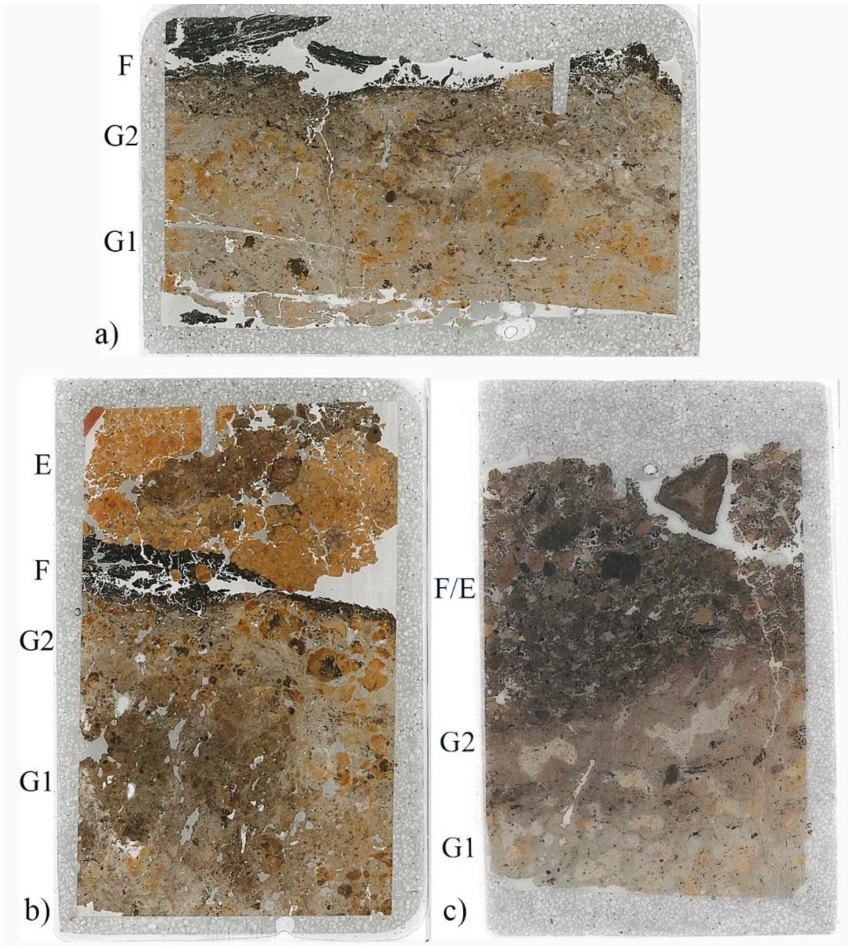
**Supplementary Text**

*Excavation Methods*

The Flying Goose Site (45PO435) was initially recorded in 1997 as an FMR scatter along the river's edge and an historic refuse dump (Dorwin 2018; Philmon 2013). The site was not tested for NRHP eligibility until 2014, at which point Feature 2 was uncovered by the Eastern Washington University field school under the direction of Dr. John Dorwin.[1] Students initially identified the structure through auger coring and excavation of a 1 x 4 m trench (Dorwin 2018:80). In 2015, Goodman Elgar and Carney extended the excavations as described below, and refined the stratigraphy.

We returned in 2015 to excavate Feature 2 stratigraphically. Prior to excavation, backfill was removed and the excavated surface scraped. The Kalispel Tribe maintains a minimally invasive excavation policy, which our field methods accommodate. We excavated an additional 1x1 m unit east of the northernmost unit and extended the 2014 trench to the east by 0.5 m. We employed a 0.5 $m^2$ gridded excavation to allow close spatial control of archaeological remains (e.g. Hrynick et al. 2012; Hrynick and Betts 2014; Milek and Roberts 2013; Ullah 2012). Topsoil was excavated in 10 cm arbitrary levels for the first 20 cm followed by 5 cm levels until we reached occupation materials. Excavation then proceeded stratigraphically to sterile soil. Bulk soil samples of 4-6 L were collected from each context, and all other soil screened through a ¼ inch mesh

[1] Across the site, the top 20 cm were disturbed from historic plowing. Field school students noted historic artifacts in their test units (Dorwin 2018). FMR was visually eroding from the river bank, but no other features (other than Feature 2) across the site retained integrity or dateable material.




**Supplemental Figure 1**. Thin sections and strata designations (5x7cm): (a) Slide SMM-1, (b) slide SMM-2, (c) slide SMM-3

screen. Sediment blocks for thin sections were collected from three locations (Figure 2). Bulk geoarchaeological soil samples were also collected from a nearby trench without features as a control.

*Laboratory Materials and Methods*

Geoarchaeological and paleoethnobotanical analyses were conducted on soil samples from four 0.5 $m^2$ units and one 1 $m^2$ unit, selected to capture different sections of the structure's interior. This judgmental sampling strategy was chosen to compliment thin section analysis and capture distinct areas within the structure for spatial analysis (d'Alpoim-Guedes and Spengler 2014:78; Pearsall 2015:14). Analyses were conducted in the Department of Anthropology, Washington State University. Bulk geoarchaeological samples were subsampled from paleobotanical soil samples through cloning and quartering (Gerlach et al. 2002) prior to flotation.

