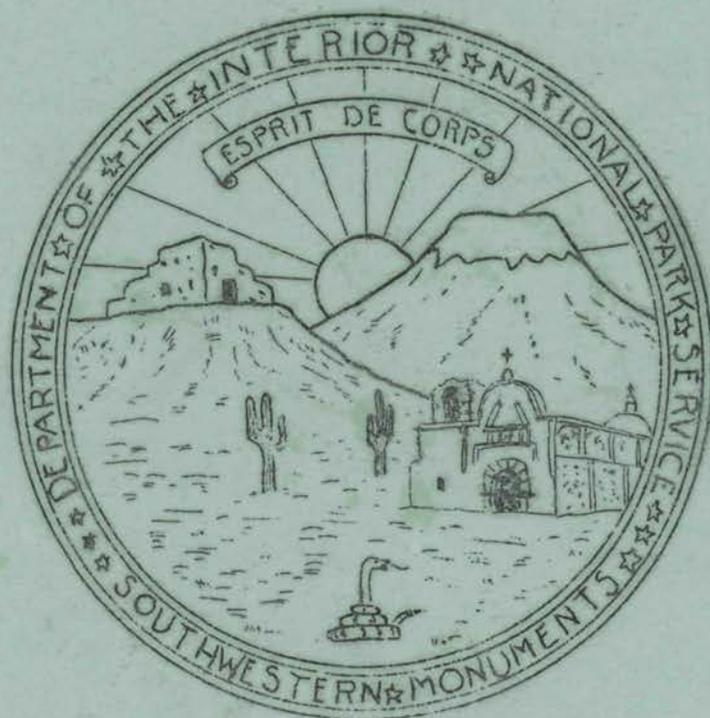


SOUTHWESTERN MONUMENTS MONTHLY REPORT

AUGUST, 1937



DEPARTMENT OF THE INTERIOR
NATIONAL PARK
SERVICE

SOUTHWESTERN MONUMENTS

AUGUST, 1937, REPORT

INDEX

CONDENSED GENERAL REPORT

Travel -----	75	300 Activities of Other Agencies	
000 General -----	76	in the Monuments -----	78
100 Administration -----	76	400 Flora, Fauna, Nat. Phenomena --	79
200 Maintenance, Improvements,		600 Protection -----	80
New Construction -----	77	Miscellaneous -----	80

REPORTS FROM MEN IN THE FIELD

Aztec Ruins -----	103	Gran Quivira -----	117
Bandelier -----	108	Montezuma Castle -----	81
Bandelier CCC -----	111	Navajo -----	116
Bandelier Forestry -----	112	Pipe Spring -----	118
Bandelier Ruins Stabilization-	134	Sunset Crater -----	92
Canyon de Chelly -----	100	Tonto -----	101
Capulin Mountain -----	113	Tumacacori -----	105
Casa Grande -----	96	Tumacacori Museum -----	133
Chaco Canyon -----	114	Walnut Canyon -----	112
Chiricahua -----	93	White Sands -----	89
Chiricahua CCC -----	95	White Sands Construction -----	132
El Morro -----	86	Wupatki -----	91

HEADQUARTERS

Branch of Education -----	120	Visitor Statistics -----	127
Mobile Unit -----	126	Closing -----	131

SUPPLEMENT

Meteor Crater, Arizona, by Vincent W. Vandiver -----	135
Montezuma Birds, by Betty Jackson -----	155
Rio Grande Glazes, by Earl Jackson -----	156
Random Notes from Tumacacori, by Louis R. Caywood -----	157
Ruminations, by the Boss -----	159

SOUTHWESTERN MONUMENTS PERSONNEL

HEADQUARTERS, Southwestern Monuments, Coolidge, Arizona: Frank Pinkley, Superintendent; Hugh M. Miller, Assistant Superintendent; James Luther, Chief Clerk; J. H. Tovrea, Assistant Engineer; Dale S. King, Assistant Park Naturalist; Charlie R. Steen, Junior Park Archeologist; Millard Singerman and Luis A. Gastellum, Clerk-Stenographers; William H. Sharpe, ECW Clerk; James W. Brewer, Roving Park Ranger; Gertrude F. Hill, Student Technician.

FIELD STATIONS

AREA (Acres)

1. <u>Arches</u> - Moab, Utah. J. M. Turnbow, Cu.	4,520
2. <u>Aztec Ruins</u> - Aztec, N. M. T. C. Miller, Cu. H. Summerfield Day, Park Ranger-Archeologist	25.88
3. <u>Bandelier</u> - Santa Fe, N. M. C. G. Harkins, Cu. Jerome W. Hendron, Woodrow Spires, and Donald J. Lehmer, Temporary Park Rangers	26,026.20
4. <u>Canyon de Chelly</u> - Chin Lee, Ariz. Johnwill Faris, Cu. Alfred Peterson, Temporary Park Ranger. Thomas B. Onstott, Temporary Park Ranger.	83,840.
5. <u>Capulin Mountain</u> - Capulin, N. M. Homer J. Farr, Cu.	680.37
6. <u>Casa Grande</u> - Coolidge, Ariz. A. T. Bicknell, Cu. J. Donald Erskine, Park Ranger.	472.50
7. <u>Chaco Canyon</u> - Chaco Canyon, N. M. L.T. McKinney, Cu. Homer Hastings, Temporary Park Ranger.	21,512.37
8. <u>Chiricahua</u> - Douglas, Ariz. Frank L. Fish, Cu. Homer Bennett and Bronson Harris, CCC Guides	4,480.
9. <u>El Morro</u> - Ramah, N. M. Robert R. Budlong, Cu.	240.
10. <u>Gila Cliff Dwellings</u> - Cliff, N. M. No Custodian.	160.
11. <u>Gran Quivira</u> - Gran Quivira, N. M. Geo. L. Boundey, Cu.	610.94
12. <u>Hovenweep</u> - Cortez, Colo. No Custodian	285.80
13. <u>Montezuma Castle</u> - Camp Verde, Ariz. Earl Jackson, Cu. Jesse D. Jennings, Park Ranger.	560.
14. <u>Natural Bridges</u> - Blanding, Utah. Zeke Johnson, Cu.	2,740.
15. <u>Navajo</u> - Kayenta, Ariz. John Wetherill, Cu. Milton Wetherill, Park Ranger-Historian.	360.
16. <u>Organ Pipe Cactus</u> - Ajo, Ariz. No Custodian	330,670.
17. <u>Pipe Spring</u> - Moccasin, Ariz. L. Heston, Acting Cu.	40.
18. <u>Rainbow Bridge</u> - Rainbow Lodge, Ariz. No Custodian	160.
19. <u>Saguaro</u> - Tucson, Ariz. No Custodian	63,284.
20. <u>Sunset Crater</u> - Flagstaff, Ariz. David Jones, In Charge	3,040.
21. <u>Tonto-Roosevelt</u> , Ariz. Irving McNeil, Temp. Park Ranger	1,120.
22. <u>Tumacacori</u> - Tucson, Ariz., Box 2225. L. R. Caywood, Cu. James Felton, Park Ranger.	10.
23. <u>Walnut Canyon</u> - Flagstaff, Ariz. P. Beaubien, Jr. Park Arch.	960.
24. <u>White Sands</u> - Alamogordo, N. M. Tom Charles, Cu.	142,987.
25. <u>Wupatki</u> - Flagstaff, Ariz. David J. Jones, Park Ranger	35,865.30
26. <u>Yucca House</u> - Cortez, Colo. No Custodian	9.6
Total Area (in acres)	724,659.96

CONDENSED REPORT

IN WHICH IS GIVEN THE HIGHLIGHTS OF THE MONTH

Coolidge, Arizona
September 1, 1937

The Director
National Park Service
Washington, D. C.

Dear Mr. Director:

The Condensed Report for the month of August, 1937, follows:

<u>TRAVEL</u>	<u>August, 1937</u>	<u>August, 1936</u>	<u>August, 1935</u>	<u>1937 to date</u>
Aztec	3,056	2,658	2,250	12,497
Bandelier	3,825	3,180	2,475	12,177
Canyon de Chelly	337	169	135	1,175
Capulin Mountain	7,000	4,500	---	21,110
Casa Grande	1,804	1,487	1,376	31,764
Chaco Canyon	1,313	1,272	1,031	6,865
Chiricahua	1,077	906	958	8,152
El Morro	561	470	333	1,873
Gran Quivira	892	730	385	3,885
Montezuma Castle	1,503	1,578	1,910	8,574
Natural Bridges	150	72	120	470
Navajo	71	---	---	94
Pipe Spring	111	105	256	
Saguaro	511	---	---	10,224
Sunset Crater	1,193	1,231	1,216	3,529
Tonto	296	324	360	5,091
Tumacacori	1,079	1,037	906	17,447
Walnut Canyon	2,590	2,034	2,047	8,844
White Sands	12,471	18,753	7,013	82,368
Wupatki	417	436	290	1,734
Totals	40,257	40,942	23,201	* 238,662

* Total does not include travel to monuments at which accurate travel counts are not maintained. The travel year 1937 is reckoned from Oct. 1, 1936, to Sept. 30, 1937.

