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ARIZONA'S PREHISTORIC CANALS, FROM THE AIR

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(From "Explorations and Field-Work of the
Smithsonian Institution in 1930")



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ARIZONA'S PREHISTORIC CANALS, FROM THE AIR¹

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Out in central Arizona, where cotton fields, citrus groves and date palms reach out across endless miles to caress jagged igneous and sandstone buttes, prehistoric peoples once erected a noteworthy civilization upon an agricultural foundation. That ancient civilization is gone now—lost with the desert acres on which it flourished—and few traces remain of the gigantic canals that made its primitive agriculture possible.

But those few traces merit careful preservation. They are all we have left to remind us of that unnamed, aboriginal folk whose engineering achievements rightfully arrest the attention of our mechanical age. For those prehistoric canals—it has been estimated that half a century ago there were no less than 300 miles of them in the Salt River valley alone—were so accurately and efficiently constructed that portions of them, taken over by white settlers of 1870 and thereabouts, are actually in use at the present time. And here is another point we are apt to overlook: Every mile of those ancient channels was literally dug by hand, since the Arizona Indians knew nothing either of beasts of burden or metal tools until well on in the seventeenth century.

Following the old canal banks, one occasionally happens upon the fragment of a stone "hoe"—a thin blade of igneous rock, chipped on one side to a cutting edge. With such rude tools, with fractured cobblestones and sharpened sticks, the canal builders hacked and prodded at the hard desert soil. In baskets and blankets, we may safely conjecture, women and children carried the loosened earth out from the excavation. Thus, mile after weary mile, an entire community labored to construct the canals that watered their communal fields.

Nowhere else in the New World has evidence been found of prehistoric irrigation systems comparable to those of central Arizona. They may even have surpassed, both in size and in the number of acres served, those famous systems of the Tigris and Euphrates valleys—irrigation works that watered the seed of native ability and

¹In December, 1930, Mr. Odd S. Halseth, of Phoenix, was continuing certain studies connected with this aerial survey, in behalf of the Bureau of American Ethnology.



FIG. 136.—Prehistoric Indian canal east of Mesa, Arizona, partly reconditioned and used by Mormon pioneers of 1878; subsequently replaced by the modern Consolidated Canal. (Photograph by Sgt. R. A. Stockwell; courtesy of the Chief of Air Corps, U. S. Army.)



FIG. 137.—"The Park of Four Waters," near Phoenix, preserves remnants of old Indian canals and the "Swilling Ditch" of 1867. On the right margin, close above the Grand Canal, Pueblo Grande ruin shows through the trees. (Photograph by Sgt. R. A. Stockwell; courtesy of the Chief of Air Corps, U. S. Army.)

brought forth into full bloom high civilizations that made Mesopotamia known throughout the ancient world.

With prodigious labor, the Peruvians of pre-Spanish times led irrigation ditches along craggy heights of the Andes to their terraced gardens. Among the highlands of Mexico and again in various sections of the southwestern United States, Indian farmers had learned that irrigation was necessary to the successful cultivation of food crops. In November, 1694, Padre Eusebio Kino stood before the drab walls of Casa Grande ruin and speculated upon the feasibility of restoring its abandoned, overgrown canals. Five hundred years before Kino was born the inhabitants of Pueblo Bonito, in Chaco Canyon, New Mexico, were capturing the mid-summer rains, taming and guiding them onto thirsty fields. But none of these efforts matched the colossal, prehistoric irrigation systems of the Gila and Salt river valleys.

We wanted maps of these latter, hand-made Indian canals. We wanted to know their extent, their position relative to each other, the approximate acreage they once watered. Similar desires on the part of other observers had prompted surveys which were not altogether successful for the very simple reason that so little is now visible of the ancient ditches. Modern agriculture has been too destructive; it has plowed and planted until the aboriginal farming communities and their works were pretty thoroughly obliterated. From the ground, one's range of vision is too limited; from the air it might be possible to recover data for the maps we had in mind. At least this seemed the most promising, expeditious method when I made a preliminary study of the situation in the autumn of 1929.¹

So, at the solicitation of United States Senator Carl Hayden, the Smithsonian Institution and the War Department cooperated in an aerial survey of the Salt and Gila river valleys, beginning late in January, 1930. Lieutenant Edwin Bobzien and Sergeant R. A. Stockwell, pilot and photographer, respectively, were detailed from the Air Corps unit at Crissy Field, San Francisco, and I was designated Smithsonian representative, to advise with the aviators.

Our small party assembled at Phoenix, blocked out the areas to be photographed and speedily set to work. Smoke and ground haze drew an impenetrable blanket over Salt River valley each morning and evening, thus restricting flying time to a brief two hours at midday when shadows are at a minimum. The longer shadows of early morn-

¹ Explorations and Field-work of the Smithsonian Institution in 1929, pp. 177-182. Washington, 1930.

ing and late afternoon would naturally have thrown into greater relief those slight elevations which mark ancient house sites and irrigation ditches.

