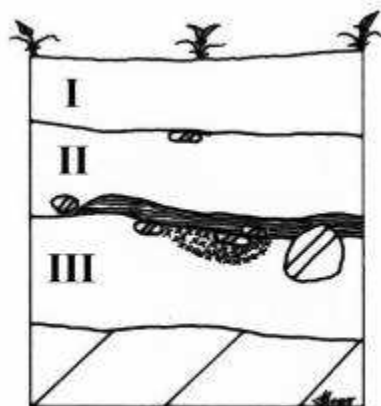
VOLCANIC ASH

CULTURAL DEPOSIT

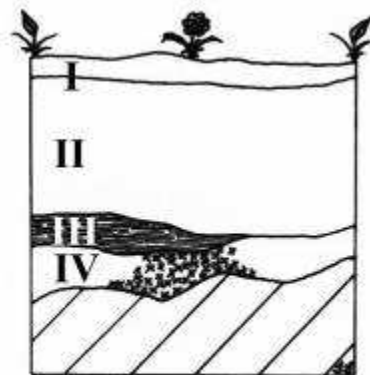
ROCKS



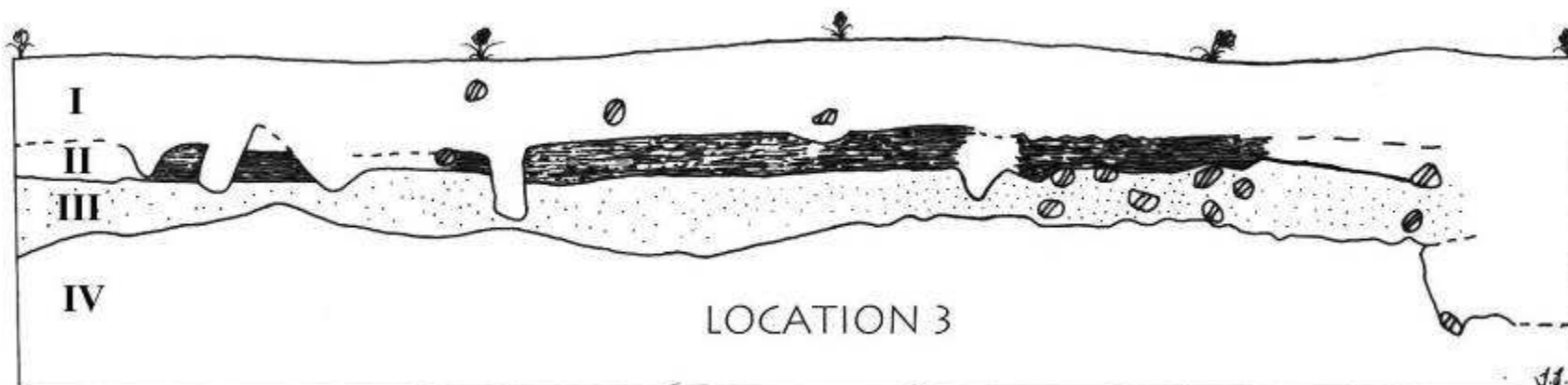
1 m



LOCATION 1



LOCATION 2



LOCATION 3

Figure 22. Profile of Location 13, labeled here “Location 3” (after Addison et al. 2006, drafted by Vai Tago). WK-14532 was taken from Layer III, a ceramic-bearing cultural stratum. “Location 1” in this figure corresponds to Location 11 (Figure 20); “Location 2” above corresponds to Location 9 (Figure 18).

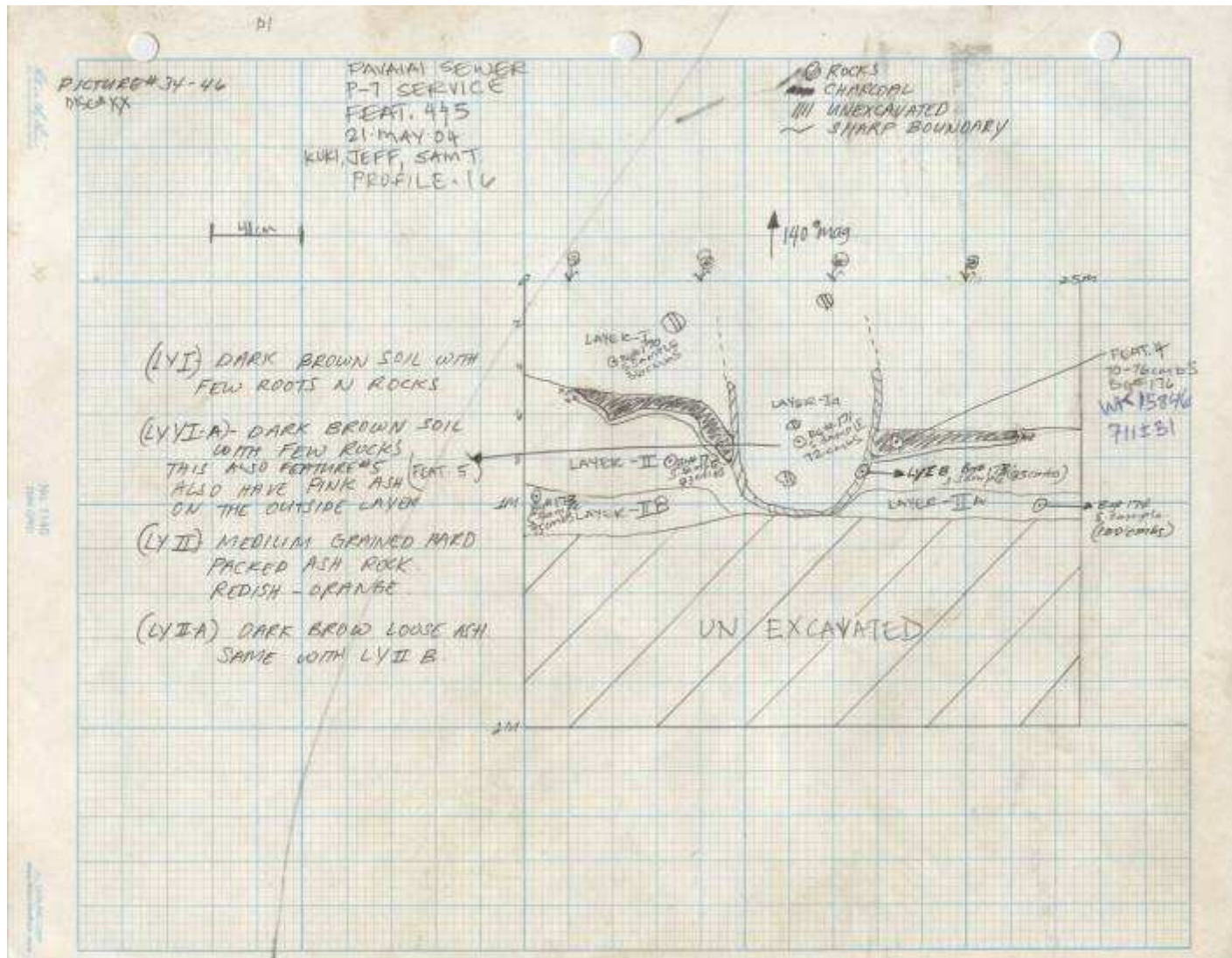


Figure 23. Profile of Location 14. WK-15846 comes from Feature 4 at the location marked "BG #176".

4.14. Location 14

Located in Pava'ia'i Village near Locations 9, 10 and 12, Location 14 has a reddish-ash layer underlain by 20 cm of "dark brown loose ash" (compare with the "dark brown loose ash" at Location 10) that continues to an unknown depth. WK-15846 (AD 1240-1390) is from above the reddish ash, hence postdating its deposition.