Although the actual reported figures show a slight drop in travel to the monuments in August, 1937, as compared with August, 1936, we believe that more visitors actually are on the road and visiting our areas. Difference in the method of computing White Sands visitors, or else a fairly inexplicable drop of more than 6,000 at that monument explains the apparent decrease. Actually, August travel records were broken at Aztec, Bandelier, and possibly other monuments.

CONDENSED REPORT (CONT.)

000 GENERAL

010 MATTERS OF UNUSUAL IMPORTANCE

Chaco Canyon: Chetro Kettle ruin is in very bad shape in places and should receive stabilization before the excavating agencies finish this field session.

El Morro - Farmers continue to haul water from the reservoir, lowering the level, and intensifying the bad taste and dangerous qualities of this very unsatisfactory sole supply of the custodian and his wife.

020 WEATHER

All northern monuments report an unusually hot and dry summer. A freak frost occurred near El Morro August 19. Casa Grande in the south reported unusually high average temperatures, but Chiricahua and Tumacacori, in the higher lands nearer the Mexican border, had much rain, the latter perhaps more than ever reported in August.

022 ROAD CONDITIONS IN MONUMENT APPROACHES

Road conditions were about as usual except that Tonto reported its entrance road so bad that visitors turned back after experiencing a little of it, and, in contrast, Walnut Canyon's heavy travel was partly attributed to unusually dry and smooth entrance highways. A new highway across the Jemez Mountains brings more visitors to Bandelier.

100 ADMINISTRATION

123 VISITS BY NATIONAL PARK SERVICE PERSONNEL

Headquarters: Charles Richey, Clinton Rose, Thomas E. Carpenter, Wm. Stevenson, Erik Reed.

Aztec Ruins - Kenneth Disher, James Brewer, Thomas Onstott.

Bandelier - Lyle Bennett, Chas. Richey, Dorothy Fisher, Tom Conley, H. S. Day, Kenneth Disher, Dale King.

Canyon de Chelly - Jim Hamilton

Capulin Mountain - W. H. Wirt, Adrey Borell.

Casa Grande - Frank Fish, George Keller.

Chaco Canyon - T. C. Miller, Thomas Onstott, H. S. Day, Kenneth Disher

Chiricahua - Chas. Richey, Thomas Carpenter.

El Morro - Erik Reed.

Gran Quivira - Kenneth Disher, Erik Reed.

Tumacacori - J. H. Tovrea, Clinton Rose, Lyle Bennett, Fred D. Nichols, Frank Fish, Wm. Stevenson, Eugene Stonehocker, Luis Gastellum.

Walnut Canyon - Erik Reed, Carl Schmidt, Thomas Onstott, Kenneth Disher, Dale King, David Jones.

Wupatki - Dale King

CONDENSED REPORT (CONT.)

150 NEW EQUIPMENT

Casa Grande - 500 feet of garden hose to utilize waste water from coolers for irrigation.

Chiricahua - Gas-operated refrigerator transferred from Tumacacori.

El Morro - Gas-operated refrigerator transferred from Tumacacori.

Tumacacori - New electric refrigerator.

180 PUBLICITY

Gallup Ceremonial - August 22, 23 and 24 six small booths at the Gallup ceremonial displayed to several thousand visitors information concerning Chaco Canyon, Canyon de Chelly, and Aztec Ruins National Monuments. The exhibit was awarded a blue ribbon "for general excellence and educational value."

Tumacacori - Pictures of Tumacacori Mission appear on the covers of recently issued Tucson and Nogales directories of the Mountain States Telephone & Telegraph Co.

200 MAINTENANCE, IMPROVEMENTS, NEW CONSTRUCTION

210 MAINTENANCE, UNUSUAL

Bandelier - Ruins stabilization on the big kiva at Tyuonyi Ruin almost finished except for clean-up.

Chaco Canyon - The Mobile Unit for ruins stabilization in preparing for its work finished 1,800 feet of water line, laid 900 feet of pipe, erected a water tower and installed a tank, erected six tent cabins, gathered 20 cubic yards of building stone, and excavated 12 cubic yards of back-filled dirt from kiva corners in Pueblo Bonito.

230 NEW CONSTRUCTION

Bandelier CCC

Hotel garage to parapet wall height. Vigas and roof sheathing complete.

Hotel dining room and kitchen to interior finishing stage. Kitchen cabinets completed and in place. Interior plaster completed. Flagstone floor started.

Water intake outlet connected to canyon water main.

Hotel sanitary sewer project started and 90% completed.

Hotel pipe line project started.

Gas tank, fittings and miscellaneous equipment installed in hotel oil house.

Monument telephone line hooked up.

Hotel stone walls as planned 100% complete.

Forestry crew cut timber for building all month.

Rock quarry crew worked all month.

CONDENSED REPORT (CONT.)

230 NEW CONSTRUCTION (CONT.)

Chiricahua CCC -

Rhyolite-Balanced Rock trail advanced 1,800 feet; 1,500 feet of light construction remain to connect this trail with the Sara Deming-Balance Rock section, and this will complete the trail project at Chiricahua.

400 square yards backsloped on Bonita Canyon road half mile above Bonita Park.

200 square yards backsloped on same road one mile above Bonita Park.

Considerable highway maintenance.

Rock work on east wing of administration building complete. Walls at front and rear of existing building completed. West wing rock work to six feet height and it will be turned over to carpentry crew about September 1.

Excavation for basement and footings finished for employee's residence.

Rock quarry in operation all month.

White Sands - Grade completed on entrance road. First rock course on and rolled in. Sand and clay being put on at rate of 1,200 cubic yards a day.

300 ACTIVITIES OF OTHER AGENCIES IN MONUMENTS

320 NON-GOVERNMENT AGENCIES

Chaco Canyon: University of New Mexico General Field Session with 40 students and staff excavating a small site east of Tseh So (excavated last summer) which is east of Casa Rinconada. Is late Pueblo II in time. Students are divided into lower, upper, and research groups. School of American Research also operating in canyon and their work will be described next month.

350 DONATIONS AND ACCESSIONS

Headquarters Loan Library: Received 112 periodicals, pamphlets, reprints, and books.

Montezuma Castle: From Fred G. Steenberg the museum received display enlargements of photos he took of the Castle in 1893. These are the oldest known photos of the ruin.

Tumacacori - In excavating for foundations of new museum building several pieces of copper plate and some broken pottery was found. A very interesting religious medal was also discovered and is added to the museum collections.

Walnut Canyon: Four pottery vessels and five baskets were transferred from Headquarters to this monument to start an adequate museum collection.

CONDENSED REPORT (CONT.)

400 FLORA, FAUNA, NATURAL PHENOMENA

Montezuma Castle: Several additions were made to the botanical check list and herbarium.

Rainbow Bridge: Hugh Cutler of Milwaukee, Wisc., collected Tradescantias and will furnish information and publications later.

410 RANGER, NATURALIST, AND GUIDE SERVICE

Aztec Ruins: H. Summerfield Day entered on duty as ranger August 2.

Casa Grande: Guide stories are being standardized as to factual content, and will be perfected for use of new personnel.

Montezuma Castle: Ranger Jesse D. Jennings entered on duty Aug. 1.

Walnut Canyon: It was neglected to state in the July Report that Paul L. Beaubien entered on duty July 1 as Junior Park Archeologist in the combined Walnut Canyon-Saguaro position.

Wupatki: Ranger David Jones entered on duty August 10.

420 MUSEUMS

Headquarters loan library: 351 books catalogued, 58 repaired, 1,406 catalog cards made. Necessary rearrangement effected.

Aztec Ruins: Eight new cases received August 18 and 23.

Bandelier: Temporary installation in one room of museum gives some museum service to visitors.

Casa Grande: Park Archeologist Steen and Custodian Bicknell finished temporary installation in new cases. One room was converted into an office for the Casa Grande staff. An unannounced number of books were obtained for the nucleus of a Casa Grande library.

440 INSECT CONTROL

Bandelier: Web worm cycle at low point so no spraying necessary this summer.

Pipe Spring: Considerable control of red ants around headquarters.

460 BIRDS

Tonto: Hundreds of Gambel Quail seen on monument.

470 ANIMALS

Montezuma Castle: Gila Monster killed by farmer on land which adjoins the monument. Is farthest north record of which Custodian Jackson knows.

Tonto: Javelina or peccary noted during the month on the monument. Rock squirrels unusually abundant.

CONDENSED REPORT (CONT.)

600 PROTECTION

650 SIGNS

El Morro: Road signs changed to new road location. Much maintenance necessary because of vandals.

Walnut Canyon: Entrance signs unsatisfactorily designed and need re-building, to obtain better visibility.

700 ARCHEOLOGY, PREHISTORY, HISTORY

Tumacacori: Custodian Caywood and Architects Fred Eastman, Chas. Maguire, and Frederick Nichols in line with policies of the Historic American Building Survey visited historic sites in Santa Cruz county, including Calabasas, Guevavi, Fort Crittenden, and Babocomari Ranch.

