

**ARCHAEOLOGICAL MONITORING
AND INVESTIGATIONS OF A
PREHISTORIC CANAL AT
DURANGO STREET AND 31ST AVENUE,
PHOENIX, ARIZONA**

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Prepared for:

**Neighborhood Services Department
Grants Administration Division
City of Phoenix**

Project No. 72842-96-08

**Technical Report No. 98-9
Northland Research, Inc.**

**FINAL
6 March 1998**

A suite of samples for specialist studies was collected from Feature 1 (Table 1). Six sets of pollen, flotation, soil (sediment texture), and ostracode samples were taken. These were collected from six strata within the feature. Strata were selected for sampling based on the ability to collect discrete samples from them. Table 1 lists the samples and provides descriptions of the strata; the results of the sediment texture (particle size) analysis performed by Laboratory Consultants, Inc. are included in this table.

The dating of AZ T:12:98(ASM) is problematic. No artifacts were directly associated with the canal; the sherd found in the disturbed layer above the feature is not temporally diagnostic. Unfortunately, the modern irrigation pipe above the feature made further excavation (i.e., horizontal exposure) of the canal unfeasible, and this prevented the collection of an archaeomagnetic sample. So, the only presently available way of dating the canal is by examining the sites that utilized this irrigation feature. Unfortunately, this canal is part of a system that has not been extensively researched. The two major sites, Pueblo del Rio and Pueblo del Alamo, that are fed by Canal System Six have not been intensively studied or excavated. These sites contain both Preclassic and Classic period components; hence, the canal could have been constructed and used at any point with a roughly 700-year period (ca. A.D. 750–1450).

POLLEN ANALYSIS

Susan J. Smith

Six sediment samples from the canal were examined for fossil pollen. Unfortunately, all six samples were evaluated to be pollen-sterile, attributed to the sandy lithology of the strata sampled. The results from these samples are combined with pollen and soil data from three other prehistoric canal investigations to show how pollen abundance is correlated to particle size in water-deposited sediments.

Methods

Sample sediments were thoroughly mixed and 20 cc subsamples extracted. A known concentration (25,084 grains) of tracers (*Lycopodium* spores) was added to each sample to calculate pollen concentration, which estimates the number of pollen grains per standard volume of sediment, abbreviated gr/cc. Samples were treated with 10 percent hydrochloric acid (to reduce carbonates), washed through 0.18 mm mesh screen, and treated for approximately 20 hours with hydrofluoric acid (dissolves silicates). After the hydrofluoric step, samples were floated twice in zinc bromide (specific gravity 1.9), followed by acetolysis (reduces organics).

Pollen assemblages were identified by counting slide transects at 400x magnification to a 100-grain pollen sum, if possible, then scanning the entire slide at 100x magnification to record additional taxa. Aggregates (clumps of the same taxon) were counted as one grain per occurrence, and the taxon and size recorded separately. The absolute abundance of pollen in each sample (pollen concentration) was estimated by relating the pollen count to the tracer count.

Pollen Results and Discussion

All six samples were evaluated as sterile, defined as a count of less than 20 pollen grains in five transects and a calculated pollen concentration of less than 1,500 gr/cc. Table 2 lists sample proveniences, pollen counts, concentrations, and taxa richness, and includes the particle size results from soil samples collected in the same stratum as the pollen samples.

Stratum	A	B	C	D	E	F
Pollen Sample	1	2	3	4	5	6
Description	Mid-Late Use	Middle Use Episode	Middle Use Episode	Middle Use Episode	Middle Use Episode	Earliest Canal Use
Depth cm bmgs (below modern ground surf.)	120-155	155-160	160-170	170-175	175-195	195-210
%Sand/Silt/Clay	51/21/18	89/5/6	91/3/6	77/10/13	91/3/6	51/29/20
Sample Pollen Conc. gr/cc	801	123	95	511	55	1293
Number of Taxa Identified	6	4	5	11	1	5
Pollen Sum	69	10	17	106	5	100
Tracers (sample size 20 cc; initial tracers 25,084 grains)	108	102	225	260	115	97
Degraded	8	1	3	19	1	6
Pine	1	-	-	2	-	-
Juniper	-	-	-	2	-	-
Sagebrush	-	-	-	-	-	1
Greasewood	-	-	1	-	-	-
Jojoba	-	-	-	1	-	-
Cheno-Am	31	3	7	41	4	59
Sunflower Family	20	3	2	32	-	12
Bursage;Ragweed	4	2	3	4	-	7
Grass	2	1	1	1	-	-
Spiderling	2	-	-	-	-	1
Globemallow	-	-	-	1	-	-
Buckwheat	-	-	-	1	-	-
Pea Family	-	-	-	1	-	-
Spurge Family	-	-	-	1	-	-
Total Aggregates	1	-	-	-	-	4
Cheno-Am Aggregates	1(6)	-	-	-	-	4(20)