4.15. Location 15

Located in Pava'ia'i Village, Location 15 has a "hard ash" layer (color not specified) ~1 m from the surface that continues to an unknown depth. WK-15843 (AD 970-1160) is from above the "hard ash" deposit, thus postdating its deposition.

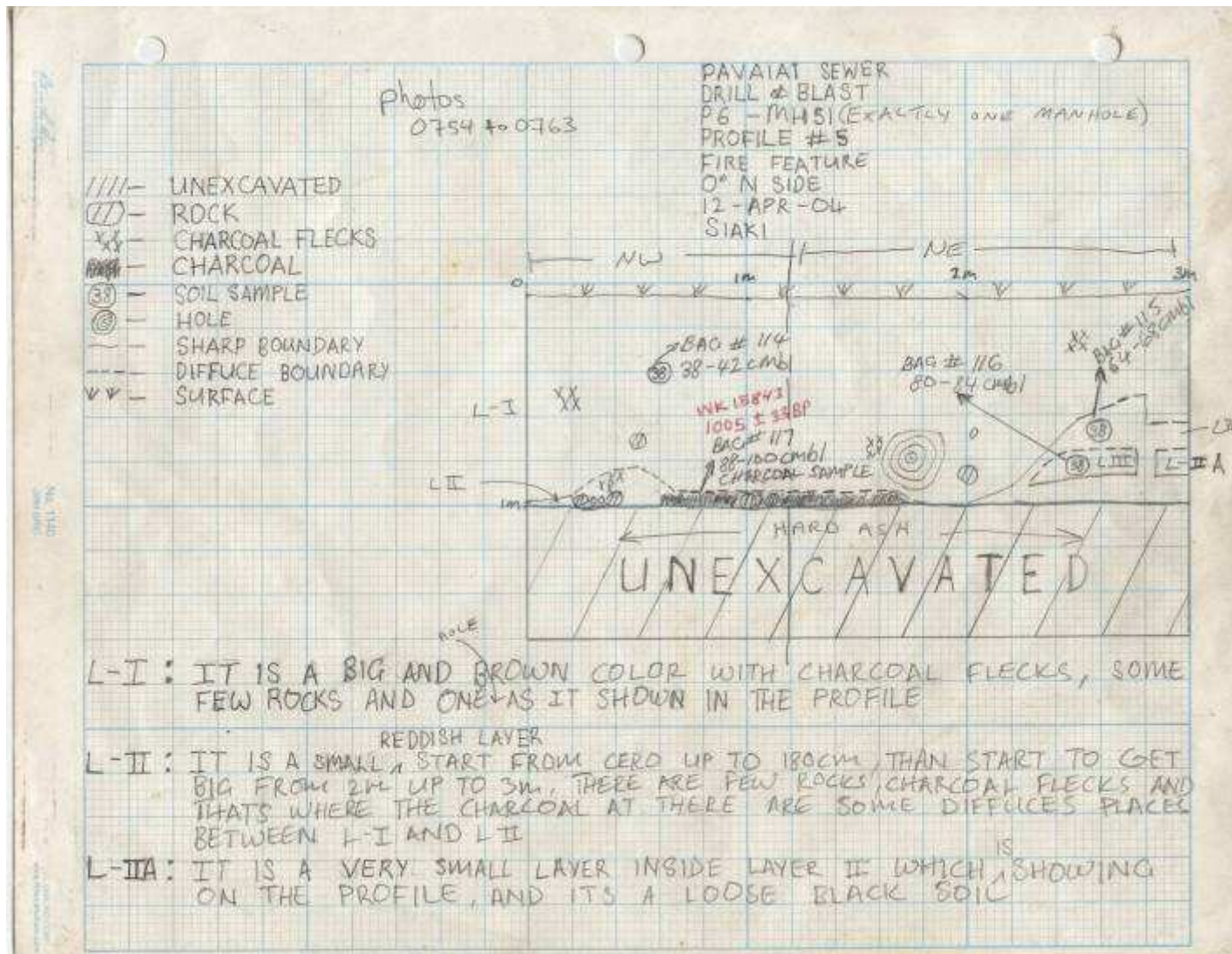


Figure 24. Profile of Location 15. WK-15843 comes from Layer I at the location marked "BG #117".

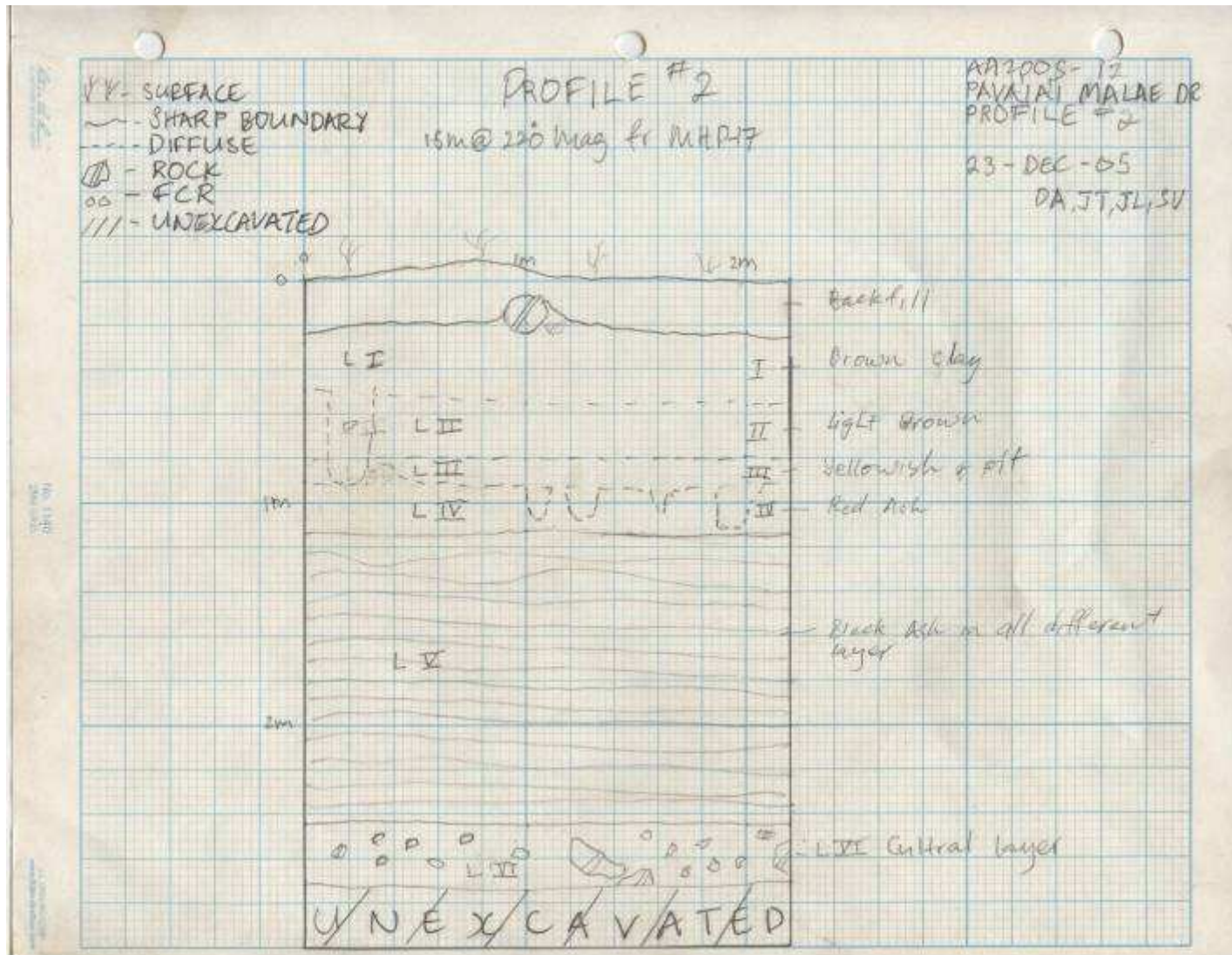


Figure 25. Profile of Location 16. WK-18327 was taken from Layer VI, a ceramic-bearing cultural layer.