MISCELLANEOUS

MAIL COUNT

Incoming:		
Official	2,016	
Personal	786	
Total incoming		2,802
Outgoing:		
Official only	2,220	2,220
Total postal mail		5,022
Telegrams:		
Incoming	38	
Outgoing	41	
Total telegrams		79
GRAND TOTAL PIECES OF MAIL HANDLED		5,101

Cordially,

Frank Pinkley,
Superintendent.

FIELD REPORTS

FROM THE MEN ON THE JOB

MONTEZUMA CASTLE

By Earl Jackson, Custodian

STATISTICAL

<u>Visitors:</u> - - - - -	1,503; Aug., 1936, 1578.
Arizona visitors by cars - - - - -	843 % of total 56.02
California visitors by cars - - - - -	224
Iowa visitors by cars - - - - -	87
Texas visitors by cars - - - - -	80
Total states (incl. Wash., D.C.) - - - - -	39
Foreign countries - - - - -	3 Eng. Italy, Ontario.

Conveyance:

Cars - - - - -	388
Arizona cars - - - - -	217

Contacts - All visitors contacted.

Trips - - - - -	261
Attendance - - - - -	1,175
Those who climbed ladders - - - - -	893 or 59.41% *
Average trip time - - - - -	29.98 minutes.
Museum lectures - - - - -	238
Attendance - - - - -	1,146
Average museum time - - - - -	18.19 minutes.

* My July figure was wrong. Change from 75.5% to 55.07%

WEATHER AND ROADS

Weather has been unusually dry. Precipitation was 1.16 inches, and occurred on August 12, 16, and 18. 16 days were partly cloudy, and three were cloudy.

Beaver Creek has quit running in front of the Castle now, and toward the upper end of the monument the remaining water is quite muddy and filthy.

Valley roads are in good condition. Highway 79 is under construction in two places, between Jerome and Prescott and between Cottonwood and Sedona. This construction work amounts to putting a light oil coat over the gravel surface, and while the road has been objectionable for a few miles at a time, I think it has not interfered with travel. For a day or so the dirt road between here and Stoneman Lake was quite muddy.

MONTEZUMA CASTLE (CONT.)

SPECIAL VISITORS

Park Service

None. It should be mentioned in this connection, however, that Kenneth B. Disher, of the Washington Office, on his museum inspection trip, called up the custodian on the morning of July 25 from Prescott, seeking transportation to Montezuma Castle. Unfortunately, this call came on Sunday morning, and it happened I was entirely alone. My ranger had not arrived yet, and I had worked a temporary man the maximum of 30 days, and had not been able to pick up a local man for one day's guide work. So it was necessary for me to spend the day in the Castle, and I was unable to go after Mr. Disher. Nobody regrets this unfortunate set of circumstances more than I.

Other Visitors:

July 25 - P. H. Bell, chief engineer of the State Land Department, was an interested visitor.

July 27 - J. W. Keating, instructor at the Palo Verde Ranch School for Boys, Prescott, Arizona, was in with a very interested group of 12 boys.

August 1 - Mr. G. B. Hartman, assistant professor of forestry, Iowa State College, and R. B. Thomson, associate professor of forestry, Iowa State College, were visitors.

August 4 - Odell Julander, instructor in forestry, Iowa State College, Ames, Iowa, was in with a party of 40, consisting mostly of students in forestry from Ames. They were from a forestry camp spending six weeks at Mormon Lake.

August 6 - Lieut. R. H. Calkins, purchasing and contracting officer for the Arizona District, C.C.C., was a very interested visitor.

August 11 - Odell Julander paid a return visit with 34 more forestry students from the Mormon Lake camp. All of these boys were as well behaved a group as I have ever seen.

August 14 - Capt. Thomas D. Tway, subdistrict commander No. 1, of the Arizona CCC District, Phoenix, Arizona, was a visitor.

On this same date a party of ten eastern boys, several of them repeat visitors, camped with us. They are completely sold on the place.

August 15 - Mr. and Mrs. Robert A. Darrow, of the University of Arizona, spent an interesting morning with us. Mr. Darrow is an instructor in botany at the University.

MONTEZUMA CASTLE (CONT.)

August 18 - Instructors Keating and Wirick, of the Palo Verde Ranch School, Prescott, Arizona, brought in another group of 12 boys.

August 19 - Guy Hobgood, superintendent of the Hualpai and Havasupa Indian Reservations, was in.

August 20 - A Mr. Glen Lukens, of Los Angeles, a ceramics teacher, was a very interested visitor, and gave us some worthwhile information on pottery.

August 21 - L. C. Houghton, educational adviser from the Verde CCC camp, F-39-A, was in with a group of 22 CCC boys.

Mr. M. G. Jorgenson, who developed the weatherproofing material which Standard Oil now uses on adobe wall construction, was a very interested visitor from California.

August 22 - Capt. and Mrs. J. V. Lowe, from 8th Corps Area Headquarters, El Paso, Texas, were in.

Comments

While our list of "Special Visitors" may seem somewhat drawn out, we found something about everyone of them which was interesting. I think, in general, we have had an amazingly high percentage of interested visitors for the summer month of August.

PERSONNEL

Our vacant ranger position was filled by the arrival of Mr. and Mrs. Jesse D. Jennings on the night of July 29. Mr. Jennings entered on duty on July 30. He came to us highly recommended, and as yet I see no cause for disillusionment.

CONSTRUCTION

The Central Arizona Light and Power Company, in running a power line up Beaver Creek, crossed the northwest corner of the monument, and one pole is planted on Park Service land.

ACQUISITIONS

Early this summer Mr. Fred G. Steenberg, of Fond du Lac, Wisconsin, was an interested visitor. It developed that in 1893 he visited Montezuma Castle and took several photographs of it. I told him we were always seeking old pictures of the Castle, and he promised to send us some when he returned to Wisconsin. On July 26 we received a set of these photographs, mounted on stiff paper in a large glass frame. They now occupy a wall in our museum. In addition to showing the front view of the

MONTEZUMA CASTLE (CONT.)

Castle these shots show several views which were taken in the building of construction features. These are the oldest scenes we have seen to date,

PUBLICITY

On August 11 we received a clipping from Connecticut, taken from the New Haven Evening Register. It was entitled "Vegetable Plate a la Cliff Dweller," and was a feature article on foodstuffs found at Montezuma Castle. The material was undoubtedly taken from the May Monthly Report; in which we had included a list of plants identified by Mr. Fred Gibson, of the Boyce-Thompson Southwestern Arboretum. They closed with the statement that archeologists were greatly puzzled that spinach had not been found in the cliff dwellings, and wondered if that meant the cliff dwellers did not eat spinach.

NATURE NOTES

On July 26 we found a Brown Garter Snake - *Eutoenia eques* (Reuss) - about 30 inches long, attempting to swallow a large toad which it had killed. It was swallowing the hind end first, but disgorged the toad as we approached. The snake now reposes in alcohol.

On August 4 Norman saw the first porcupine reported on the monument. It was at the top of a limestone hill and was headed for the creek. We did not get the species. We suppose the porcupine was coming down to sample our mesquite beans.

August 15 brought a neighbor from across the creek on land adjoining the monument. He claimed he had recently killed a Gila Monster there, and described it in such detail we knew he was not mistaken. This was our first knowledge that Gila Monsters range this far north.

On August 16, about an hour after a heavy rain, Betty and I saw an unusual sight. It was a multiple honeymoon of the large red ants. They were congregated very densely over an area of about 100 square feet. A few minutes later we found one of the brides who had already shed her wings and left her husband, and was very busily engaged in digging a hole in which to build a den.

On August 18 we saw a peculiar battle which waged furiously for over half an hour on the hard packed ground in front of the museum. A slender, round bodied, smooth scaled snake, about 14 inches long, was having a mighty tussle with a four and a half inch centipede. The snake was trying to get the enemy's head in its mouth, and while he was maneuvering for this hold the centipede thrashed wildly about, part of the time wrestling with his larger opponent in what looked like a death grip, and part of the time walking off backward, pulling the snake quite easily over the smooth ground. Finally the centipede's

MONTEZUMA CASTLE (CONT.)

head disappeared in the snake's mouth. When this happened, the whip-like end of its tail, with the sharp claw tips, slapped into the snake's body, burying the points. This did not bother the snake, however, for he went right on trying to swallow the head. You see, although a centipede has sharp claws on its legs and tail end, the only poison glands are in its two jaws, in the head.

At length the centipede whipped loose and started drunkenly off, its head half smashed. The snake poised its head a moment, grabbed the victim once more, and started off toward a rock wall. Here the combatants disappeared in a crack, to fight it out in privacy.

We got a good description of the snake, but cannot identify it with Ditmars. Maybe someone can help us. The body was pale yellow from tip to tail, 14 inches long, round, smooth scaled, head indistinct from body, nose rounded, tail three or four inches long. Eyes were rounded. There were 15 or 17 rows of scales around the body, with bottom scales complete. Incomplete dark brown rings went across the back and down the sides of the snake. These rings were three to four scales wide.

