SUPPLEMENTAL MACROBOTANICAL DATA AND POLLEN ANALYSIS FOR THE YUMA WASH SITE

Michael W. Diehl, Desert Archaeology, Inc.
Owen K. Davis, University of Arizona

Pollen analysis of the Yuma Wash site, Loci AZ AA:12:122 (ASM), AZ AA:12:311 (ASM), and AZ AA:12:312 (ASM), and AZ AA:12:314 (ASM) was conducted at the request of Deborah Swartz, Desert Archaeology, Inc., as part of the Silverbell Road widening project. Samples from the 2007 investigations at Locus AA:12:312 by Desert Archaeology are included in this report. The samples from that site are primarily Tanque Verde phase in age, but Tucson and Tortolita-Cañada del Oro components are also present.

The sites are within a 1-km radius on the west bank of the Santa Cruz River channel, east of Silverbell Road, between Cortaro and Ina roads, Tucson, Pima County, Arizona (32° 21' N, 111° 5' W, 655 m elevation). Locus AA:12:312 is within the distributary fan of Yuma Wash, which heads at 1,353 m on Wasson Peak, 11 km southwest of the sites. Locus AA:12:311 is northwest of the fan, Locus AA:12:122 is downstream from the fan, and site AA:12:314 is south of the fan in what previously would have been part of the Santa Cruz floodplain, below its confluence with Cañada del Oro and the Rillito River.

The prehistoric vegetation of the lower slopes of the Tucson Mountains west of the site were probably dominated by creosotebush (*Larrea tridentata*), triangle-leaf bursage (*Ambrosia deltoidea*), turpentine bush (*Ericameria laricifolia*), paloverde (*Cercidium microphyllum*), and saguaro (*Carnegiea gigantea*). The floodplain of the Santa Cruz, below its confluence with the Cañada del Oro and Rillito River channels was probably dominated by seepwillow (*Baccharis salicifolia*), desert broom (*Baccharis sarothroides*), saltsages (*Atriplex* spp.), grasses, and scattered mesquite (*Prosopis*).

PREVIOUS PALYNOLOGICAL INVESTIGATIONS

Valley bottom (floodplain) sites in the Tucson Basin are typically dominated by high values of Chenopodiaceae-*Amaranthus* and other Compositae (30-70 percent), and low values of *Ambrosia* pollen (less than 20 percent). Corn (*Zea mays*) pollen is typically present at less than 3 percent.

Archaeological sites nearby include Las Capas, AZ AA:12:111 (ASM) (Davis 2001); the Dairy site, AZ AA:12:285 (ASM) (Davis 2009; Fish, et al. 1992); the Badger Hole Ranch site, AZ AA:12:40 (ASM) (Davis 1997b); the Costello-King site, AZ AA:12:503 (ASM) (Davis 1998); the Valley Farms site, AZ AA:12:736 (ASM) (Cummings and Moutoux 2000); AZ AA:12:753 (ASM) (Davis 2008); and the Silverbell Coachline site, AZ AA:12:321 (ASM) (Davis 1997a). These sites contain some of the earliest indications of irrigated agriculture in the United States. Chenopodiaceae-*Amaranthus* averages 25-75 percent and Other Compositae averages 3-28 percent in these seven sites. The pollen of riparian plants (cottonwood, willow) is rare, but fern spores are sometimes present (Davis 2006).

These floodplain sites contrast with the palynology of Silvercroft Wash, a Tucson foothills tributary of the Santa Cruz River, draining the Tucson Mountains west of Tumamoc Hill. The pollen analysis (Davis 2004) indicated dominance by bursage (*Ambrosia,* 3-27 percent), other Compositae (13-47 percent), and Chenopodiaceae-*Amaranthus* (11-43 percent). Wormwood (*Artemisia*) averaged 3 percent. Corn (*Zea mays*) pollen was present at less than 1 percent in three of 41 samples.

Methods

Pollen was extracted from the sediment samples by routine acid digestion (Table I.1). One *Lycopodium* tablet (13,911 spores) was added to each sample (volume 5 cm^3) to permit calculation of pollen concentration.