4.16. Location 16

Location 15 is on the *malae* of Pava'ia'i Village. There are ~80 cm of likely volcanic ash derived sediments above the reddish-ash layer. Below it are ~120 cm of layers of "black ash," similar to that encountered at Location 7, which is ~1000 m away. Below the "black ash" is a cultural deposit dating to 50 BC – AD 80 (WK-18327). This is underlain by a pahoehoe flow of unknown depth. WK-18327 therefore give a minimum age for the deposition of the pahoehoe flow.

4.17. Location 17

Located in Malaelo Valley, unlike the locations in Faleniu and Pava'ia'i that are *east* of the rift zone, Location 15 is *west* of the rift zone. Due to the proximity of steep slopes, here the sediments are likely derived from a combination of airborne volcanics and erosional material. The reddish-ash layer is underlain by 60 cm of gray ash that continues to an unknown depth. This gray ash is common throughout the area west of the rift zone (and the areas nearest the seaward craters) and can be many meters thick. WK-19414 is from above the red ash and calibrates to AD 1230-1390.

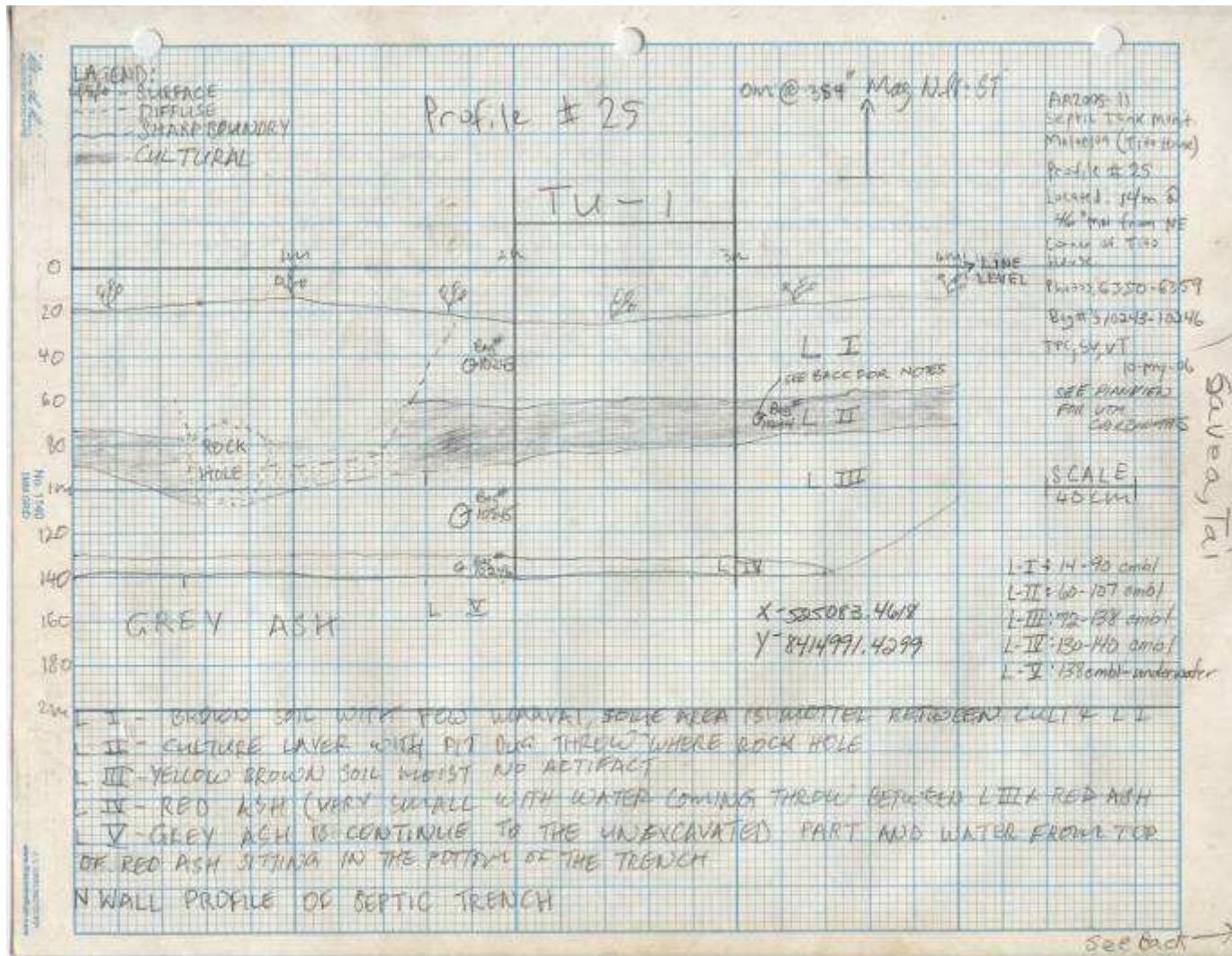


Figure 26. Profile of Location 17. WK-19414 comes from Layer II at the location marked “Bag #10244”.