The soil analysis results show that all of the strata sampled were very sandy with the percent of sand ranging from 51 to 91 percent (Table 2). Pollen concentrations paralleled the sand percentages with values between 55 and 511 gr/cc in strata with greater than 70 percent sand. Samples from strata A and F with sand at 51 percent yielded the highest concentrations, 801 and 1,293 gr/cc, respectively. No cultigen pollen was recovered from the canal samples, and the minimal recovery of other taxa precludes interpretation.

Pollen travels and deposits in flowing water by the same physical laws that govern the hydraulic behavior of other particles, and pollen abundance appears to correlate best with fine-grained sediments. The trend for pollen to deposit with silt and clay is emphasized in Figure 4, which shows the pollen

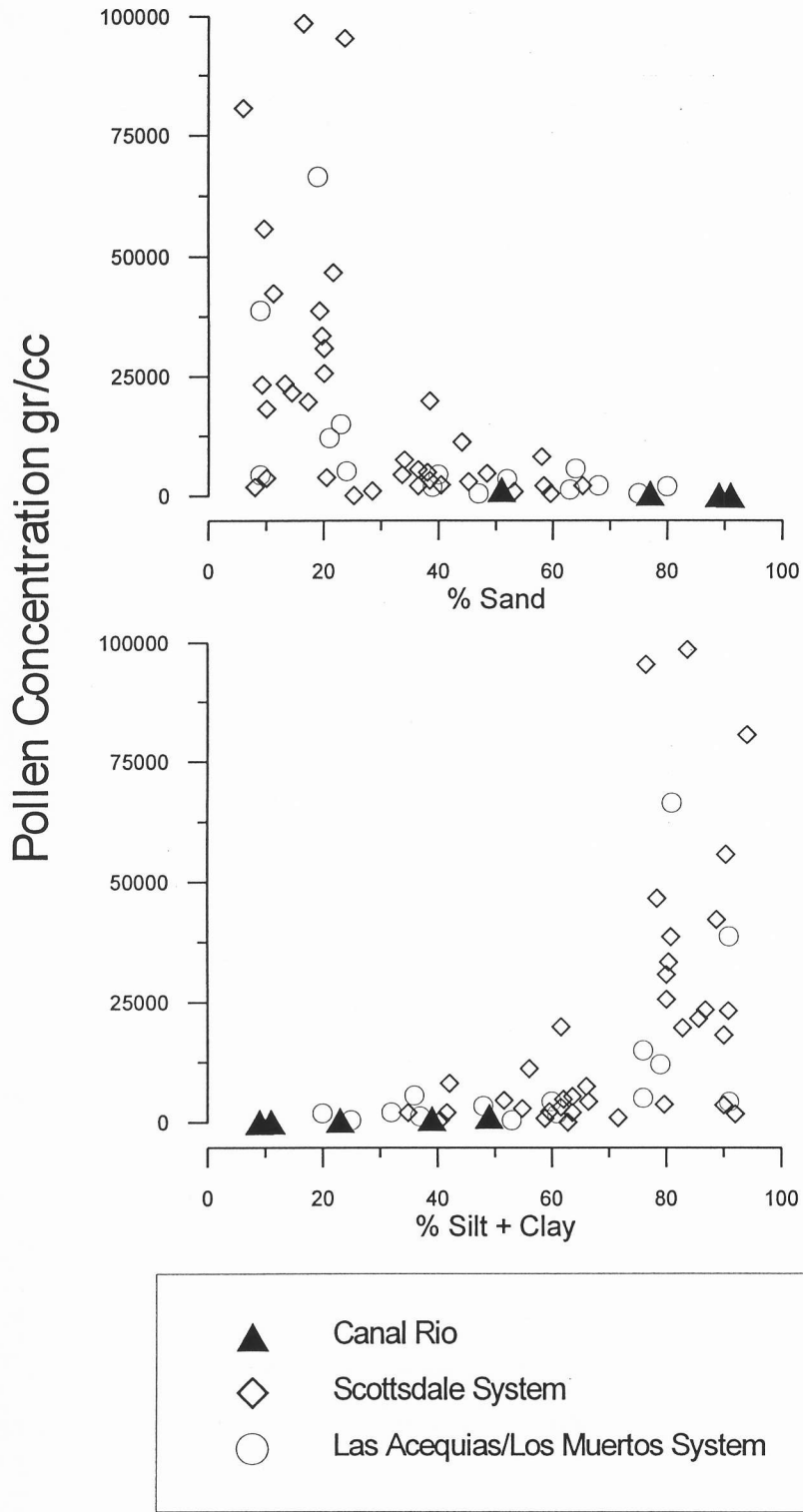


Figure 4. Sediment particle size and pollen concentrations from 59 Hohokam canal samples.