Quantification

Three hundred grains of the pollen of upland plants were counted per sample. Pollen of aquatic plants, spores of ferns and fungi, algae, charcoal, and other microfossils are not included in the sum. Typically, more than 1,000 microfossils were tabulated per sample. Pollen clumps (aggregates) were counted as four grains, and were not recorded separately.

The pollen sum of 300 upland spores was the divisor for determining the percentages of all pollen types, spores, charcoal, and other microfossils. The pollen concentration is calculated for the pollen sum. It is an index of preservation and the sediment accumulation rate. Low concentration combined with poor preservation may indicate loss of pollen, making interpretation of the pollen assemblage questionable. Alternately, good preservation and low concentration might result from rapid sediment accumulation.

Identification

Pollen and spore identifications are based on the University of Arizona reference collection of pollen taken from identified and deposited plants. Corn (*Zea mays*) pollen is distinguished from that of wheat (*Triticum*) by its larger size (> 80μ), and particularly by its wider and thicker annulus (Figure I.1).

Table I.1. Pollen extraction procedure.

1. Add 1 *Lycopodium* tablet (batch # 710961, 13,911 grains/tablet)
2. Swirl solution, let stand 15-20 seconds, and screen (180-micron mesh, stainless steel); transfer into 50-ml test tubes, rinse; add 10 ml 10 percent HCl
3. Add 10 ml concentration HCl mix, add 30 ml H_2O, mix; centrifuge, decant, water rinse
4. Add 40 ml HF overnight or 1 hour in boiling water bath; centrifuge, decant, water rinse; transfer to 15-ml glass tubes
5. Acetolysis[a]; centrifuge, decant, water rinse
6. Add 10 ml 10 percent KOH, 2 minutes in boiling water bath; centrifuge, decant, water rinse with hot water until clear
7. Stain with safranin "O"
8. Transfer to labeled 1-dram shell vials
9. Add a few drops of glycerin

[a]Acetolysis: (1) 5 ml glacial acetic acid, centrifuge and decant; (2) stir sample, add 5 ml acetic anhydride (volumetric dispenser); (3) add 0.55 ml H_2SO_4 to acetic anhydride solution (volumetric pipette), mix, centrifuge, decant into glacial acetic acid; and (4) 5 ml glacial acetic acid, centrifuge and decant.