*Geoarchaeological Analyses.* Twenty-five cultural and six samples from an off-site trench were examined. Bulk soil samples were described in the laboratory and descriptions of soil horizons and sediments follow NRCS guidelines (Burt 2011; Goldberg and Macphail 2006; Holliday 1992; Soil Survey Staff 2017; Supplemental Table 6).

Samples were lightly ground and screened in a 2 mm brass sieve. pH and electrical conductivity (EC) were determined on a Gardco electrode to ±1.0%. Organic carbon and carbonate were determined by loss-on-ignition, a method with an error margin of ± 1% (Heiri et al. 2001). Texture was determined through a two-part process. Very coarse, coarse, and medium sand was determined by wet sieving on 40g subsamples. Fine sand, silt, and clay was determined by laser diffraction on a Malvern Mastersizer S in the Department of Crop and Soil Sciences, Washington State University after pretreatment for organic matter and suspension in sodium hexametaphosphate (Gee and Orr 2002:257; Holliday 2004:373). Samples were sonicated for one hour before analysis. Results were prorated and combined with wet sieving data. Since laser diffraction and sieves measure particles differently, we combined the medium sand fractions for both methods to improve accuracy.

Block samples were collected from three locations to capture the contacts between Strata E-F-G where they appeared well-preserved (Supplemental Figure 1). After air drying for two months, blocks were processed into four 5x7cm thin sections by Spectrum Petrographics (Vancouver, WA). Observations were made on a Nikon Optihot-pol microscope under plane polarized (ppl) and crossed polarized light (xpl) at 50-600x magnification. Photomicrographs were captured with the Nikon Infinity 1 digital camera and software package. Thin section descriptions follow the terminology and conventions of Stoops (2003; Supplemental Table 7).

*Archaeobotanical methods*. A total of 110.2 L from 18 sampled contexts were examined for paleoethnobotanical remains. 32.2 L from the upper strata of Unit B were collected and examined in 2014. An additional 78 L from the 2015 excavations were collected and processed in 2015. After bucket flotation, the light fraction was caught in a 0.25mm nylon mesh (d'Alpoim Guedes 2015; Pearsall 2015:29-33). The light fractions of these samples were divided into a 2 mm, 1 mm, 0.5 mm and 0.25 mm fractions and were each examined using an Olympus SZX7 light microscope. Comparative collections were employed to identify seeds, wood charcoal, and plant tissue. Wood was only examined from the 2 mm fraction, however plant remains were pulled from all other fractions.

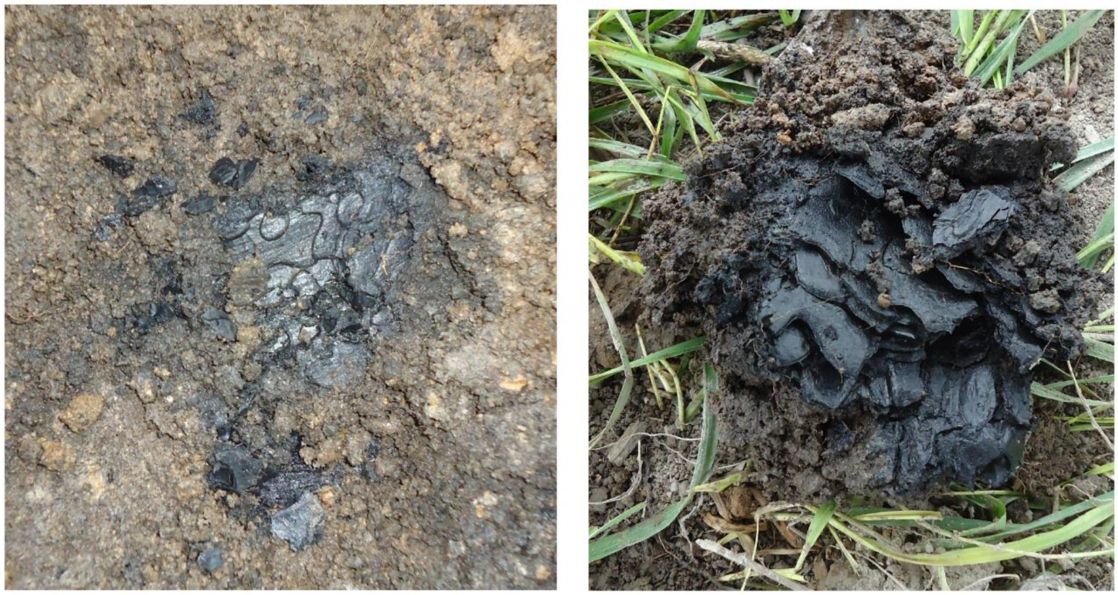
Wood charcoal and parenchyma were selected for Scanning Electron Microscopy imaging on the Hitachi SEM and the FEI Quanta SEM at the Washington State University Franceschi Microscopy and Imaging Center. A modern charred sample of *Camassia quamash* (common camas) was also photographed and the cellular structure noted for comparison to archaeological samples.