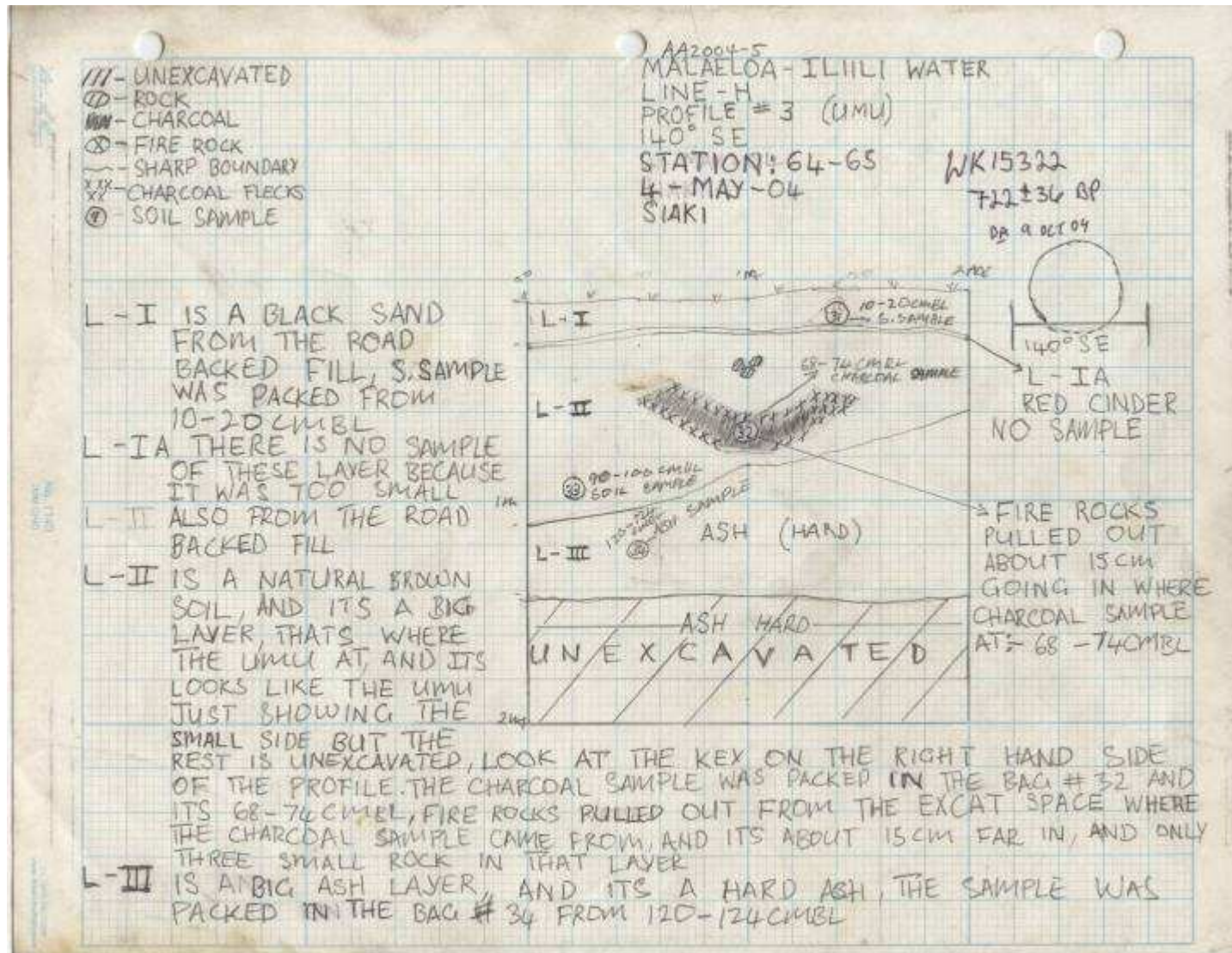


Figure 27. Profile of Location 18. WK-15322 comes from a cultural feature in Layer II at the location marked "32".

4.18. Location 18

Located in Ili'ili Village and on the east side of the rift zone, Location 18 has a “hard ash” layer of unknown thickness (color not specified). It is common in this part of Ili'ili, near the rift zone, to encounter layers of hard grayish ash, sometimes meters thick. At this location, there are ~60 cm of ash derived soil above the hard ash layer. WK-15322 is from above the hard ash and calibrates to AD 1220-1390.

4.19. Location 19

Located in Ili'ili Village and on the east side of the rift zone near Location 18, Location 19 has similar stratigraphy, with a “hard ash” layer of unknown thickness (color not specified). The ash-derived soil above the hard ash layer at this location is ~40 cm thick. WK-15323 is from above the hard ash and calibrates to AD 1300-1440.

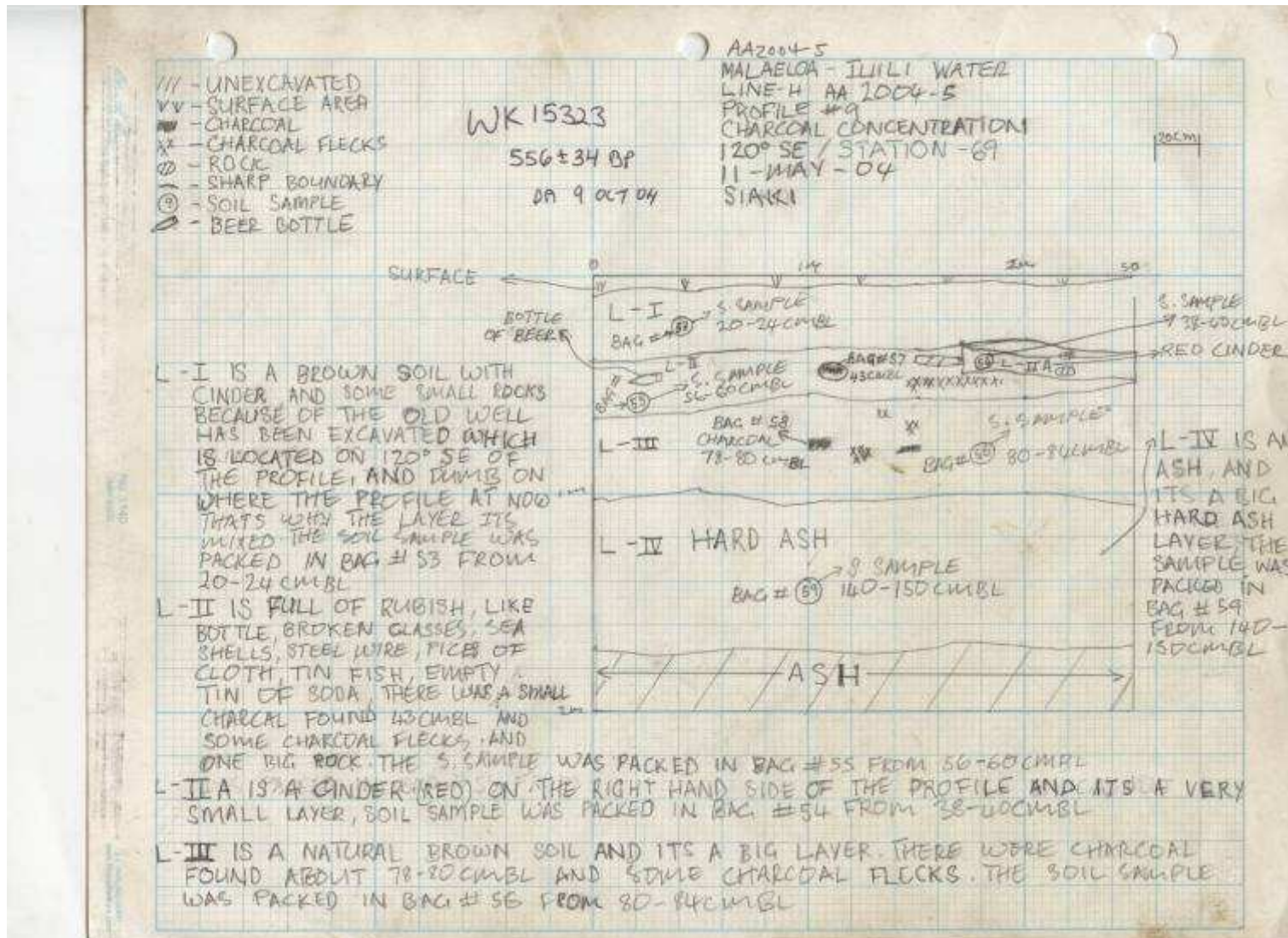


Figure 28. Profile of Location 19. WK-15323 comes from Layer III at the location marked "58".