A King's Lizard was recently captured by Jane Jennings. This lizard is *Gerrhonotus Kingii* (Gray).

Odell Julander and Robert Darrow (mentioned in visitor list) gave us a number of new plant identifications, and checked old ones previously submitted as accurate. The new ones follow:

Arrow bush - - - - -	Hymenoclea Mongyra.
Snake weed or Broom weed - - - -	Gutierrezia sarothrae (sp?).
Algerita - - - - -	Odostomon Fremontii. (Genus sometimes called Berberis)
Water Moody - - - - -	Baccharis glutinosa.
Desert Willow - - - - -	Chilopsis linearis.
Fremont Cottonwood - - - - -	Populus Fremontii.
Prostrate or Redroot Pigweed - -	Amarathus californicus (sp?).
Juniper - - - - -	Juniperus scopalorum.
Lamb's Quarter - - - - -	Chenopodium Fremontii (Wats).
Rat tail Cactus - - - - -	Opuntia leptocaulis.
Graythorn - - - - -	Zizyphus lycioides.
Wild buckwheat - - - - -	Eriogonum trichopes (sp?)
Mentzelia - - - - -	Mentzelia multiflora.
Mormon Tea - - - - -	Ephedra Nevadensis.
Puncture Vine - - - - -	Tribulus terrestris.
Russian Thistle - - - - -	Salsola pestifer.
Gnat Weed - - - - -	Polygonum aviculare.
Jimson Weed - - - - -	Dature meteloides.
Fluff Grass - - - - -	Triodea pulchella.
Bush Muhly Grass - - - - -	Muhlenbergia Porteri.
"Fake" Palo Verde - - - - -	Canotia holocantha.

MONTEZUMA CASTLE (CONT.)

A word or two of explanation is due. Of the plants listed, I am sure the puncture vine and the Russian thistle are not native. "Fake" Palo Verde is the only name I know at the present time for a low tree which I have called Palo Verde for years. To the layman the trees look alike, except that this tree has rough bark, and the true Palo Verde has a smooth greenish bark.

While Mr. Darrow was here he was allowed to take a few plant specimens with him to check on when he returns to Tucson. He promised to send identifications on them later.

GENERAL

August has been one of the most satisfactory months this custodian has seen since entering the Service. Usually summer visitors are so uninterested that one's brain goes into hibernation, but August has produced plenty of intellectual challenges.

We are glad to welcome Mr. and Mrs. Jennings into the Service and hope they will like us and our work. If Bob Rose were back with us he would probably refer to those ups and downs which Jesse has ahead of him in the next few months on those Castle ladders, but we wouldn't do it for the world.

Mr. Steenber has made a real contribution to the Service with his early pictures of the Castle. Let us try to get his story of the visit, Earl, for the Supplement.

Chief, I feel like Earl has turned in a corking good report this month, don't you? - F.P.

*****OOO*****

EL MORRO

By Robert R. Budlong, Custodian

TRAVEL

During the month of August a total of 561 persons visited this national monument. Of this number, 517 received guided trips. Those not receiving guided trips were people who entered the grounds, inspected the inscriptions, and only came to the office to register after they had inspected inscriptions; those who arrived at the monument during one of the custodian's trips to town for supplies; and those who desired to hold picnics or take the trail over the rock or past inscriptions unattended. All were contacted, however, with the exception of those who arrived during the absence of the custodian.

EL MORRO (CONT.)

Our 517 visitors were shown our monument attractions in 94 guided trips; time occupied, 9,100 minutes; average time per trip, 96.8 minutes. Parties averaged 5.5 persons.

On July 25 we had the pleasure of welcoming Erik Reed to the monument. His visit was brief, as rain was falling in the pass to the east, but we hope he will soon pay us another, and longer visit.

Father Stoner visited here August 4, and the custodian profited greatly from his visit, both in pleasure and in the acquiring of much new and valuable information. He, also, arrived at a time when a light rain was falling.

We also had the great pleasure, on August 13, of being visited by Dr. Ruther M. Underhill and party. Their visit was, of course, all too short, but we are hoping for the pleasure of a longer one in the near future.

WEATHER

Another month has rolled by with no rain at this national monument. And this is considered to be the rainy season. We had a few light sprinkles, but only sufficient precipitation to settle the dust. No water drained into the water reservoir. A few showers have fallen in the nearby vicinity, but they were confined to a few small, scattered localities. Crops nearby are suffering because of insufficient moisture. Many farmers claim they will not make a crop.

The night of the 19th of August we had an early frost, a few plants in neighboring fields being frosted. Ice formed on water at the logging camp a few miles distant. We seem to be having a freak season.

Water

I know this has been mentioned in past reports, but it still is deserving of comment. No rain having fallen to replenish the supply, save once during the entire summer, and water-haulers coming daily from near and far, the level of the water in the reservoir continues to sink steadily. Boss, you should see the stuff. I've had to discontinue boiling it, because it has become so thick that upon cooling, after boiling, it jells, and has to be eaten in chunks, with knife and fork. This does not satisfy thirst. I have by now become so accustomed to the violent comments of our visitors relative to the water that the other day when a lady asked how long I had been damming the water, I told her I had been doing so steadily ever since I first saw the pool and heard it was the only available supply of drinking water at the monument. I am still wondering if I might not have misunderstood her question, though she seemed to find my reply entirely satisfactory.

EL MORRO (CONT.)

SIGNS

It continues to be impossible to keep road signs in place more than a few days at the most. Whenever I go to Gallup for supplies, which is about every ten days, I take along hammer and nails, and stop to repair what signs I can. I continue to find that some have been taken down and erected on the wrong side of the road, pointing in the wrong direction.

Several new signs were ordered during the month, the principal one to be erected at the entrance road. During the early part of the travel month the old entrance signs, which were seldom seen, being on the old road which is not now used, were taken down and erected on the new road. A large percentage of visitors still continues to attempt to take any cowpath or rabbit run seen diverging from the main road, however, for reasons impossible to understand.

EQUIPMENT

Last week we received the Electrolux refrigerator transferred here from Tumacacori. Our great thanks, Boss. We hope to have it installed in the cabin and in working condition before much longer. The problem right now is where to put it, and we have decided that the only available room is at the foot of the bed in the "blue room." (That is, the one-car garage used as a bedroom; we call it the "blue room" because one can see such great areas of blue sky through the cracks in the walls and ceiling) It is thought that this installation will have one distinct advantage: during the winter the custodian can sleep with his feet resting on one of the shelves of the refrigerator. Since temperatures here go down to around 45 degrees below zero in the winter, the interior of the refrigerator with cooling mechanism going full-blast, should be around 45 degrees above zero. This being 90 degrees higher than the circumambient atmosphere in the blue room, I should be able to keep my feet sufficiently warm during the cold weather. For many reasons we greatly appreciate this new item of equipment.

ICE CAVES

The ice in the Perpetual Ice Cave about 19 miles east of the monument is being chopped away steadily. I understand that much is taken out to supply refrigerators at the lumber camp at the base of the Zuni Mountains; more is utilized to cool various and sundry beverages at a saloon or two at La Tinaja; and the remainder taken by visitors and local inhabitants. Regular picnics are held there every week-end or so, I am told, the people taking ice-cream freezers and the necessary ingredients, and making ice-cream there for their picnics. Though I never have been able to inspect the cave, I am told by visitors that several tons of ice must have been removed within the last month.

GENERAL

The month has been the peak month this season for visitor travel. With schools opening in the month of September, it is expected that the coming month will mark the beginning of the decline in the number of visitors per month to this national monument.

In closing the custodian should, perhaps, make his apologies for this and last month's reports. The water supply apparently has been responsible for his going into a marked "decline", and after a month or more of it he is somewhat below par.

o

We are glad Padre Stoner got over to see Bud because now he will get interested in helping us out over there at El Morro with our historical problems just as he has at Tumacacori in Southern Arizona. Amongst his other work he has been Chaplain for a lot of CCC camps in Southern Arizona for the last couple of years and drops in at headquarters about once a month for a talk with us about Padre Kino and mission history. What a difference there is in the last couple of centuries between Padre Kino's thirty or forty miles per day over his district and Padre Stoner's three hundred or more of the present! But I expect the percentage of sinners holds about the same.- F.P.

*****ooo*****

WHITE SANDS

By Tom Charles, Custodian

We have had two good rains at the White Sands in the past month. But what is a rain at the White Sands? It neither does any good nor any harm. Neither rain extended out as far as Mr. Underhill's road project which was bad for he needed rain badly, nor to headquarters, which was good for Mr. Veal and Johnnie are waiting for roofing and a heavy rain would not be so good for their new administration building.