*Experimental Methods.* Two firing experiments were conducted to determine the thermal effects of earth oven cooking on the surrounding sediment matrix. Small block subsamples of natural sediment were collected from a depth of 30-35 cmbs which is roughly analogous to the Feature 2 rim depth (Goodman Elgar 2017). These sediment samples were fired at 100 degree intervals between 100-700°C (modified from Shepard 1956 and Rye 1981). Subsamples were fired for a single hour and removed. Color and visible organics were recorded before and after firing (Supplemental Table 8).

The second experiment used the temperature intervals of the ethnoarchaeological earth oven experiment reported by Jackson (1998) in an attempt to replicate the Stratum E samples. Six aggregates from the 35-50 cmbs sample were fired at 700°C for two hours, one was removed, and the remaining subsamples were fired at 800°C for three hours, lowered to 400°C and left for 16 hours when a subsample was removed from the oven. The remaining four "final" samples were further fired at 200°C for 12 hours, 100°C for 17 hours and at 60°C for 16 hours. The total experiment ran 67 hours which is within the range reported by Thoms (1989) for earth ovens (Supplemental Table 9).

*Results*

The following summarizes the site's stratigraphic sequence and each section discusses results from the basal stratum, moving upwards through the profile. Based on field observations, we designated Stratum G a culturally sterile B-horizon. We hypothesized that the well-preserved plant remains in Stratum F constituted the floor of Feature 2. During excavation, Stratum E's soil color appeared reddish; color observations in the laboratory revealed light yellowish brown to pink sediment with extremely firm aggregates (Supplemental Table 5). The composition of Stratum E was puzzling as the rubified sediments did not appear to derive from the fire that burned Stratum F and structural remains recovered along the perimeter. We hypothesized that Stratum E was heated elsewhere and transported to the site. The patchy Stratum D was culturally sterile and appeared to be a riparian deposit. Stratum C had profuse charred plant remains which we



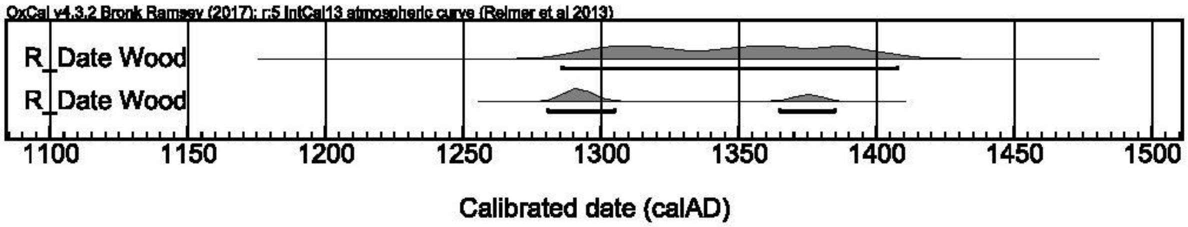
a) b)

**Supplemental Figure 2.** (a) Stratum F ponderosa pine bark as it appeared during excavation, surrounded by Stratum E. (b) Stratum F ponderosa pine after removal from matrix.

interpreted as a second fire event. Stratum B had sparse FMR and may represent a short-term occupation of the locality. Stratum A is topsoil that was plowed (1900's) and subsequently covered in wild grasses.

*Field Excavations.* Several small pieces of FMR and one Plateau Side Notched projectile point were found by the Eastern Washington University field school excavations in the A and B strata (Dorwin 2018). Small (< 5 cm in diameter) and infrequent (< 5 pieces per level) FMR was noted in these upper strata. This FMR was not associated with any features.

Several large concentrations of charcoal were also noted during excavation in Strata C and E. A concentration of fragmented woody charcoal was noted in the upper section of Unit G1 Stratum E. Here, the sediment appeared to have an increased amount of microcharcoal stretching 38 cm long by 7 cm wide. We were unable to separate discrete chunks of charcoal but the charcoal




**Supplemental Figure 3**. Oxcal plot of radiocarbon dates from Stratum F (top date, 710 ± 30 BP, Beta-411665) and Stratum C (bottom date, 670 ± 30 BP, Beta-423252).

appeared log like and may have been a fuel source for the Stratum C incendiary event. A charred log was also visible in the profile wall of Unit F4, Stratum C, and stretched diagonally from 33-45 cmbl and measured 15 cm long. Bulk botanical and geoarchaeological analyses were not conducted for this unit, although there is potential to examine these samples.