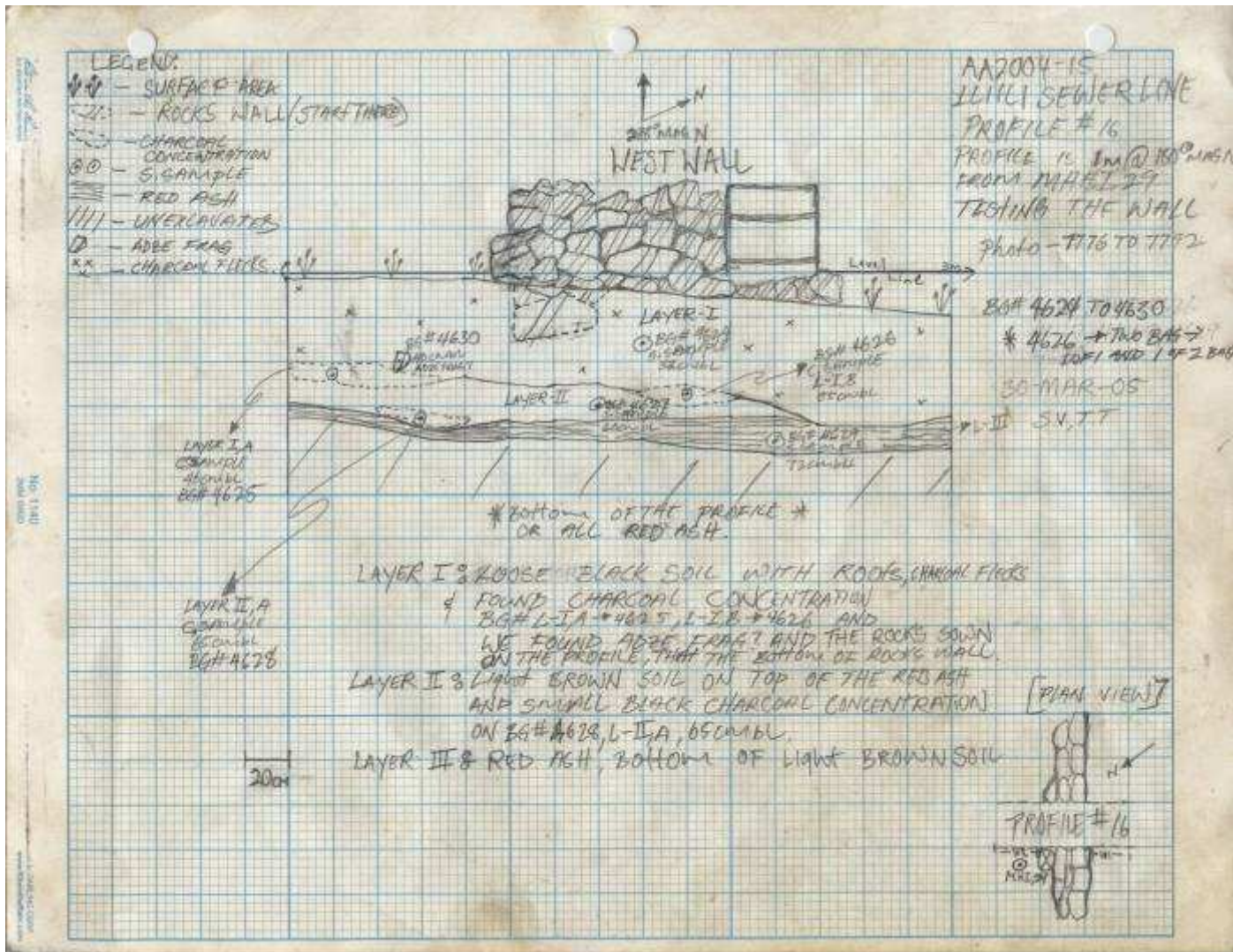


Figure 29. Profile of Location 20. WK-16989 comes from Layer II at the location marked “BG #4628”. WK-16988 comes from Layer I at the location marked “BG #4626”.

4.20. Location 20

Located in Futiga Village on the centerline of the rift zone and between two craters, Location 20 has ~60 cm of ash-derived soil above a reddish-ash layer. The reddish-ash layer is of unknown thickness at this location. Two dates from above the reddish ash calibrate to AD 1510-1810 (WK-16989) and AD 1680-1960 respectively (WK-16988).

4.21. Location 21

Located in Ili'ili Village near Locations 18 and 19, Location 21 has a more complex stratigraphy. Here, there are ~70 cm of ash-derived soil above a thick layer of “reddish orange compacted ash rock.” This is underlain by a layer of “grey compacted ash rock” analogous to the “hard ash” layers at Locations 18 and 19, and here of unknown thickness. WK-16990 is on human bone from above the reddish ash and calibrates to AD 1685-1950.

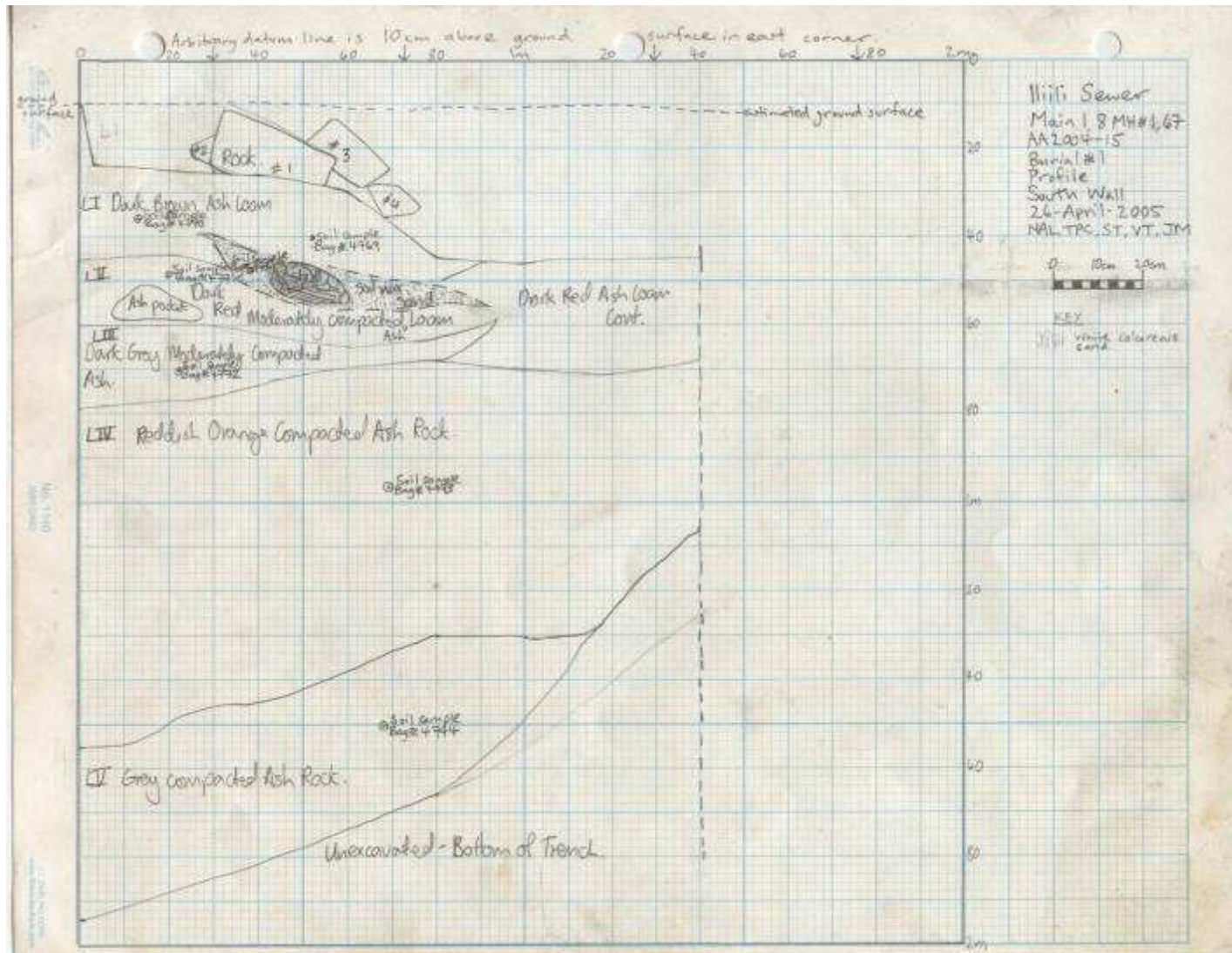


Figure 30. Profile of Location 21. WK-16989 comes from a sample of human bone from Layer I at the location marked “Skull”.