But, despite handicaps of various sorts, our air survey proceeded about as we had planned it. First of all there was the Gila River valley, from its union with the Rio Salado to the northwestern slopes of the Tortilla Mountains—a far-reaching plain whereon Pima and Papago farmers tilled favored patches of irrigable land long before the advent of missionaries, trappers, Pony Express riders, and other pioneers of a period now all but forgotten.

American settlers trailed into the upper Gila valley during the third quarter of the nineteenth century and drew so heavily upon the available water supply that the Indian farmers below were finally brought to a state of destitution. Government promises of relief were made and remade but a half century passed before the Coolidge Dam was completed and provision thus made to meet the needs of whites and Indians alike. The great reservoir is slowly filling and, 70 miles away, farm lands wait thirstily for the life-giving waters.

With huge, snorting machines that make an Indian's home-made tools seem, by comparison, as nothing at all, 56,000 acres of desert land are being cleared, leveled, and otherwise prepared for irrigation at the rate of 20 acres a day. But the mechanical monsters of the modern engineer are no respecters of prehistoric canals! The latter were being destroyed along with other heritages from the past. Ours was the task of discerning and recording some vestige of those ancient irrigation systems while fleeting opportunity permitted.

Up one side of the Gila and down the other, Lieutenant Bobzien held his blue Douglas observation plane on a fixed course at 10,000 feet elevation while Sergeant Stockwell pointed his camera through a hole in the floor and snapped the shutter with clock-like precision to picture a square mile on each successive negative. Over famed Casa Grande ruins the ship sailed lower in search of those ancient canals seen by Kino and which new cotton fields seem to have erased absolutely. And then back to the Indian gardens that border the meandering Gila from Sacaton to Pima Butte and beyond.

Like strips of Grandmother's quilt those gardens are! Queer, misshapen patches with thin ribbons of dark green running this way and that where lesser irrigation ditches crazy-stitched the variegated scraps together. Yet, hopelessly confused and insignificant as these miniature farms appear from a height of nearly two miles, they played a not unimportant part in the conquest of southern Arizona.



FIG. 138.—Prehistoric canals on north side of Salt River, north of Mesa, Arizona. (Photograph by Sgt. R. A. Stockwell; courtesy of the Chief of Air Corps, U. S. Army.)

Indian farmers tended those fertile fields for untold generations before Francisco Vásquez de Coronado and his band of resolute adventurers marched gayly northward out of Mexico in 1540 to dig mythical gold from the Seven Cities of Cibola. When Padre Kino came plodding his patient way toward salvation of the Pima and Papago tribes late in the seventeenth century, those funny Indian gardens fed his men and mules. And they supported, too, the westward-bound gold-seekers of '49; the animals and personnel both of the Pony Express and the later stagecoach companies; the U. S. Army units stationed in Arizona before and after the Civil War. Except for those gardens and the Pima and Papago scouts who served so faithfully throughout the protracted Apache campaign, Victorio and Geronimo doubtless would have continued their murderous depredations for still another decade. The peaceful Indian tribes of the Gila valley have well merited, and with interest, the Government-aided irrigation system which once more makes possible the successful cultivation of their Lilliputian farms.

In the Salt River valley, prehistoric peoples also converted cacti-covered wastes into gardens of maize, beans, and squashes. They built, nearby, thick-walled, flat-roofed homes of mud, pressed and patted into layer upon layer. Here, as along the Gila, industrious generations dwelt in peace and plenty, tending their growing plants, digging new ditches, hunting deer among thorny mesquite, until some great, irresistible force came finally to claim possession. What that force really was no one knows today. It may have been a slight diminution in annual rainfall; more likely, it was increasing pressure from nomadic tribes. But, in either case, after a period which none may yet measure, the Indian farmers of the Rio Salado vacated their cultivated fields, abandoned their compact settlements and moved on to other, perhaps less favored localities. Substantial dwellings crumbled into low, spreading mounds; irrigation systems slowly filled with wind-driven sand; the desert crept back to claim its own.

Not until the middle nineteenth century did Salt River valley reawaken to such industry as it had known in prehistoric times. Not until 1865, or thereabouts, did hardy pioneers follow in on the dim trails of the beaver trappers and the gold-seekers to select the thorny plains of the Rio Salado as a likely place in which to build their humble homes.

Among these pioneers was one Jack Swilling, somewhat more imaginative than his neighbors, who appears to have been the first to recognize the possibility of local irrigation. Obviously influenced by the nearby prehistoric canals, Swilling started to clear out one of



FIG. 139.—A section of an ancient Indian canal west of Granite Reef dam.
(Photograph by Judd.)