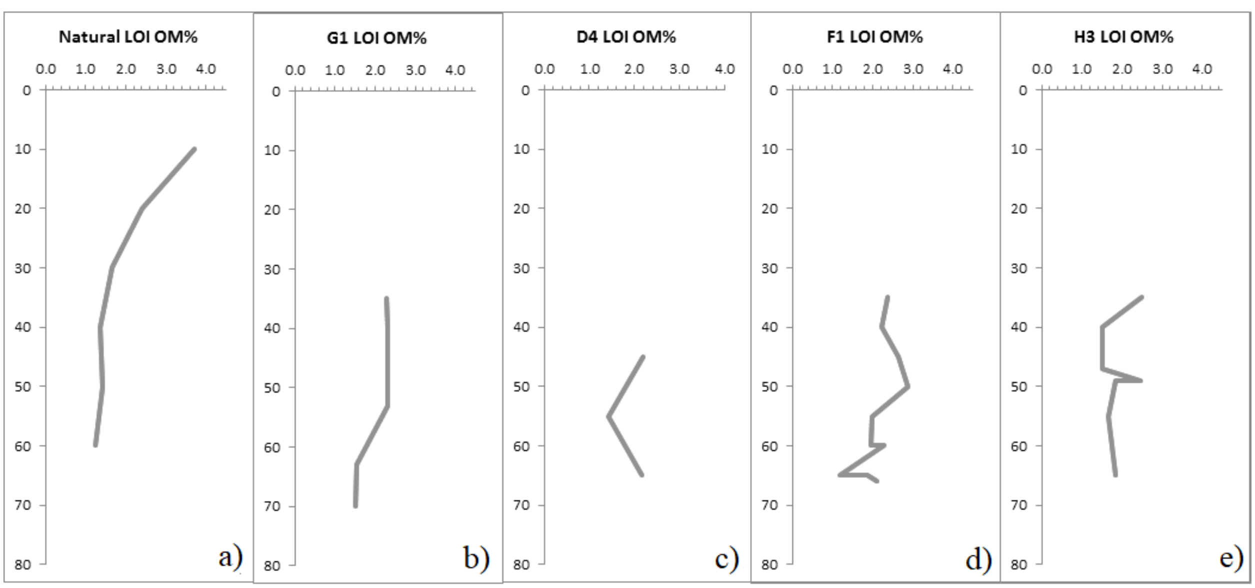
During excavation, it was noted that Stratum E undulated and was varied in depth and soil consistency throughout. Authors Goodman Elgar and Carney also noted in some locations, Stratum F appeared as a bark matting and was exceptionally well preserved (Supplemental Figure 2).

Two dates (woody charcoal) from Strata C and F yielded an occupation range of 577-683 cal BP or 1335-1441 cal AD (Dorwin 2018; Supplemental Figure 3). The basal date of 570-685 cal BP is associated with Stratum F, while the Stratum C date yielded a range of 560-675 cal BP.

During their field excavations, Goodman Elgar and Carney recovered one metasedimentary flake in Stratum E, and no faunal remains were recovered during screening (1/4" mesh) or flotation.

*Bulk Geoarchaeology*. Organic matter content (OM) yielded the most salient results (Supplemental Figure 4). Stratum F OM trends slightly higher than that of the surrounding strata, most likely due to the presence of charred plant remains. As mentioned previously, Stratum E was markedly different than the other strata in both soil color and consistence (Supplemental Tables 5 and 6). There is an increase in overall sand content and decrease in OM, likely related to the sintered sediment and paucity of charred macroremains in this stratum. These results indicate this sediment layer differs significantly from the natural soil matrix. Only one Stratum D sample was processed, as this stratigraphic layer was not consistent throughout. OM, color, and sand content is comparable to natural soils and this stratum may represent a riparian freshet event. Stratum C also exhibited a marked increase in OM percentage (Supplemental Table 5). Macrocharcoal was noted during soil description and this most likely contributed to these OM values and the macrobotanical results. No microartifacts or faunal material was recovered from fine screening of soil samples.

*Micromorphological.* Thin section sample SMM-1 was recovered from the western excavation wall of Unit D at the corner with the pedestalled excavation (Supplemental Figure 1a). SMM-2 was collected from the north central edge of Unit C (Supplemental Figure 1b), and SMM-3 was taken from the eastern excavation edge of Unit C (Supplemental Figure 1c) and was bioturbated. In thin section, Stratum G comprised two microstratigraphic layers differentiated by color, birefringence, porosity and organic inclusions (Layer G1, Layer G2). All thin sections