concentrations calculated from 59 canal samples graphed against the percent of sand and silt plus clay analyzed from complementary soil samples. The samples graphed on Figure 4 include the Durango Street Monitoring (Canal Rio) results and data from three previous canal investigations directed by Northland: McDowell-to-Shea project in the prehistoric Scottsdale canal system (Smith 1995); Esteban Park/Las Canopas project in Turney's Canal Seven system (Smith 1997a); and Mesa City Sound Barrier project in Turney's Canal One (Las Acequias/Los Muertos) system (Smith 1997b). Most of the data on Figure 4 (38 samples) was extracted from canals in the Scottsdale irrigation system (Hackbarth et al. 1995; Smith 1995).

Figure 4 clearly shows that canal sediments with greater than 25 to 30 percent sand contain minimal pollen as measured by concentration values of less than 1,000 gr/cc. Pollen concentrations begin to rise in sediments characterized by less than 30 percent sand and a silt plus clay component greater than 50 percent. These two graphs show that the abundance of pollen entrained in canal sediments is dependent on sediment composition, which in turn is a function of flow regime.

If the abundance of pollen in canal sediments is a reflection of flow regimes, which can be derived from soil particle analyses, then what information can pollen analysis contribute to prehistoric canal investigations? There have been several pollen studies of Hohokam canals that have contributed valuable information on how pollen abundance and the composition of pollen assemblages were influenced by season of canal operation, flow regime, canal capacity or rank, and distance from source intakes (Fish 1987; Gish 1989; Nials and Fish 1988; Smith 1995). These studies have documented important baseline data for more sophisticated analyses, such as predicting how far a canal's cross section was from an intake. Emerging from these data is the potential for a synthetic analysis of the spatial distribution of crops along canals and the layout of fields. Canal pollen and macrobotanical studies have also shown that wild plants, such as cheno-am, agave and cholla, were probably encouraged, tended, or deliberately cultivated along canals (Gish 1989; Miksicek 1995; Smith 1995). In conclusion, pollen analysis of canal samples can contribute information on prehistoric irrigation systems with appropriate contexts and sampling designs directed by specific questions.

OSTRACODE ANALYSIS

Manuel R. Palacios-Fest

Six samples from the prehistoric canal were analyzed for ostracodes. The samples were processed using a freeze and thaw technique, washed and dried at room temperature. Routine micropaleontological analysis was then conducted using a low-power stereoscopic microscope.

The samples consisted of alternating layers of gravelly sand to silty sand and sandy silty clay. In average 42 g of bulk sediments were processed. The residues ranged from 5.25 to 37.10 g. Large residual fraction and particle angularity indicate fast streamflow. No ostracodes or other fossils were preserved in this high energy environment. Due to the negative results, no further interpretation is attempted. Descriptions of the analyzed samples are provided below and summarized in Table 3.

- NRI-1-8-A: Moderate yellowish brown (10YR 5/4) silty (coarse) sand consisting of quartz, chert flakes, feldspars, biotite, muscovite, glass, andesite, charcoal, gneiss (?), dolomite, and other rock fragments. Poorly sorted, angular to subangular. Massive to finely laminated, friable. No fossils.