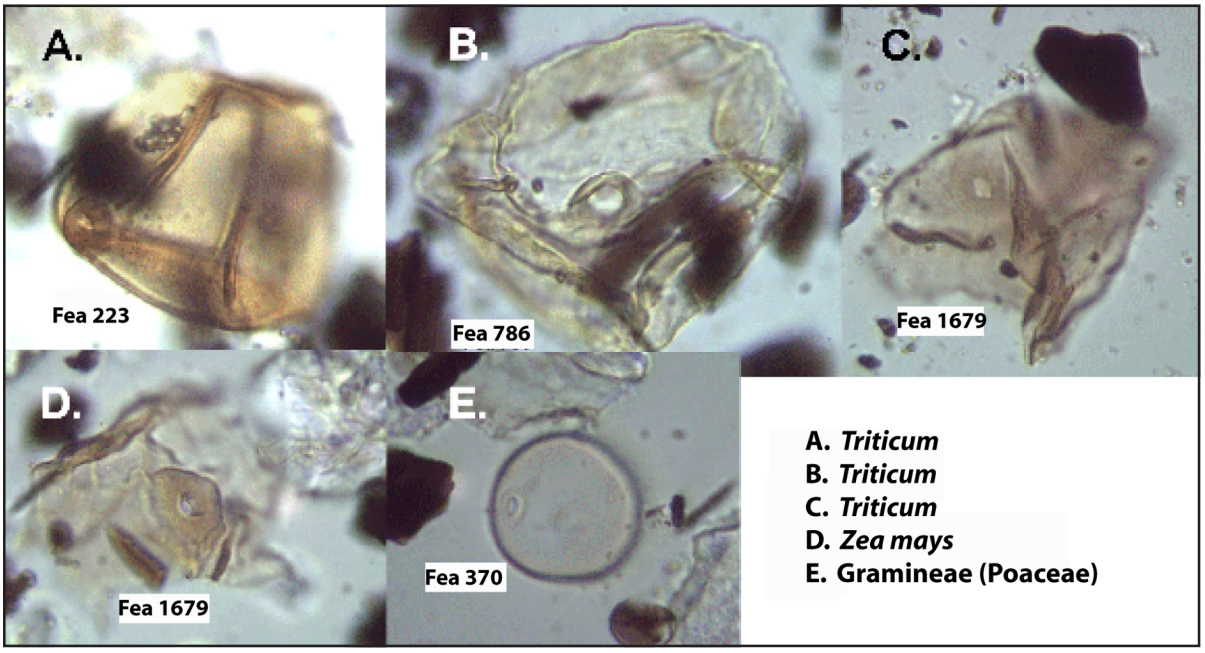

Figure I.1. Photomicrographs of wheat, maize, and grass pollens, the Yuma Wash site.

Results

The pollen preservation is superb in all 33 samples (55 including the samples analyzed previously). All samples provided full 300 grain counts, and the concentration is high, average 35,000 grains/cc (7,134-69,787 grains/cc). The pollen assemblage is dominated by Chenopodiaceae-*Amaranthus* (average 66 percent) and sunflower (other Compositae) pollen (average 22 percent). The abundances of charcoal and fungal spores are very low compared to other Tucson Basin samples: 120 percent and 158 percent of the pollen sum, respectively (Figure I.2) (see also Diehl and Davis 2015).

Even though the three loci, AA:12:122, AA:12:311, and AA:12:312, are within one mile of each other, they have consistent differences. Loci AA:12:122 and AA:12:311 have higher percentages of Chenopodia-