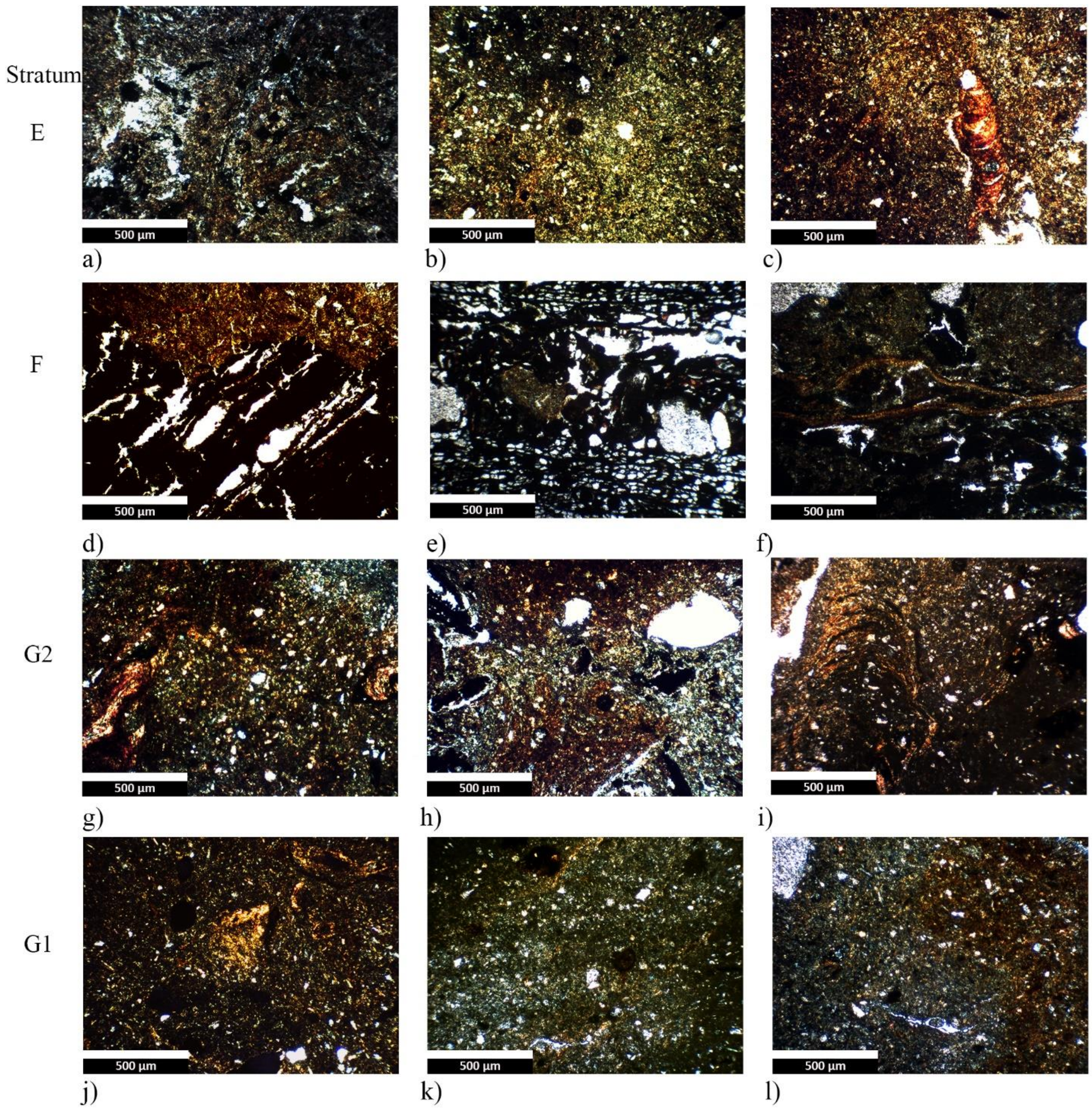

**Supplemental Figure 4**. Organic matter percentage depth plots. The x-axis is a percentage; the y-axis is depth below level in cm.

contained captured Layers G1and G2 and Stratum F (Supplemental Figure 1). The lower portion of Stratum E was also seen in Slide SMM-2 (Supplemental Figure 1b). No mineral or artifact inclusions were observed.

The groundmass of Stratum G1 is light-colored fine silty loam with low porosity. There are abundant clay and sesquioxide pedofeatures including amorphous staining, infillings and nodules (Supplemental Figure 5k, l). Yellow to orange illuvial clay pedofeatures appear as linear or crescentic light yellow void infillings (Supplemental Figure 5j), or compound infillings with sesquioxides. Sesquioxide are common both as infilling, and nodules which range from silt to pebble size, and appear as mottles in hand specimen (Supplemental Figure 1). The groundmass is partly sorted into rounded domains, and fresh root was present.

The fabric of Stratum G2 has the same texture and range of pedofeatures as G1. However, the clays on the contact with Layer F in the top 0.5 cm are higher chroma tending towards orange with cross-striated b-fabric (Supplemental Figure 5g, i). There are fragments of charred plant remains (Supplemental Figure 5h) and rubified *in situ* clay infillings (Supplemental Figure 5i). Some well-preserved charred plant fragments are embedded in sediment along the contact between Strata F/G2. Root, vermiform voids, vughs, and small charcoal fragments increase up to the contact with Stratum F.