4.22. Location 22

Located in eastern Ili'ili Village, at Location 22 there are ~60 cm of ash-derived soil above lava bedrock that extends to an unknown depth. There is no hard or reddish-ash layer at this location, however, there is a thin (~5-10 cm) layer of "black sand" directly overlaying the lava flow. WK-15320 (AD 1650-1960) is from above the "black sand."

4.23. Location 23

Located in Leone Village, Location 23 is west of the rift zone. As at Location 17 in Malaeloa Valley, here the sediments are likely derived from a combination of airborne volcanics and erosional material because of the proximity of steep slopes. The reddish-ash layer is underlain by a layer of "black (brown) ash" that continues to an unknown depth. This lower ash layer is likely the same as that at Location 17 in Malaeloa, and Locations 18, 19, and 21 in Ili'ili, and similar deposits underlie most of the landscape between western Ili'ili and Leone.

WK-18326 is from above the red ash and calibrates to AD 1020-1190.

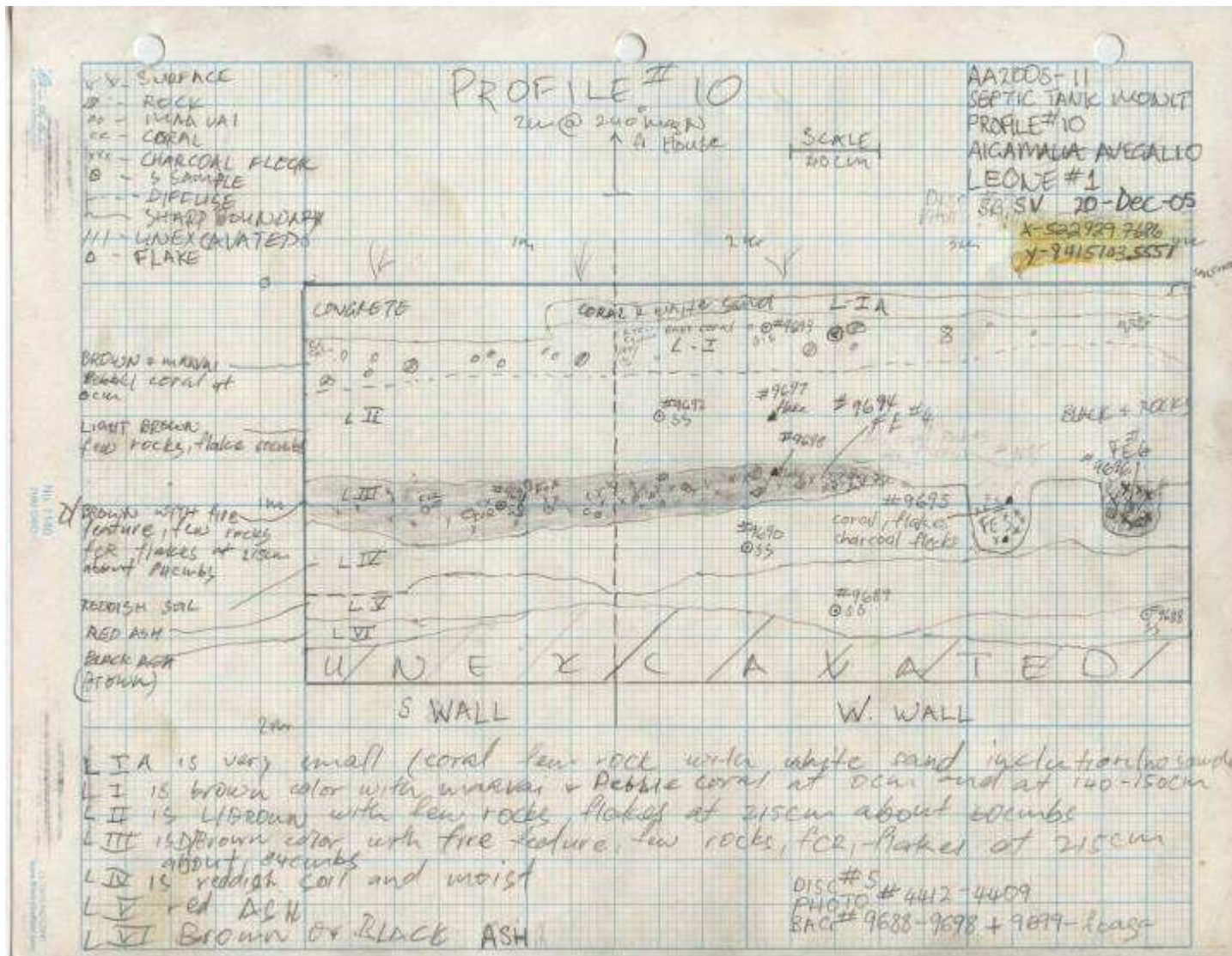


Figure 32. Profile of Location 23. WK-18326 comes from Feature 4 in Layer III at the location marked “#9694”.

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6. Appendix

Table 1. Data on excavation locations.

LOCATION #	ASPA PROJECT #	VILLAGE	PROFILE #	WK #	95.4% DATE	LAYER	THICKNESS	SEDIMENT DESCRIPTION	SEDIMENT ABOVE RED ASH	NON-BEDROCK SEDIMENT BELOW RED ASH
1	AA-2005-2	Faleniu	5				10 cm	Dark brown soil mottled with red cinder with grass. No artifacts, no charcoal.	110 cm	90 cm
	Easting	527418.00				II	10 cm	White sand and few small corals. No artifacts, no charcoal.		
	Northing	8416003.00				III	120 cm	Dark brown soil with a lot of small and big rocks at the far left on the profile is sub-feature, no charcoal. We found few flakes in this Layer, but not sure if its from there or Layer I/II. Also, it has a lot of small water worn rocks (ma'a vai) and few big rocks.		
				16984	1170-1280 AD	IV	20 cm	Dark brown soil with small and medium rocks and few charcoal flecks (small ones). No artifacts.		
						Va	10 cm	Reddish brown soil mottled with red ash. No charcoal, no artifacts.		
				16985	130-390 AD	V	20 cm	Light brown soil with few small rocks and few small roots. Few charcoal flecks (small ones). No artifacts.		
						VI	60 cm	Dark brown with a lot of small rocks. Diffuses with charcoal.		
						VII	40 cm	Light brown soil with a lot of small rocks and few medium rock. No charcoal, no artifacts.		
						VIII	60 cm	Hard solid bedrock (a'a) no charcoal, no artifacts. Layer VIII continues to unknown depth.		

LOCATION #	ASPA PROJECT #	VILLAGE	PROFILE #	WK #	95.4% DATE	LAYER	THICKNESS	SEDIMENT DESCRIPTION	SEDIMENT ABOVE RED ASH	NON-BEDROCK SEDIMENT BELOW RED ASH
2	AA-2005-2	Falenu	15	18316	1160-1270 AD	I	50 cm	Dark brown soil with few medium rocks and a lot of coconut roots. No artifacts and there is a fire feature to the far right (Feature-12).	60 cm	30 cm
	Easting	527400.00				II	20 cm	Light brown soil with few small rocks, with few medium roots. No charcoal, no artifacts.		
	Northing	8415733.00				III	5 cm	Reddish ash. No charcoal, no artifacts.		
				18315	530-650 AD	IV	30 cm	Dark brown soil with few small and medium rocks and a lot of coconut roots. It looks like the original surface. Features 10, 11, and 12 are dug into this layer. No charcoal, no artifacts.		
				18314	580-665 AD					
						V	5 cm	Lighter brown soil with a lot of small loose rocks. No charcoal, no artifacts.		
						VI	70 cm	Hard solid pahoehoe. No charcoal, no artifacts.		
						VII	10 cm	Loose a'a. No charcoal, no artifacts. Layer VII was mostly filled with back dirt because it was too deep. Layer VII continues to unknown depth.		
3	AA-2005-8	Falenu	8			I	30 cm	Light brown clay	35 cm	>50 cm
	Easting	527268.00				II	10 cm	Red ash		