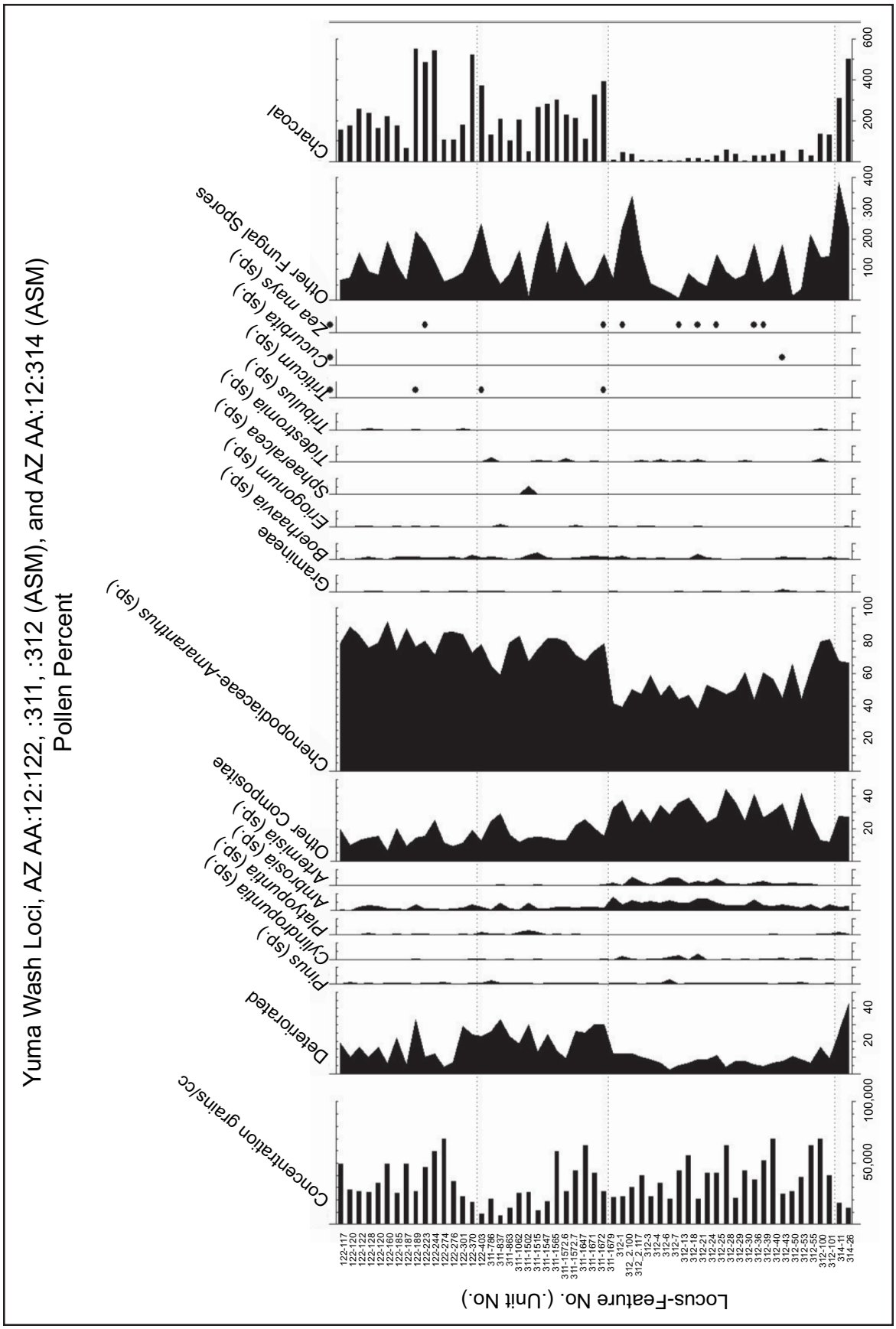

Figure I.2. Percentage pollen diagram, the Yuma Wash site. (Samples plotted and sample numbers, shown to the left.)

ceae-*Amaranthus* (average 81 percent and 74 percent vs. 52 percent) and charcoal (average 262 percent and 226 percent vs. 31 percent) than all but two samples from Locus AA:12:312. But, Locus AA:12:312 has higher percentages of *Ambrosia* (4.3 percent) and *Artemisia* (1.9 percent) pollen than Locus AA:12:122 and Locus AA:12:311, and Locus AA:12:312 has all but two of the samples containing corn (*Zea mays*) and the only grain of squash (*Cucurbita*). Three samples from Loci AA:12:122 and AA:12:311 contain wheat (*Triticum*), but none in Locus AA:12:312.

Locus AA:12:122 differs from Locus AA:12:311 in having generally higher pollen concentration (39,482 vs. 28,161 grains/cc) and lower percentages of deteriorated pollen (8 vs. 29 percent). The two samples from site AA:12:314 are very different from the other three. They are typical Tucson Basin samples: high percentages of charcoal and fungal spores, low pollen concentration, and high percentages of weed pollen (Cruciferae and *Mirabilis*).

CONCLUSIONS

This same atypical dominance by other Compositae pollen is found at the Columbus Park site, AZ AA:12:96 (ASM) (Davis and Diehl 2008), which is also on the west bank of the Santa Cruz River, at the mouth of Sweetwater Wash as it drains into the Santa Cruz, about 10 km upstream from the Yuma Wash site. Although the relative importance of bursage *Ambrosia* pollen is less at the Columbus Park site and Yuma Wash Locus AA:12:312 than at Silvercroft Wash, the Tumamoc Hill site, AZ AA:16:6 (ASM), and AZ BB:13:92 (ASM) (Davis 2004), all three sites have other Compositae values above 30 percent (vs. 14 percent and 18 percent for Loci AA:12:122 and AA:12:311). One explanation is that Locus AA:12:312 and the Columbus Park site both receive a substantial portion of pollen from the washes that drain the Tucson Mountains, but that does not explain the low *Ambrosia* percentages at these sites. A second explanation is that Locus AA:12:312 was receiving more runoff from Yuma Wash and was wetter at the time the samples were deposited, and therefore contained less salt sage than Loci AA:12:122 and AA:12:311.

There is weak support for this alternative from the very slightly higher percentages of pollen of riparian vegetation (0.3 percent). Plus, the presence of corn (*Zea mays*) pollen in Locus AA:12:312 vs. Loci AA:12:122 and AA:12:311 suggests more favorable conditions for agriculture than existed at Loci AA:12:122 and AA:12:311.

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