The first rain came one Sunday about five p.m. when there were 25 or 30 cars in the Turn-Around and in the picnic grounds. It was a regular old-fashioned desert rainstorm - big drops splashed holes in the sand half as big as the palm of one's hand and the visitors soon scurried to the shelter of their cars. All save two - two small boys, apparently twins $2\frac{1}{2}$ to 3 years old, attired in little more than the good Lord gave them, stayed on the hills during the storm and what a time they had. It was hard to tell who was having the most enjoyment - the children in the rain or the crowd watching them. It was at least something new at the Great White Sands.

The new road project is moving right along - the grade is up, and before you get this report the first rock course will be on and rolled

WHITE SANDS (CONT.)

in. This is no wheelbarrow job, I can assure you. They put sand and clay on at the rate of 1,200 yards a day. By the way, you may be interested to know that we took the sand from the face of one of the long white hills to the left of the road going in, and the scar is so nearly effaced already that a stranger could not distinguish the place.

We are having a detour around the construction work on Mr. Underhill's project. Only once before have we had to detour since the road was built into the Sands in 1934. That time the clay road was wet and slick, but this time we just had too much business. Thirty trucks hauling sand and a couple of graders processing made the detour necessary.

On Sunday, the 14th, we had over 100 cars over that detour and before night several cars had to be lifted out of the chuck-holes. Funny incidents occur, even on serious occasions. I came upon one of the cars which was stuck in the dry dust of a chalk hill - every time he spun his wheels the floury dust fairly fogged the landscape. A fair young nymph was taking dust baths first on one side of the car and then on the other. When I drove up she rushed up to me with the information that "Oh, it is too bad - too bad - and we are on our honeymoon!" It was not long until enough men had gathered to pick the car up and set it on solid soil again, but no amount of argument could persuade that young couple to go on out to the heart of the Sands. They had enough.

By six o'clock that day the heavy machinery had been pulled off the road project and by night traffic did not have to detour. It was fortunate too for there were 24 cars at the Turn-Around at dark when I left there and the evening crowd had just started.

We have had big crowds this month - mostly evening visitors and that does not give us a break on the count for after dark visitors never register. For instance last Saturday night, the 21st, the watchman at the headquarters said over 100 cars went in after dark. The man on the heavy grader, working on the night shift, supported the statement by the information that he had to quit work at eight p.m. because of the traffic. "There were between 50 and 60 cars drove in there between six and eight o'clock," said he. "The dust was so bad and the cars so thick that I felt it was not safe to keep the roller on the road." On the night previous to that the Methodist church had a big picnic, besides several other groups. Friends who were there say there were 45 or 50 cars out that night. On Sunday, the 22nd, there were close to 150 cars at the Heart of the Sands in the day time. There were 32 cars - at least 160 people, there when I left at dark. None of those night visitors register, and we have no check on them whatever but no doubt our basis of 14% registration still gives us a fair estimate, of the total number of visitors.

Sunday, the 22nd, I counted cars at the intersection for one hour. There were 64 cars passed in 60 minutes and 19 of them went into the heart of the Sands.

WHITE SANDS (CONT.)

It is a long step, Boss, from the day about four years ago when we all stood at the edge of the Sands and wondered if we could build a road into them - if we would be able to find it some morning after a New Mexico windstorm; if we would ever draw as many as 50 cars a day; and if there would ever be any money for a headquarters building. This baby of ours is certainly a modern one - it has had but few of the ills of childhood.

This month we have had 32 states and three foreign countries represented on the registration records - figuring those as average days we had 1,746 register, and on the basis of 14% registration our total would be 12,471 for the month.

o

Tom, we are not to first base yet with White Sands, and by the same token, we haven't begun to have our troubles with it yet either. It is one place where the visitor curve can go straight up if it wants to for all I care if we can just get the Budget to give us one employee for each additional 30,000 visitors and enough to keep him on the job. Your visitors can't do much harm and when we get our new administration area blown in, we will have the traffic pretty well under control, so let them come.

It won't be long now until we have a man on the ground and you are going to be put on the spot with your visitor count, Tom. I think some of the boys might be interested in starting a little pool on what a poor guesser you are, from rumors that filter in to us from the field, but I'm on your side until the figures prove us wrong.

*****ooo*****

WUPATKI

By David J. Jones, Park Ranger

With the addition of 28,000 acres to Wupatki National Monument one must spread himself pretty thin to cover it. With pride, however, I can announce it as being the fifth largest in the Southwestern Monuments with no doubt but what it is the finest.

Since my arrival most of my time has been taken up with the process of getting settled in my quarters and acquainting myself with the surrounding country. Dr. and Mrs. Colton have been extremely helpful to me in orienting myself, and I am looking forward to many pleasant contacts with them in the year to come. Many of the interesting finds of Wupatki would not have been mentioned to the visitors, but for the efforts of Dr. Colton.

Within the last month there have been 280 visitors at the Citadel, and 180 at Wupatki. 53 of these having been duplications, a total of 417 persons visited the monument as compared to 290 in August, 1936. Most of those whom I have contacted seem to be very interested and do

WUPATKI (CONT.)

not regret traveling the slow road into the monument. Among the noteworthy visitors for the month are Dr. and Mrs. Colton who brought out a group of 24 for a picnic supper. For the past few days Phillip Welles has been here taking a rest before a proposed cat hunt into Mexico.

As to the roads, I suppose that one might say that they are no better nor worse than usual - the best being none too good. Numerous small showers, however, have kept the road between Wupatki and Sunset Crater passable.

Specific data regarding the weather is not available for this month, but there has been a shower almost every day since my arrival on August 15. I might add that the Snake Dance at Walpi today (August 23) seems to have been quite successful. At least, it has rained here most of the afternoon.

Among the proposed improvements is the construction of a protection for an exposed burial which is in one of the rooms. This burial is of considerable interest to the visitors and should be more adequately protected than is possible with the present tarp. In addition, a stabilization crew has been promised for the late fall or early winter to stabilize some of the walls. Dale King, from Headquarters, accompanied me on the first trip here and took several photographs of those portions of the ruins which are in a bad state of repair. Let us hope they will produce results.

SUNSET CRATER

By David J. Jones, In Charge

During the month of August a total of 1,193 visitors registered at Sunset Crater, as compared to 1,216 in 1936. Remarks on the ledger indicate that the Crater should be better advertised by the use of road signs, and that there should be some better means of conveying information to the visitor than by the pamphlets which are posted there at the present time. Since it is impossible to place a permanent ranger at the Crater with present appropriations, I hope to make some progress on the plan for a wayside shrine with exhibits regarding the Crater.

o

And here is another new man to welcome into our Service, Davey Jones. He will be up at Wupatki eight months of the year and be third trick man at Casa Grande the other four months. It is going to be a great life, Davey, if you don't weaken, and we are glad you have thrown in with us. Be sure to keep the quarters in fine order because those quarters at Wupatki are known across the United States and most of your visitors, as you have already found out, will want to see how you fit into the prehistoric rooms. When Charlie Steen was on lone post at Tonto he always had a perfectly clean towel hanging by the wash bowl. The field was about equally divided on whether he never used a towel

WUPATKI (CONT.)

or kept the one he used under the mattress.

I am glad you have caught the problem at Sunset Crater. We have been worrying about that for two or three years and any suggestions you can work up will be gladly received. We aren't unanimously sold on a wayside shrine there. Personally I believe it will be vandalized, but if you are willing to work it up we will do everything we can to back you. This may be another time I am wrong and I hope it is. - F.P.

*****OOO*****

CHIRICAHUA

By Frank L. Fish, Custodian

GENERAL

This should be classed the month of smiles for the Cochise County cattlemen. The faces of the stockmen have broadened considerably since the rainy season has arrived. With the prospects of better cattle prices, everything favors a better than average year. Another interesting item for Cochise County is the lowering of the tax rate this year from \$1.30 per hundred dollar valuation to 76 cents. This is due mainly to near capacity operation of the mines of the county and the Phelps-Dodge Smelter at Douglas. The smelter produced over one million pounds of copper a day for five days this year, setting new records for that plant. The number of new cars points toward the general trend of purchases made by the workers and this is verified by statements of amusement operators who believe they are not getting their share of the money in circulation compared with the similar conditions of the post-war boom days.

WEATHER

Electrical storms were spotted over the Chiricahua Mountain region until August 9. Since that date daily rains have occurred in the monument and neighboring areas. Unlike the cloudburst or "Gully Washer" of July 19, the rains this month have been gentler of the type referred to locally as a "Ground Soaker".

Temperatures have been mild and without exact figures it is believed the mean maximum for the month was around 85.

The lookout was closed August 14, two days later than the closing date for the Forest Service stations in this region. We have been fortunate so far this season in not having any fires in the monument and one of major proportions in the neighboring Forest Service area.

ROADS AND TRAILS

Approach roads have been open all month and except for short sections under construction or damaged by storms have been in good condition.

CHIRICAHUA (CONT.)

Monument roads and trails have been maintained and improved by the CCC under Mr. Stevenson and details will be found in his report.

VISITOR STATISTICS

<u>States</u>	<u>Cars</u>	<u>Visitors</u>	<u>Foreign Countries</u>
Arizona	204	780 (73%)	Mexico
Other (31)	62	297 (27%)	
Totals	32	1,077	1

Educational contacts: 59 parties, 303 people, 2,553 minutes.