LOCATION #	ASPA PROJECT #	VILLAGE	PROFILE #	WK #	95.4% DATE	LAYER	THICKNESS	SEDIMENT DESCRIPTION	SEDIMENT ABOVE RED ASH	NON-BEDROCK SEDIMENT BELOW RED ASH
	Northing	8415517.00		18320	70-230 AD	III	30 cm	Black clay		
						IV	20 cm	Brown clay		
4	AA-2005-2	Falenu	8			I	15 cm	Hard concrete for parking lot for Lion's Mart. No charcoal, no artifacts.	100 cm	80 cm
	Easting	527405.00				II	30 cm	Dark brown soil mottled with white sand, few small rocks (filled). No charcoal, no artifacts.		
	Northing	8416173.00		16987	810-990 AD	III	30 cm	Lighter brown soil with a lot of charcoal and few charcoal flecks and few rocks. No artifacts.		
						IV	10 cm	Red ash, no charcoal, no artifacts.		
						V	20 cm	Dark brown soil with a lot of small rocks with few small charcoal flecks. Diffuses with Layer IV. No artifacts.		
						VI	35 cm	Light brown soil with a lot of rocks (small/medium). No charcoal, no artifacts.		
						VII	10 cm	Lighter brown soil with few small rocks. No charcoal, no artifacts.		
						VIII	30 cm	Hard solid bedrock (a'a). No charcoal, no artifacts. Layer VIII continues to unknown depth.		
5	AA-2005-2	Falenu	17	18317	1030-1220 AD	I	40 cm	Black soil with rocks same with the soil inside the pit, and also have root.	50 cm	>40 cm
	Easting	527400.00				II	20 cm	Mottled soil with light brown soil or mixed.		

LOCATION #	ASPA PROJECT #	VILLAGE	PROFILE #	WK #	95.4% DATE	LAYER	THICKNESS	SEDIMENT DESCRIPTION	SEDIMENT ABOVE RED ASH	NON-BEDROCK SEDIMENT BELOW RED ASH
	Northing	8415733.00				III	5 cm	Tiny black rocks between the mottled and the red ash.		
						IV	10 cm	Reddish ash on the top of Feature 10.		
						V	30 cm	Light brown soil with roots and rocks. Layer V continues to unknown depth.		
								Feature 12 on the bottom of Layer I and top of Layer V and mottled.		
6	AA-2005-2	Faleniū	18			I	10 cm	Dark brown soil with few big rocks and a lot of small rocks. No charcoal, no artifacts.	10 cm	20 cm
	Easting	527250.00				II	10 cm	Light brown soil mottled with red ash and few small coconut roots. No charcoal, no artifacts.		
	Northing	8415486.00		18321	330-540 AD	III	10 cm	Cultural layer. Dark black soil with a lot of charcoal flecks. Found one piece of pottery on the wall during clearing for profile. Few small roots diffuses with Layer IV. Has <i>umu</i> rocks.		
						IV	5 cm	Dark brown soil that diffuses with Layer III, a lot of small rocks and few medium rocks. No charcoal, no artifacts.		
						V	10 cm	Light brown soil with few small and medium rocks. No charcoal, no artifacts.		
						VI	50 cm	Hard solid a'a. Layer VI continues to unknown depth.		
7	AA-2005-2	Faleniū	6			I	30 cm	Layers of red and black cinders mottled with dark brown soil and crushed rock. No charcoal, no artifacts.	70 cm	50 cm

LOCATION #	ASPA PROJECT #	VILLAGE	PROFILE #	WK #	95.4% DATE	LAYER	THICKNESS	SEDIMENT DESCRIPTION	SEDIMENT ABOVE RED ASH	NON-BEDROCK SEDIMENT BELOW RED ASH
	Easting	527424.00				II	30 cm	Dark brown soil with few small rocks, with Layer IIA runs right in the middle of it. No charcoal, no artifacts.		
	Northing	8416026.00				IIA	5 cm	Consists of white sand and few small coral, no charcoal, no artifacts.		
						III	20 cm	Light brown soil with few rocks (small and medium). No charcoal, no artifacts.		
						IV	40 cm	Layers of hard/loose black ash.		
						IVA	10 cm	Hard and loose red ash. No charcoal, no artifacts.		
				16986	670-880 AD	V	20 cm	Dark brown soil with few small and medium rocks. No artifacts, charcoal sample. May be intrusive.		
						VI	40 cm	Consists of light brown soil with a lot of small rocks and few medium rocks. No charcoal, no artifacts.		
						VII	70 cm	Hard solid bed rock (a'a). No charcoal, no artifacts. Layer VII continues to unknown depth.		
8	AA-2004-2	Pava'ia'i	28			I	30 cm	Dark brown with few small rock with a lot of small grass roots. No charcoal, no artifacts.	45 cm	40 cm
	Easting	527185.00				II	15 cm	Light brown soil with few small rocks, and few small roots. No charcoal, no artifacts.		
	Northing	8415293.00				III	10 cm	Hard orange ash with no rocks. No charcoal, no artifacts.		

LOCATION #	ASPA PROJECT #	VILLAGE	PROFILE #	WK #	95.4% DATE	LAYER	THICKNESS	SEDIMENT DESCRIPTION	SEDIMENT ABOVE RED ASH	NON-BEDROCK SEDIMENT BELOW RED ASH
						IV	30 cm	Dark brown soil with one big rock about 24 cm and few small rocks. No charcoal, no artifacts.		
				15849	780-1000 AD	V	20 cm	Light brown soil with few small rocks. No charcoal, no artifacts.		
						Va	10 cm	Loose orange ash with no rocks. No charcoal, no artifacts.		
								Feature 5 consists of loose brown soil in the middle, and charcoal at the bottom of it. Didn't see any burnt soil or <i>umu</i> rock. A lots of small roots, no artifacts.		
								Lava bedrock below Layer V continues to unknown depth.		
9	AA-2004-2	Pava'ia'i	4			I	15 cm	Recent fill.	60 cm	15 cm
	Easting	527102.00				II	10 cm	Old agricultural(?) soil, hard.		
	Northing	8415035.00		16246	900-1150 AD	III	50 cm	Cultural layer. Sandy clay loam.		
						IV	10 cm	Reddish, weathered-in-situ volcanic ash.		
				15842	430-640 AD	V	15 cm	Cultural layer with charcoal flecks. Sandy clay loam.		
						VI	20 cm	Weathered pahoehoe bedrock. Layer VI continues to unknown depth.		
10	AA-2004-2	Pava'ia'i	15			I	25 cm	Dark brown soil with few roots and rocks.	20 cm	N/A

LOCATION #	ASPA PROJECT #	VILLAGE	PROFILE #	WK #	95.4% DATE	LAYER	THICKNESS	SEDIMENT DESCRIPTION	SEDIMENT ABOVE RED ASH	NON-BEDROCK SEDIMENT BELOW RED ASH
	Easting	527102.00		15845	1210-1390 AD	II	80 cm	Medium grained hard packed ash rock reddish-orange.		
	Northing	8415035.00				IIA	10 cm	Dark brown loose ash.		
						IIB	20 cm	Dark brown loose ash. Layer II continues to unknown depth.		
11	AA-2004-2	Pava'ia'i	6			I	30 cm	Top soil having black charcoal flecks, rocks and no artifacts.	50 cm	>30 cm
	Easting	527058.00				II	25 cm	Brown soil mixed with rocks and red ash and the charcoal under the red ash. Layer II has a charcoal concentration.		
	Northing	8415284.00		15844	420-600 AD	III	40 cm	Dark brown soil with rocks and charcoal concentration on top of Layer III. Layer III continues to unknown depth.		
12	AA-2004-2	Pava'ia'i	14			I	30 cm	Dark brown layer with few rocks and few medium roots. No charcoal, no artifacts, no cultural material.	50 cm	100 cm
	Easting	527102.00		15848	1220-1380 AD	II	20 cm	Light brown soil with few rocks and a lot of small roots. At the bottom of this layer, there are two fire features.		
	Northing	8415035.00				III	30 cm	Orange-red ash with no rocks and Features 1 and 2 are mostly in this Layer. Layer III Continues to unknown depth.		
						IV	60 cm	Hard grey ash. No charcoal, no artifacts, no cultural material.		
						V	20 cm	Black loose rough a'a.		