Stratum F is composed primarily of microcharcoal with tissue structures. This anthropogenic stratum is discontinuous with excellent preservation of subhorizontal articulated charred bark along most of the contact (Supplemental Figure 5d, e). Several long pieces of woody charcoal extend 1 cm or more along the horizontal contact with excellent preservation of the tissue structure. Some large horizontal plant tissues are browned rather than charred (Supplemental Figure 4f). On the left is an aggregate of the G1 subsoil and a domain of charcoal mixed with dark




**Supplemental Figure 5**. Photomicrographs under plane polarized light (ppl): Layer E: (a) aggregate with ash and microcharcoal, (b) dark aggregate fabric, (c) rubified clay infilling in red aggregate; Layer F: (d) oriented bark in floor showing sharp contact with Layer E, (e) horizontal charred plant tissue and browned sediment aggregate, (f) browned and charred plant tissue; Layer G2: (g) rubified subsoil, (h) microcharcoal and rubified sediment, (i) *in situ* clay accumulation; Layer G1: (j) golden clays in subsoil, (k) and (l) mottled unaltered subsoil.

sediment aggregates. In SMM-1 Stratum F was heavily impacted by soil faunal bioturbation which integrated it into Stratum E. The basal date of 570-685 cal BP is associated with this stratum

(Dorwin 2018).

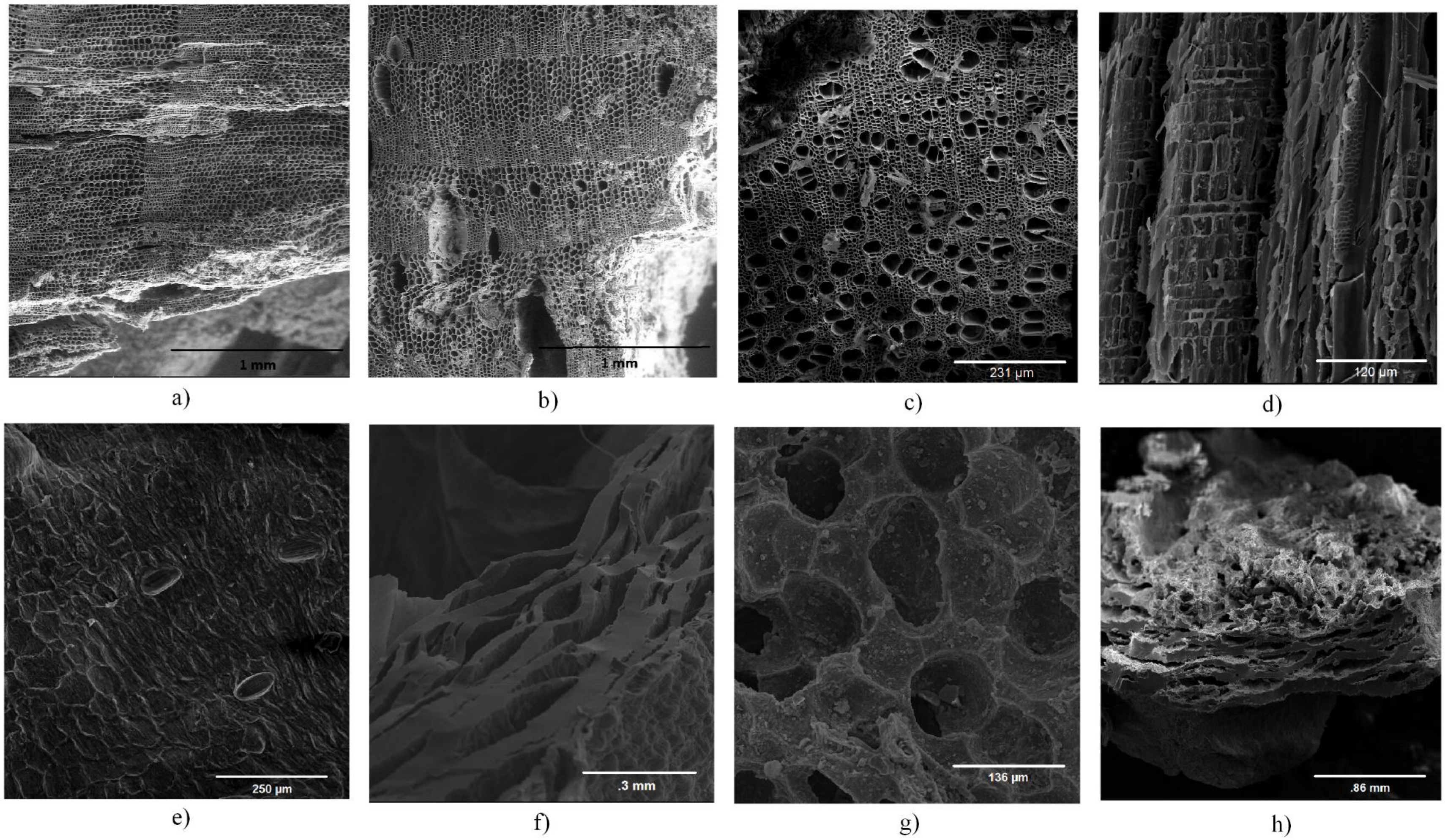
Slide SMM-3 captured heterogeneous aggregates within Stratum E, which vary in color, birefringence of the groundmass, secondary accumulations such as clay infillings, and plant remains (Supplemental Figure 1c). The contacts between aggregates are sharp, and discontinuous. The aggregate on the top right has a heterogeneous composition with a light orange groundmass with amorphous sesquioxides and several fresh rootlets. Microcharcoal and white birefringent patches, possibly ash, cluster at the top left (Supplemental Figure 5a). In contrast, in the center of the slide, a brown aggregate had dull yellow birefringence, no intact clay infillings, and abundant subangular microcharcoal in random orientation (Supplemental Figure 5b). The highly birefringent orange aggregate (top left of slide) has no plant remains in the groundmass, bright red clay infillings (Supplemental Figure 5c), burgundy amorphous sesquioxides, and a rubified bone fragment. The aggregate itself is highly heterogeneous and appears mixed because the orientation of pedofeatures is random and the microcharcoal is fragmented. Two bone fragments were observed in Stratum E.