On August 8 a new count on educational contacts was started. Prior to this the only count made was on hiking parties desiring guides and parties desiring a guide to ride with them from Headquarters to Massai Point through Bonita Canyon. The following figures are offered for comparison: Period July 22 to August 8 - 7 parties, 29 people, 880 minutes; total visitors for period, 469; this shows a 6-plus percent educational contacts with an average time of 125-plus minutes. August 8 to 22, inclusive - 52 parties, 274 people, 1,673 minutes; total visitors for period, 608, a 45% educational contact with an average time of 32-plus minutes.

NATIONAL PARK SERVICE OFFICIALS

Charles A. Richey and Thomas Carpenter were in August 2. We spent the afternoon with Bill Stevenson going over the proposed trail location into Picket Canyon. Everyone had a good workout climbing over the scenery.

TRIPS BY THE CUSTODIAN

August 10 a trip was made to Tumacacori National Monument by way of Tucson for the Electrolux refrigerator transferred to this monument. The refrigerator was installed in the ranger's quarters on the 17th.

August 20 I accompanied Bill Stevenson to Headquarters. It was a pleasure to meet everyone there again and see the many improvements.

CIRCULARS

Pamphlets of the "Wonderland of Rocks" have been mailed to the Chambers of Commerce of Lordsburg, N. M., El Paso, Texas, and El Centro, Calif., U. S. Tourist Bureaus at New York City and Washington, D. C.

0

I am glad you have revised your method of reporting visitor contacts,

CHIRICAHUA (CONT.)

Frank. You weren't getting a fair shake in the comparative table with the other monuments.

We at Headquarters enjoyed that little visit too and were glad to get the chance to go over the master plans with you. - F.P.

*****000*****

CHIRICAHUA CCC

By Wm. Stevenson, Project Superintendent

Rhyolite-Balanced Rock trail advanced 1,800 feet.

This trail is now completed through Hunt Canyon and approximately 1,500 feet of very light construction remains to connect with the Sara Deming-Balanced Rock section. It is estimated that this connection, which will mark the completion of our present trail program, will be made by September 1.

Two crews have continued on the backsloping project throughout the month. Four hundred square yards of banks were sloped one-half mile above Bonita Park and all materials were used for surfacing.

Two hundred square yards of rock banks were sloped one mile above Bonita Park and the materials were used in rebuilding low cut banks which will serve in lieu of guard rail. Explanatory note: During the construction of Bonita Highway, the contractor found it convenient to "day light" "through cut" sections at regular intervals to facilitate turning his equipment. These sections are sufficiently wide to permit rebuilding a low bank without decreasing the specified road width.

Highway maintenance was necessary during the greater part of the month. Successive rains filled the ditches and blocked culvert basins. A few small slides occurred in the section where banks have not been sloped. One half mile of road was surfaced.

Rock work on the east wing of the administration building is complete. The masonry walls at front and rear of the existing building are complete, and the rock work on the west wing is complete to a height of six feet. This building will be turned over the carpentry crew about September 1.

Excavation, for the basement and for the footings of the employee's residence, is complete.

Rock quarry operation continued throughout the month.

Bill's job is going right along. We will be glad to see the end of the trail program, and the only other item we are likely to ask for
SOUTHWESTERN MONUMENTS 95 MONTHLY REPORT FOR AUGUST, 1937

CHIRICAHUA CCC (CONT.)

in the way of trails will be a fire trail over in the northwest portion of the monument where the boys tell us we have a "hot spot". We need some more utility area construction and one more residence and a lot more road trimming, so we hope to have Bill and the boys with us for some time yet.

By the way, I've forgotten to ask Bill if he ever hears from Tiny who graduated out of our CCC camp and went off to play college football and finish his schooling. I expect he is making good; he did with us.

*****OOO*****

CASA GRANDE

By A. T. Bicknell, Custodian

WEATHER

Days clear - -----	20
Days partly cloudy -----	10
Days cloudy -----	1
Maximum temperature -----	114° on July 26, 26 & Aug. 3 and 4.
Mean Maximum temperature -----	107.8°
Maximum temperature -----	68° on August 3.
Mean Minimum temperature -----	74.8°
Precipitation -----	1.4 inches, July 26, 28, Aug. 12, 15, 17, 21, 22, and 24.

This past month has seen our temperatures running well above normal. The mean maximum temperature for the month is more than four degrees above normal, and that makes quite a difference to us here. It means that there were many more really hot days, and few or no breathing spells in between. Electrical storms continue nightly making radio reception very poor. Our rainfall this year is slightly below normal.

GENERAL

As is expected in August our travel figures begin their slow climb from the low of July toward the high of the winter season. Following the trend of previous months this year, this past month again shows a higher travel count than the corresponding month of the past two years. An increase of 191 visitors over last month was also shown. This year bids fair to be a record travel year.

The visitors in the summer are naturally bothered with the heat and this past month with our temperatures running well above normal many visitors refused to leave their cars in the extreme heat of the day and contented themselves by a hurried view of the ruins from the car, and then drove on. Of our total of 1,804 visitors to the monument, 1,593 were contacted. Our visitors continue to come from all over the country. 39 states were represented, District of Columbia, Alaska, and three foreign

CASA GRANDE (CONT.)

countries, Canada, Scotland, England, and the Netherlands. Breaking the figures down a little shows us that 51% of our visitors were from Arizona, nine percent from Texas, and seven each from California and Oklahoma. Thus those four states accounted for 74% of our total. Other states having more than 20 visitors were in order: Missouri, New York, Ohio, Illinois, Kansas, and Michigan.

We were happy to meet Dave Jones on August 10. Dave is to be the Casa Grande-Wupatki ranger, spending the summers at Wupatki, and the winters at Casa Grande. He left on August 14 for Wupatki National Monument.

It has long been our hope to work out some sort of a definite outline as to what a proper talk in the ruins and the museum should contain. This would be especially valuable to a new man. With that in mind, the Boss and Ranger Erskine have written out their stories as nearly as they could remember telling them, and these will be submitted to the naturalist office for corrections and suggestions. Then perhaps some definite outline can be drawn up.

USE OF MONUMENT FACILITIES BY THE PUBLIC

Total trave: 1937 - 1804; 1936 - 1487; 1935 - 1374; 1934 - 1376.

Of the 1,804 visitors to the monument, 1,593 were contacted on guided trips through either the ruins or the museum, or both. 7,445 minutes were spent guiding 219 parties through the ruins for an average time of 34 minutes. 3,025 minutes were spent guiding 152 parties through the museum for an average time of 19.9 minutes. Breaking those figures down to find out what each guide contributed we find the following:

Custodian Bicknell: Ruins, 84 trips, 37.7 minutes average; Museum, 57 trips, 22.3 minutes.
Ranger Erskine: Ruins, 129 trips, 31.3 minutes average; Museum, 93 trips, 18.6 minutes.

These figures cannot be considered normal for any long period since a great many days during the month Ranger Erskine was guiding alone, thus accounting for his larger number of trips and somewhat shorter time per trip. During the past few months it has been necessary for the custodian to attend to many other duties around the monument which had been allowed to slip for many years and thus now require considerable time to straighten out. It should also be considered that on the ranger's days off the custodian was guiding alone. All these facts must be considered in an understaffed monument. The fact that many visitors who received ruins trips did not receive museum trips can be readily explained by the fact of one man working alone thus not being able to give service to everyone in the museum because of having to go from one ruins trip to another.

CASA GRANDE (CONT.)

One trailer party stayed overnight and the picnic grounds were used nearly every day by one or more parties. There were no special parties during the month.

NEWSWORTHY VISITORS

National Park Service visitors for Headquarters included: Charles A Richey, assistant regional landscape architect; Clinton Rose, resident landscape architect; Landscape Architect Thomas E. Carpenter; Project Superintendent William Stevenson from Chiricahua National Monument; and Regional Archeologist Erik Reed. National Park Service visitors for the monument included: Frank Fish, custodian of Chiricahua National Monument, and George Keller, CCC traveling mechanic.

Other visitors worthy of mention were: Dr. John Y. Keur of Long Island University, long a friend of Southwestern Monuments; and Dr. E. M. Brigham, Sr., director of the Public School Museum, Battle Creek, Mich.

IMPROVEMENTS

Received during the month were 500 feet of garden hose which is being put to good use carrying water from the air coolers to various parts of the residence and headquarters area for irrigation purposes.

Installation of the new cases for the museum continued and they are now all in place and seem very satisfactory. Charlie Steen, junior park archeologist, supervised the installation aided by Custodian Bicknell. The installation of the new cases now makes surplus of the old ones, so if any of the custodians of other monuments would like any or all of the old cases we would be glad to get rid of them, as we do not have adequate storage space for them. The cases constructed for Aztec Ruins National Monument were taken in two trips by Tom Onstott on Aug. 16 and Aug. 21, and we hope arrived safely.