FIG. 140.—A partially destroyed ancient Indian canal west of Granite Reef dam, lying 25 feet above the present bed of Salt River. (Photograph by Judd.)

these as a ready means of watering his own fields. And then, in 1867, he organized the company which constructed the first modern canal in Salt River valley.

Remnants of this old "Swilling ditch" and sections of three ancient Indian canals are still visible in "The Park of Four Waters," wisely preserved by the city of Phoenix. Close by stands the ruin of Pueblo Grande, a huge pile of crumbling walls and pale yellow clay, excavation of which was initiated in 1929 by City Archeologist Odd A. Halseth.

Largest surviving example of the communal dwellings which dotted Salt River valley in prehistoric times, Pueblo Grande marks a former center of population from which industrious Indian farmers trudged forth to their daily toil. From the flat roofs of their earth-walled homes those same farmers saluted the rising and setting sun as the father of all living things. For in olden times, no less than today, the sun meant life to dwellers in Salt River valley.

Over on the south side, Pioneer Charles T. Hayden camped one day at the foot of Tempe Butte and watched the swollen river race past. Then he constructed a rude ferry to float his wagons across; remained to transport other early settlers, to build the first local store, walled with mud-plastered willows. More than this, he cleaned out an old Indian canal and drew into it, from the Rio Salado, water with which to turn the wheels of his primitive mill. The new Hayden mill, erected on the same site, is no longer powered by an irrigation ditch but it served, nonetheless, as one of our principal landmarks in the recent aerial survey of Salt River valley.

Mormon settlers came, in 1878, to found the contented village of Mesa; to recondition other abandoned Indian canals and thus save their pioneer community an estimated \$20,000 in labor alone. Part of one such rebuilt ditch is still in use but, as elsewhere in the valley, increase in population has brought about larger, more serviceable canals with their far-flung network of laterals.

Inquiry elicits the information that there are no fewer than 1,200 miles of these modern watercourses. Most of them measure from 18 to 90 feet wide at the top and average about five feet in depth; sections of them have cost as much as \$22,000 a mile to construct. But the prehistoric canal builders, with barefooted helpers instead of caterpillar tractors, with stone hoes as precursors of the steam shovel, unhesitatingly set about the completion of comparable works. I photographed one aboriginal canal north of Mesa that stands today 66 feet wide and 8 feet deep. It led from the Rio Salado far across the valley; as the river cut its channel below the canal floor, the useless ditch



FIG. 142.—Reconditioned Indian canal at Hayden's Mill, near Tempe Butte. (Photograph by Odd S. Halseth.)



FIG. 141.—Lieut. Bobzien (left) and Sgt. Stockwell preparing for a mid-day flight. (Photograph by Odd S. Halseth.)

was replaced by another which connected with a new intake, farther up stream. Such substitutions were necessitated by altered conditions in prehistoric times no less than today.

Modern irrigation canals and the industry they symbolize have done most to erase from central Arizona former vestiges of that native civilization which once prospered there. The sad ruins of aboriginal homes have been leveled with their neighboring fields; the ditches which once watered those fields have been filled or scraped away. Where Indian farmers eight or ten hundred years ago cultivated gardens of beans, maize and squashes, vast acres of cotton, lettuce and melons are now harvested. Neat orchards of dates and grapefruit flourish where catclaw and mesquite stretched their spiny branches only a generation ago. The diabolical Apache has been tamed if not conquered. Bow-legged cowboys, garbed according to the latest fashion notes from Hollywood, ride herd on eastern "dudes." Attractive dwellings and sumptuous winter resorts, with green lawns and flower-bordered walks have replaced the mud-walled habitations of the ancient folk.

As one looks down from the air upon this Paradise that is Salt River valley today, one is impressed first of all by the orderly habits of mankind. At least there is a semblance of order, from a height of 2,000 feet or more. Long, straight roads on which autos slither away like headless roaches; brown and yellow fields all nicely squared; orange trees that seem as tiny pellets of dark green, patiently arranged, row upon row; little cubed houses, fringed with flat green things.

Reaching across these fields and under these houses, light or dark streaks mark former prehistoric Indian canals which only the aviator may readily detect. Silt deposited in those old ditches shows dark brown against the drab desert soil; pale yellow lines remain where embankments have been smoothed away. Slight differences in vegetation, imperceptible when close at hand, take on color variations that enable one at a considerable height to retrace works which otherwise have been wholly effaced.

The blue Army plane glides down from the clouds and back to port with numbed crew and empty cameras. Camel Back Mountain squats complacently at one side and looks out across the valley where such momentous changes have taken place within memory of men still living. Squaw Peak lifts her unkempt bulk to frown upon this new civilization, as she did upon the old. A setting sun momentarily gilds the giant sahuaro whose long, fingered shadows point eastwardly to rugged mountain ranges whence flow the life-giving waters of the Gila and the Rio Salado.