Soil micromorphology indicates Stratum E contains heterogeneous aggregates which vary in color, birefringence of the groundmass, secondary accumulations such as clay infillings, and plant remains. The contacts between aggregates are sharp, and discontinuous. At the Strata E-F boundary, thin section microstratigraphy indicates a clear upper contact between Stratum F and oxidized Stratum E.

*Paleoethnobotanical.* Stratum F, which appears to correspond to the occupation surface of the structure, was dominated by (*Pinus ponderosa*) ponderosa pine bark which appeared as a matting during excavation. Across Stratum F, charcoal belonging to the *Abies* (fir) or *Tsuga* (hemlock) genera were identified based on the smaller cell size, traumatic resin canals in tangential rows, and a gradual transition between early and latewood cells (Supplemental Figure 6a). Although present in lower densities, this species had a ubiquity of 44% (Supplemental Table 2). *Equisetum* sp. (horsetail) and is also present in very small quantities (≤0.01 g/L) in this stratum and in Strata E and D. Organic matter (OM) in Stratum F trends slightly higher than that of the surrounding strata, likely from these plant material remains.

Few paleobotanical remains were recovered in Strata E and D. Some small quantities of ponderosa pine bark, horsetail, *Vicia americana* (vetch), and camas fragments were identified in Stratum D. This layer and Stratum E may have been devoid of plant material upon initial deposition, and their presence may be reflective of bioturbation and agrilliturbation processes (Canti 2003; Waters 1992). Highly fragmented wood charcoal and bark recovered in Stratum E is attributed to fuel sources for the Stratum C event.

Stratum B, above C, was likely turbated during pedogenesis and botanical results are discussed in conjunction with Stratum C. These layers contained many seeds and economically useful plants. These include goosefoot (*Chenopodium* sp.), vetch, thimbleberry (cf. *Rubus parviflorus*), hawthorn (*Crataegus* sp.), and Cyperaceae seeds (Supplemental Figure 7; Figure 6). As modern and archaeological *Chenopodium* sp. seeds (Supplemental Figure 7a) are difficult to identify without destroying the seed coat and are very common in Pacific Northwest paleobotanical assemblages (Herbel et al. 2012:117; Herbel and Greiser 2008; Parish et al. 1996:147; Stenholm 2000:14.6), seeds from this genus are often considered an incidental environmental inclusion. All seeds listed in Supplemental Tables 2-4 were charred. Sixty-five vetch seeds out of 65 total vetch