Eugene Stonehocker left on his annual leave on Aug. 6, but before leaving he overhauled two of the government cars, 1803 and 8124. Stonehocker also made a trip to Tumacacori National Monument to deliver a new electric refrigerator there and to pick up a mechanical one which has been shipped to El Morro National Monument.

One change during the month which the monument personnel especially appreciates is the changing of one of the old museum display rooms into an office. Formerly our desks have been in the display room, and there has been no opportunity for concentrated work with visitors at one's elbow all the time. A new 16-inch ceiling light fixture has been installed which will diffuse the light instead of creating the glare which formerly prevailed. The personal mail boxes have been installed in our office now, thus relieving a crowded situation in the headquarters office.

CASA GRANDE (CONT.)

On the advice of the naturalist division letters were written to many sources in an attempt to build up a monument library. Results so far have been most gratifying. The Southwest Museum presented us with their material on this area. Smithsonian Institution has been most cooperative sending us many very fine publications. And the University Press of the University of California sent several fine papers. We are going to continue our efforts in this line until we have a really fine Casa Grande library. We hope to obtain considerable material on things other than archeology, though our archeological publications will of course be most important.

NATURE NOTES

Little of major interest has occurred in the nature line during the month. The snakes referred to last month continue to frequent the Casa Grande, frightening the visitors and the bats. One Horned Rattlesnake or Sidewinder was killed just back of the administration building one evening by Chief Clerk Jim Luther. That makes the third rattlesnake of the year.

Since the first of the month all of our barrel cacti have come into bloom, and, while not spectacular, are of much interest to our eastern visitors.

Several large scorpions and centipedes have been found and killed in the various residences. Only one actual casualty has occurred, however. Mrs. Hugh Miller was stung on the foot by a large scorpion one night, and suffered some pain for several days, but no serious consequences. Ranger Erskine was bitten on the hand several times by a small Western Whipsnake he found in his dining room, but the snake not being poisonous, no effects were felt.

0

These are very interesting visitor figures, and Al brings out a change which has occurred in the operation of Casa Grande within the last couple of years. Formerly the Headquarters office had time to detail help to the monument for handling visitors. This is no longer possible and Casa Grande is running now strictly as a two-man monument with an additional part-time ranger through the winter months when the peak load occurs.

The new arrangement of the Casa Grande museum is proving an interesting study. We do not expect to know for three or four months how successful it is because the boys will have to get accustomed to the change.

*****000*****

CANYON DE CHELLY

By Johnwill Faris, Custodian

"TIME MARCHES ON", so we are told over certain radio hookups, but with us this summer time has more than marched on and we find that it is only a question of days until our normal season is considered over and we prepare for the winter months.

Maybe one reason the time has slipped up on us so is that some 337 visitors were here during the month and helped us spend several pleasant hours. Mr. and Mrs. Hamilton were in with Mrs. Conley of the Santa Fe Office, and while the Canyon was running and we could not get Mrs. Conley up the Canyon we did go up and down the trail wading across to the White House. She practically promised to come back and bring her husband with her some time when we could go up the canyons.

Taking it all in all there has been a good share of the time that we were able to go up the two canyons in private cars. In several instances we had to shovel some sand and one I remember I managed to run into a channel flow and we were some three hours getting it out. No damage at all was done and the party from New York in the car we were guiding were thrilled to death at getting stuck in the Canyon. I would much rather, however, give them a thrill some other way. I imagine that Tommy would much rather I did too since he was drafted into water detail and responded in a noble manner.

Administrative features of the monument for the month have not been at all out of the ordinary. Unfortunately the pickup went entirely haywire the early part of the month and permission was received to have it overhauled in Gallup since it was not possible to drive it to Coolidge. Only a few days after getting it back an axle went out and damaged one wheel considerably. Fortunately, however, arrangements were made with the CCC to fix it up here thus saving us a great deal in mechanic fees. The Indian Service mechanic was away and we could not get him. At the present writing the Ford is in tip-top shape, however, and we have hopes of it holding up for a time. It is hard to imagine how hard the canyons are on a car that must go up quite often and if we are to use a car in the Canyons much I think we should consider a new car every two years. Even a minor defect at times here might mean that we would lose a car.

Ranger Onstott has been on special assignment for a time leaving Pete and me to handle the Snake Dance crowds but we had no trouble and Tommy lost out on a lot of good parties.

Several visitors this month have taken the time and trouble to hunt me up and tell me that they were very much impressed with the service given by both Ranger Onstott and Ranger Peterson. It pleases me a lot and I know it does you to have the visitors favorably comment on our men.

CANYON DE CHELLY (CONT.)

Well, Boss, I want to leave early in the morning for Gallup and do what I can for the exhibit for the Ceremonial; I shall include more in the next report.

o

Johnwill is correct in saying his country is hard on cars. So is Chaco and El Morro and others we could mention. It is quite clear, however, that our present appropriations are not going to afford a car every two years to these monuments. We will do well to get around with replacements in four years at the present rate so all field men please take note and handle rolling equipment about as carefully as you would handle your watch - and I don't mean oil it once a year.

We are glad to hear Tommy and Pete are still sending away satisfied visitors. We are not surprized, of course, because it is a habit with both of them. Which reminds us that we put into our files this month several letters from enthusiastic visitors complimentary to Johnwill.F.P.

*****OOO*****

TONTO

By Irving McNeil, Park Ranger

All aboard for the Tonto National Monument Special!

Travel over our roadways has not been as heavy as it might have been this month. However, everybody who has taken the trip to our mountain resort (cliff dwellings) agrees that the trip was worth every cent of energy expended. The trip is a bit warm, but we try to keep our stations, the museum and the cliff dwelling, as cool, clean and comfortable as possible. Satisfied customers are our best type of publicity, and we believe that we are turning them out. Different from the prophet, we are recognized in our own country - note the number of people from Arizona, 107.

Next time, Travel Tonto Way:

Passenger list of the month

Total -----	296
Total guide trips -----	58
Total number attending trips -----	226
Total time on trips (minutes) -----	3,049
Average time on trips -----	52.5
Average attendance on trips -----	3.8
Total museum lectures -----	66
Total attendance museum lectures -----	233
Total time museum lectures -----	735
Average time museum lectures -----	11.1
Average attendance museum lectures -----	3.5

Crew

Dale S. King from Headquarters.
Frank Russell from Santa Fe.

Interesting facts about our System

This month began with a bang, or rather a scream. At about mid-night of the 25th of July we heard a mountain lion.....Several more holes appeared in Room 6 and were filled.....Killed a visiting rattlesnake at the back door on the seventh....have a desert refrigerator that is as much appreciated as the electric ones at Casa Grande....very often people want to know if it was the Indians who carved their initials on the timbers of the dwelling....Now, people want to know if the Indians put the fence around the ruin, what next?

Enjoyed a visit with Dale King, who came by on the eighth and brought oil, tires and tubes.....Certainly am pleased to go down the road without fear of a blow-out at every pebble.... The solitude with the unforgettable moonlight nights here, are something to write home about.....the other morning this ranger was on the back porch about 7:00 a.m., when a loud squeal was heard up the canyon. He stepped on the roof and heard it again, unmistakably a javelina. At the second squeal, two young coyotes came out of the bushes about 100 yards up the canyon. One climbed on a high rock and looked back. After some time they cautiously went back into the bushes, but soon returned. Evidently they had nerve, but not enough to get breakfast.

Have everything down to a routine, house cleaning, cooking, etc.... There are hundreds of quail and dozens of rock squirrels on the monument.for the first couple of weeks, people always left the water running under the big cottonwood tree. The tree was dying. Now, the faucet is turned off tight, the tree is watered regularly, and is doing fine..... It is discouraging to throw away garbage, and five minutes later see it running across the yard in front of a delighted squirrel.....have noticed, especially on Sundays, when ranger is in ruin, cars will come, the people look up and then leave - if the ranger could be in two places at the same time, the people can usually be persuaded to go up.....

On Friday, the 13th, during a high wind, the case for displaying posters fell, and shook several of the display boards loose. This ranger thought that one man was going to make a window in the north side of the house in his hurry to get out.....Also, on the 13th, we had some trouble with the bees in the dwelling.....One can actually see places on the entrance road where people have turned around and gone back - the road was just too rough for them.

This ranger's spare time has been spent in cleaning the dwelling, raking the parking area, rebuilding in part the barbecue pit, lining the

TONTO (CONT.)

walks near the house with stones, and generally "keeping the place up."

After having the bravery and the audacity of the chaparral cock ballyhooed to us for years, we saw a common ground squirrel chase one of the cocks for 25 yards and then return triumphantly to his fellows..... One reason for the drop in visitors is two wet week-ends.....Wish we had several more months with the Service, so that we could substantially raise the field trips, museum lectures, etc. Anyway, we have really enjoyed our two months with the Park Service and the monthly reports, but our appointment will be up before the next report, so au revoir and good luck to you all.

o

Irving's first season with us has been very satisfactory from our standpoint and seems to have been a very pleasant time for him. We hope we will be seeing you again next summer, Irving.