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						VI	5 cm	Loose black cinders.		
						VII	20 cm	Pahoehoe rock. Continues to unknown depth.		
13	AA-2004-2	Pava'ia'i	3			I	20 cm	Brown silty loam garden soil.	20 cm	20 cm
	Easting	527136.00				II	15 cm	Reddish volcanic ash.		
	Northing	8415254.00		14532	240-540 AD	III	20 cm	Dark, charcoal enriched cultural deposit.		
						IV	120 cm	Pahoehoe bed rock. Layer IV continues to unknown depth.		
14	AA-2004-2	Pava'ia'i	16	15846	1240-1390 AD	I	60 cm	Dark brown soil with few roots and rocks.	60 cm	>20 cm
	Easting	527102.00				Ia	Feature Fill	Dark brown soil with few rocks. This also Feature 5.		
	Northing	8415035.00				Ib	Feature Fill	Pink ash lining Feature 5.		
						II	40 cm	Medium grained hard packed ash rock, reddish-orange.		
						IIa	20 cm	Dark brown loose ash.		
						IIb	25 cm	Same as Layer IIa. Layers IIa and IIb continue to unknown depth.		
15	AA-2004-2	Pava'ia'i	5	15843	970-1160 AD	I	90 cm	Brown color with charcoal flecks, few rocks and one hole as it shown in the profile.	90 cm	NA

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	Easting	526632.00				II	40 cm	Reddish layer starts from 0 up to 180 cm horizontally, then starts to get big from 2 m up to 3 m on the profile. There are few rocks, charcoal flecks. There are some diffuse places between Layer I and Layer II		
	Northing	8414733.00				Ia	10 cm	Very small Layer inside Layer II which is shown on the profile, and it is loose black soil.		
						III	10 cm	Same as Layer Ia		
								Hard ash below Layer II continues to unknown depth.		
16	AA-2005-12	Pava'ia'i	2			I	40 cm	Brown clay.	70 cm	160 cm
	Easting	526824.00				II	20 cm	Light brown.		
	Northing	8415216.00				III	15 cm	Yellowish pit.		
						IV	30 cm	Red ash.		
				18327	50-80 AD	V	120 cm	Black ash in all different layers.		
						VI	30 cm	Cultural layer. Below Layer VI, pahoehoe continues to unknown depth.		
17	AA-25-11	Malaeloa	25			I	40 cm	Brown soil with few <i>ma'avai</i> , some area is mottled between cultural layer and Layer 1.	115 cm	NA
	Easting	525116.00		19414	1230-1390 AD	II	20 cm	Culture layer with pit dug through.		
	Northing	8415042.00				III	40 cm	Yellow brown soil, no artifacts.		

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						IV	10 cm	Red ash (very small, with water coming through between Layer III and red ash).		
						V	60 cm	Grey ash continues to the unexcavated part and water from top of red ash is sitting in the bottom of the trench and wall profile of septic trench. Layer continues to unknown depth.		
18	AA-2004-5	Ili'ili	3			I	20 cm	Black sand from the road back fill.	80 cm	NA
	Easting	526931.00				Ia	5 cm	Road back fill.		
	Northing	8413759.00		15322	1220-1390 AD	II	80 cm	Natural brown soil, and it's a big layer, that's where the umu is, and it looks like the umu just showing the small side but the rest is unexcavated, look at the key on the right hand side of the profile. The charcoal sample was packed in the bag #32 and the charcoal sample came from, and its about 15 cm far in, and only three small rocks in that layer.		
						III	80 cm	Hard ash layer, continues to unknown depth.		
19	AA-2004-5	Ili'ili	9			I	40 cm	Brown soil with cinder and some small rocks. Recent fill.	50 cm	NA
	Easting	526931.00				II	20 cm	Full of rubbish, like bottle, broken glasses, sea shells, steel wire, pieces of cloth, tin fish, empty tin of soda, there was a small charcoal found 43 cmbl and some charcoal flecks, and one big rock.		
	Northing	8413759.00				Ila	10 cm	Red cinder on the right-hand side of the profile and it's a very small layer.		
				15323	1300-1440 AD	III	50 cm	Natural brown soil and it's a big layer. There were charcoal found about 78-80 cmbl and some charcoal flecks.		

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						IV	80 cm	Big hard ash layer. Layer IV continues to unknown depth.		
20	AA-2004-5	Futiga	16	16988	1680-1960 AD	I, Ia, Ib	50 cm	Loose black soil with roots, charcoal flecks, possible adze fragment and charcoal concentration. The rocks shown on the profile are the bottom of a rock wall.	60 cm	>20 cm
	Easting	526423.00		16989	1510-1810 AD	II, IIa	20 cm	Light brown soil on top of the red ash, small black charcoal concentration in Layer IIa.		
	Northing	8413535.00				III	10 cm	Red ash, bottom of light brown soil. Layer III continues to unknown depth.		
21	AA-2004-5	Ili'ili		16990	1685-1800 AD	I	35 cm	Dark brown ash loam.	50 cm	>100 cm
	Easting	526931.00				II	15 cm	Dark red moderately compacted ash loam.		
	Northing	8413759.00				III	20 cm	Dark grey moderately compacted ash.		
						IV	70 cm	Reddish orange compacted ash rock.		
						V	40 cm	Grey compacted ash rock. Layer V continues to unknown depth.		
22	AA-2004-10	Ili'ili	3	15320	1650-1960 AD	I	20 cm	Dark black soil with a lot of small roots and mixed with sand and few small rocks. No charcoal, no artifacts.	NA	NA

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	Easting	528073.00				II	30 cm	Consists of dark brown soil with a charcoal concentration with few charcoal flecks and few small roots. No burnt rock. Just burnt soil under the charcoals.		
	Northing	8414162.00				III	30 cm	Consists of light brown soil with few small roots and no rocks.		
						IV	10 cm	Black sand that strip through Layer III.		
						V	80 cm	Lava bedrock, continues to unknown depth.		
23	AA-2005-11	Leone (Auma)	10			I	40 cm	Brown colour with <i>ma'a vai</i> and coral pebbles at 0 cm and at 140-150 cm horizontally.	130 cm	>10 cm
	Easting	522964.00				Ia	10 cm	Coral rocks with white sand.		
	Northing	8415111.00				II	40 cm	Light brown with few rocks, flakes at 215 cm horizontally and about 60 cmbs.		
				18326	1020-1190 AD	III	25 cm	Dark brown color with fire feature, few rocks, <i>umu</i> rocks, flakes at 215cm horizontally and about 84 cmbs.		
						IV	20 cm	Reddish soil.		
						V	30 cm	Red ash.		
						VI	15 cm	Brown or black ash. Layer VI continues to unknown depth.		