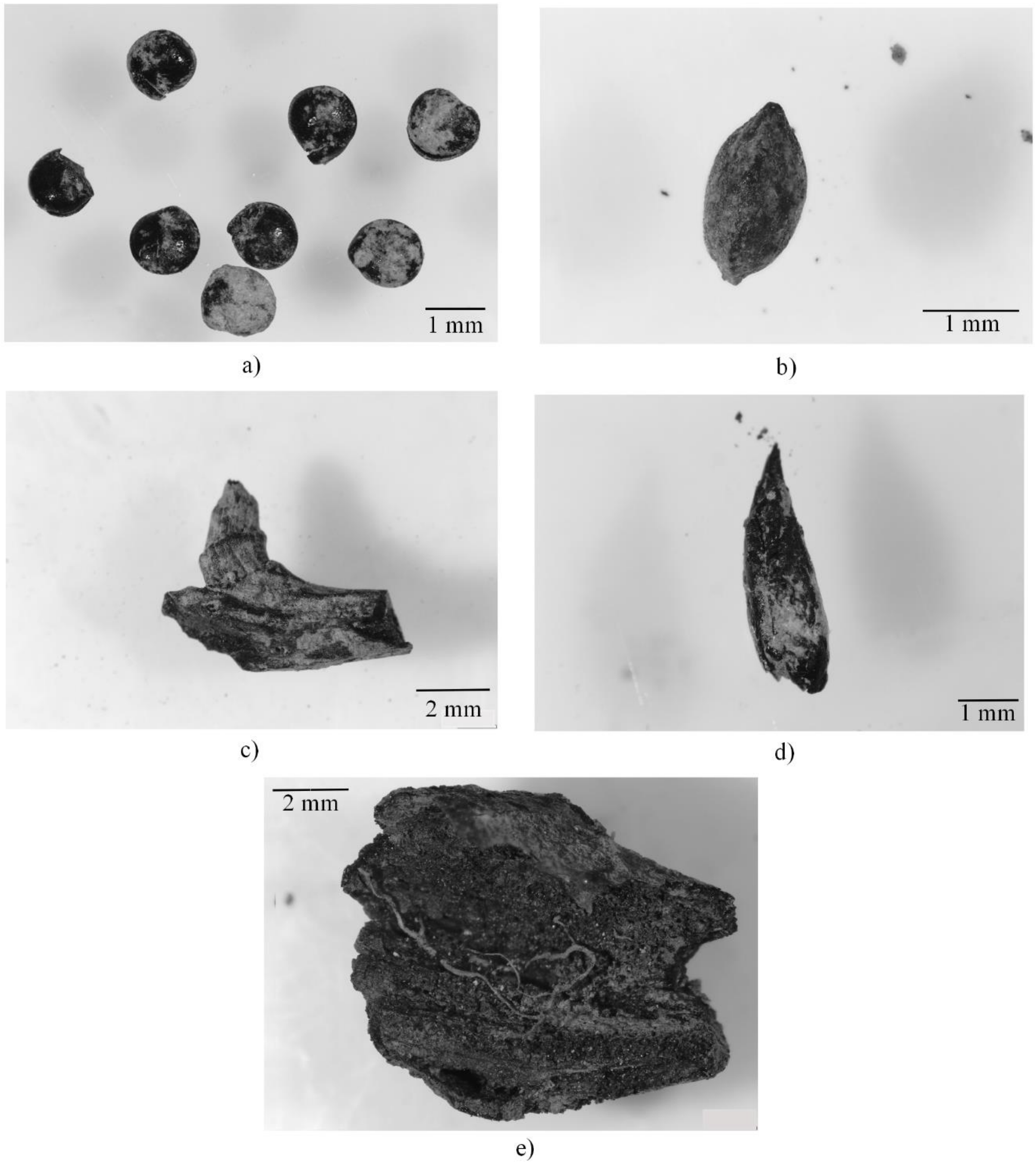

**Supplemental Figure 6.** Electron micrographs of archaeological charcoal and modern and archaeological camas (*Camassia quamash*): (a) *Abies/Tsuga* sp. charcoal, (b) *Pinus* sp. charcoal, (c) *Salix* sp. transverse section, (d) *Salix* sp. radial section showing heterocellular rays, (e) Modern camas epidermal cells, (f) Reference collection camas bulb scales, (g) Archaeological camas epidermal cells, (h) Archaeological bulb scales.

seeds were recovered in Stratum C. Cyperaceae seeds (Supplemental Figure 7b) were only noted in the upper layers as well.

Stratum C also had significant amounts of vegetative tissue. There is a concentration of horsetail in Unit G1-C1 (0.23 g/L) and horsetail tends to concentrate higher in the site's stratigraphy, although it is present in smaller quantities across both horizontal and vertical space in the structure with a ubiquity of 72% (Supplemental Table 2). Several horsetail rhizomes (Supplemental Figure 7c) were also recovered in this strata. Several small whole camas bulbs and bulb fragments were noted in several units within this stratum (Supplemental Figure 6e-h, Figure 6e). There were also many embryonic shoots or buds in this level, with 83 buds recovered in sample F1-C1 and 48 in F1-C2 (Supplemental Figure 7d). Both pine wood charcoal (*Pinus* sp.) and willow wood charcoal (*Salix* sp. were identified in these strata (Figure 6b-d) but are also common throughout the assemblage.

Across almost all strata and contexts we recovered significant quantities of unidentifiable parenchyma tissue with a ubiquity of 94%. Much of this material was too degraded to yield diagnostic cell structure morphology, necessary in the identification of parenchymous material (Hather 2016). Recovered wood charcoal was also very fragmented, and many pieces did not have a full growth ring or were too small to successfully capture the radial and tangential sections necessary in identification (Pearsall 2015:124). We attribute much of this taphonomy to bioturbation and argilliturbation processes within the floodplain's soils (Canti 2003; Waters 1992).

*Experimental.* The experimental firing of natural Pend Oreille Valley sediment samples follow the patterns predicted from prior experiments (Jackson 1998). Between 100-400°C sediment colors change slightly and organics are preserved. Organics began to char over 300°C. Over 500°C, no organics were observed, and the sediments were higher chroma orange to pink.




**Supplemental Figure 7.** Composite of additional plants identified: (a) *Chenopodium* sp. seeds, (b) Cyperaceae seed, (c) *Equisetum* sp. rhizome, (d) embryonic shoot or bud, (e) *Camassia quamash* leaflet or bulb scale.

When Stratum E colors are compared to these results (Supplemental Tables 6, 7, 8 and 9), the very pale brown oxidized sediments in Stratum E appear to have been heated between 400-700°C for at least an hour, while the pink oxidized samples required firing at least 700°C for two hours.

These conditions can be part of the same burning installation; in experimental camas earth ovens color changes from the oxidized (pink) fire exposed surface to lower chroma sediments produced by reducing conditions deeper into the oven wall (Goodman Elgar 2017). This qualitative experiment lends support to the interpretation that Stratum E materials were produced under much hotter conditions than the charred organics in Strata C or F.

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