Table 3. Ostracode Sample Identification and General Characteristics, Including Lithologic Description and Petrologic Composition.						
Sample:	NRI-1-8	NRI-1-11	NRI-1-14	NRI-1-17	NRI-1-20	NRI-1-23
Stratum	A	B	C	D	E	F
Height	70	50	45	30	20	10
Depth	20	50	55	60	70	80
Bulk Wt (g)	40.81	40.46	41.17	47.08	47.02	40.43
Residual Wt (g)	28.36	5.25	31.67	10.88	37.10	7.52
Lithology	Silty coarse SAND	Sandy silty CLAY	Gravelly silty SAND	Sandy silty CLAY	Gravelly SAND	Sandy silty CLAY
% Gravel	5	<5	10	<5	15	<5
% Coarse Sand	40	5	20	5	15	5
% Medium Sand	20	5	30	5	25	5
% Fine Sand	20	15	15	10	20	10
% Silt	10	20	15	15	10	10
% Clay	5	50	10	60	15	65
Munsell Chart	10YR5/4	5YR5/6: 10YR5/4	10YR5/4	5YR5/6: 10YR5/4	10YR5/4	5YR5/6: 10YR5/4
Color	Mod. yellow brown	Lt. brown to mod. yellow brown	Mod. yellow brown	Lt. brown to mod. yellow brown	Mod. yellow brown	Lt. brown to mod. yellow brown
Remarks	No fossils	No fossils	No fossils	Extremely rare	No fossils	No fossils
Petrologic Composition:						
Quartz	X	X	X	X	X	X
Feldspars	X	X	X	-	X	-
Biotite	X	X	X	X	X	X
Muscovite	X	-	X	-	X	X
Andesite	X	X	X	X	-	X
Glass	X	X	X	X	X	-
Gneiss	X	X	X	-	-	-
Chert flakes	X	-	-	-	X	X
Charcoal	X	-	-	X	X	X
Travertine	-	X	X	-	-	-
Dolomite	X	-	-	-	-	-
Calcareous aggregates	-	-	-	X	-	X
Basalt	-	-	-	X	X	-
Obsidian	-	-	-	-	-	X
Pegmatite	-	-	-	-	X	X
Rhyolite	-	-	-	-	X	-
Rock fragments	X	X	X	X	-	X
X = present, - = absent						

• NRI-1-11-B: Light brown (5YR 5/6) to moderate yellowish brown (10YR 5/4) sandy silty clay consisting of quartz, travertine, feldspars, biotite, glass, gneiss (?), andesite and other rock fragments. Moderately poorly sorted, angular to subangular. Finely laminated, friable. No fossils.

- NRI-1-14-C: Moderate yellowish brown (10YR 5/4) gravelly silty sand consisting of quartz, feldspars, biotite, muscovite, andesite, gneiss (?), pegmatite, glass, travertine and other rock fragments. Poorly sorted, angular to subangular. Massive, friable. No fossils.
- NRI-1-17-D: Light brown (5YR 5/6) to moderate yellowish brown (10YR 5/4) sandy silty clay consisting of quartz, calcareous aggregates, biotite, charcoal, basalt, andesite, glass and other rock fragments. Moderately well sorted, subangular to subrounded. Finely laminated, fairly compacted. Extremely rare calcareous worm tubes.
- NRI-1-20-E: Moderate yellowish brown (10YR 5/4) gravelly sand consisting of quartz, chert flakes, feldspars, rhyolite, andesite, biotite, muscovite, glass, basalt, pegmatite, charcoal and other rock fragments. Poorly sorted, angular to subangular. Massive, friable. No fossils.
- NRI-1-23-F: Light brown (5YR 5/6) to moderate yellowish brown (10YR 5/4) sandy silty clay consisting of quartz, chert flakes, calcareous aggregates, biotite, muscovite, andesite, charcoal, obsidian (?), pegmatite and other rock fragments. moderately well sorted, subangular to subrounded. Finely laminated, fairly compacted. No fossils.

FLOTATION ANALYSIS

Johna Hutira

Six sediment samples from canal Feature 1 were processed for flotation analysis; the specimen number and context of each sample is listed in Table 1. The samples were floated using a device similar to that utilized by the Black Mesa Archaeological Project (described in Hutira 1989). Poppy seed tests (after Wagner 1982) were regularly performed throughout the water separation procedure to monitor the effectiveness of the system. In general, the poorest recovery rate, as measured by the poppy seed test, was 80 percent. That is, 40 out of 50 poppy seeds that were "salted" in a flotation sample prior to water separation were recovered during analysis. The highest recovery rate was 100 percent. The gravel portion that remained in the bottom of the screened insert was quickly examined for artifactual and other biofactual materials.

The dried light fractions were sorted using a series of screens that facilitated identification of seeds and plant parts¹. Each subset was examined under a variable 10x–30x power light microscope. Identification of remains was aided by the use of a seed manual (Martin and Barkley 1961) and the author's modern reference collection.

The six flotation samples were analyzed for charred botanical remains and molluscan fossils. None of the samples yielded identifiable remains. The absence of material precludes further interpretation.

SUMMARY AND DISCUSSION

A prehistoric canal, AZ T:12:98(ASM), was identified during the archaeological monitoring of trenching for sewer line installations along Durango Street and 31st Avenue. This canal is either the

¹ Technically, the term "seed" refers to a matured ovule, consisting of an embryo and its coats, and a supply of food (Harrington and Durrell 1957:186). For the purposes of this report, the term "seed" will include not only true seeds, but equivalent structures that look and function like seeds: achenes, caryopses, nuts, and other disseminules.