We plan for Tommy Onstott to take over for a time at Tonto until other arrangements can be made. The sooner we get this monument under a year-round custodian, the better. It has too many visitors and is so open to serious vandalism; we must protect it throughout the year. - F.P.

*****ooo*****

AZTEC RUINS

By T. C. Miller, Custodian

GENERAL

August has been a very busy and satisfactory month, with heavy travel and fine weather. While our hours have been quite long, we have been so busy that the time has certainly gone by in a hurry. We reached an all-time high record this month in the way of travel. It is believed that the closing of Wolf Creek Pass has no doubt affected our travel to some extent; however, we have had all the visitors that we could handle with the present personnel. The approach road has remained in good shape all the month, with some maintenance performed by the State Highway Department. We have been advised that our approach road will be graveled early in September. Our road bed is in excellent shape for graveling.

The custodian made a trip to Yucca House National Monument on July 28. The purpose of the trip was to take Roving Ranger Brewer some lumber and wire. The lumber was to be used in building a stile over the fence and the wire is to be used in closing both the north and south gates to the monument. This should eliminate the stock altogether as our trouble in the past has been that the visitors leave the gates open, then the stock could come in or out at will. I had planned to make another inspection trip up there just to see how good our Roving Ranger is at work

AZTEC RUINS (CONT.)

of art with saw, hammer, lumber, nails and barbed wire, but have been too busy handling visitors. I found where some driver had been stuck in the mud for several hours and was informed by Mr. Ismay that it was Jimmy, and all this excavating had been done on July 27 in order to get the Dodge out of the mud hole.

Two trips were made to Chaco during the month. The first trip was on July 31, then again on the evening of the 18th. I had to take Tommy Onstott down there to get the dump truck to send to headquarters to get the museum cases. Spent the night in Chaco and motored to Gallup on the 19th with Naturalist King, Custodian McKinney and Onstott who drove the dump truck. In Gallup Custodian Budlong met us and we had a joint meeting with the Gallup Chamber of Commerce to discuss the placing of monument exhibits at the Indian Ceremonial held at Gallup Aug. 25, 26, and 27. It was decided that each custodian would bring in a display, then Naturalist King would take full responsibility of all exhibits for the three days mentioned above. The materials from this monument will be transported to Gallup on the 24th.

WEATHER STATISTICS

Maximum for the month was 96 on July 24 and August 10. Minimum was 46 on August 11. Precipitation .81 inch was recorded for the month. The greatest amount recorded in 24 hours was .28 on the 4th. Clear days, 15; partly cloudy days, 10; cloudy days, seven.

NATIONAL PARK SERVICE OFFICERS

Kenneth G. Disher, Washington, D. C., and Roving Ranger Brewer of Hovenweep and Yucca House National Monuments were monument visitors on July 29. Ranger Onstott, Canyon de Chelly National Monument, was here August 18 and 23.

PERSONNEL

Herbert Summerfield Day entered on duty as ranger-archeologist August 2. That seemed like quite a long handle for a ranger and he suggested that we could just call him Pete. Pete arrived in time to help handle the largest crowds ever handled in this monument, and I can say that he has certainly made a good hand.

MUSEUM

On August 18 we received five new cases for our museum; on the 23rd we received three cases and all the glass. We are proud of these cases and it is hoped that we can find time to install our artifacts within the next few days, as it will greatly simplify the handling of visitors problem, when our museum unit has been completed.

AZTEC (CONT.)

TRAVEL

3,056 people entered the monument in 737 automobiles, coming from every state in the Union, except Maryland and West Virginia. The above number of visitors were contacted and guided through the ruins and museum in 339 parties. Average time for field trips 44.6 minutes. Average museum trips 19.4 minutes.

O

We welcome another new man to our organization in the person of Pete Day.

Mr. Day has been connected with E.C.W. work for the Park Service in the East and so is not entirely new to Service policies in his new position with the Southwestern Monuments. Here's hoping you make the grade, Pete, and I don't know a better man to start you with than the one you have.- F.P.

*****OOO*****

TUMACACORI

By Louis R. Caywood, Custodian

During the month 1,009 visitors were contacted on trips through the mission, while 70 additional used the monument facilities, making a total of 1,079 visitors. Rainy weather probably reduced the count somewhat and cloudy afternoons made many short trips. During such dark days poor visibility in the mission is not conducive to long visits. Many people feel oppressed by the gloomy interior and will not even enter.

A number of National Park Service officials visited the monument during the past month. J. H. Tovrea, assistant engineer, and Clinton Rose, resident landscape architect, were here July 26 in regard to the well and other monument improvements.

August 7 brought Lyle Bennett, associate architect, Santa Fe, New Mexico, and Frederick D. Nichols, junior architect, Washington, D. C. Mr. Nichols is the Federal building inspector for the construction of the Tumacacori Museum and Administration Building. In addition Mr. Nichols plans to do work in Arizona on the Historic American Building Survey.

On August 10 Frank Fish, custodian of Chiricahua National Monument, and Bill Stevenson, project superintendent of the CCC there, dropped in looking for an ice box. We gave them the Electrolux from the ranger's quarters and had them help us install the Westinghouse in its place. Mechanic Stonehocker from Headquarters brought a Kelvinator and took the Electrolux from the custodian's quarters to be sent to Budlong at El Morro.

TUMACACORI (CONT.)

August 13 I accompanied Frederick Eastman, Charles Maguire and Frederick Nichols on a HABS tour of historic sites in Santa Cruz County. We visited Calabasas, Guevavi, Fort Crittenden and Babacomari Ranch. The boys plan to measure and sketch a number of early historic sites in Arizona.

J. H. Tovrea made a second visit on August 20 to inspect the preliminary work on the museum building and pass on some problems.

Luis Gastellum spent a couple of hours on Sunday morning, August 22, "chewing the fat".

Noteworthy visitors during the month included Mr. F. W. Taylor on August 7. With him came Dr. F. L. Robbins and daughter Gene. Dr. Robbins is a member of the Mayo Clinic in Rochester, Minn. Mr. Taylor was formerly president of the Tucson Chamber of Commerce and was active in raising money for repairing the mission in early days. He said that he first visited the mission when one could enter the church by way of treasure hunters' tunnels through the walls. Mr. Taylor promised some old pictures of the mission.

Dr. E. D. Ball and Dr. H. M. Harris of the Agricultural College of the University of Arizona were here August 15 with their wives.

July was reported as extremely dry with no rain. The range cattle were beginning to suffer from lack of feed and the drying up of water holes. August has been the reverse with many rains and floods. The hardest rain at the monument came on August 12 with large hailstones which beat the leaves off the trees. Weather reports show that during August, 1936, Nogales had 4.45 inches of rain. During August, 1937, there has been over seven inches with still a week to go in this month. The rains have been almost daily with hard driving thunder showers in the afternoon and sometimes at night drenching downpours with no wind.

During some of the severe winds which accompanied the rain storms two large branches were blown from the umbrella trees. Jim trimmed off the broken wood of one break and tried some tree surgery. It looks very good and if it heals properly will be a first-class job.

And with the rains comes the rapid growth of the weed population. The favorite sport here now is weed chopping and we all take an active part. We are thankful that the museum and administration building will cover some very fertile ground and reduce the weed growing area of the monument. We are in favor of more and larger buildings. Mr. Boundey said that it took him three years to rid the monument grounds of tumble wees. Now the sand burr or puncture weed is the chief culprit.

During the excavation for the foundations of the museum very little has turned up in the way of archeological 'finds'. A few pieces of

TUMACACORI (CONT.)

copper plate and some pieces of broken pottery were uncovered. A number of early foundations going back to Spanish times were cut through. An Indian hearth was found almost four feet below the ground level and below the stratum bearing Spanish remains.

After the rains a number of arrow points have been found and some time ago an interesting religious medal was found. When discovered, the medal was covered with a patina of lime and sand. The sand had become incrustated with a copper corrosion from the medal and was extremely hard to remove. It is of brass and seems to have been stamped from dies similar to the way coins are made today. It is oval and measures 1-1/8 inches in height and one inch in width. It has a cameo-like design on either side. On the obverse side is a highly raised likeness of Santo Wencelaus, patron saint of the Bohemians. He was king of Bohemia from 1378 to his death in 1419, succeeding his father, Charles IV. He was also Emperor of the Holy Roman Empire from 1378 to 1400. He is shown crowned and in heavy armor with a flag on a staff over his left shoulder. On the reverse side is quite the opposite with a full length figure of Santo Isidro or Saint Isidorus, patron saint of the farmer or laborer. He was born about 560 and died in 636. Around his head is a halo and in his right hand the staff. In his left hand is a sheaf of wheat. He is dressed in a belted tunic falling almost to his knees and on his feet there is high top foot-gear. Behind him is a pastoral scene showing a field of wheat, a man driving what looks like a pair of oxen plowing and in the background are mountains. Such a find will make an interesting museum piece.

I am enclosing some notes on archeology and history which may be of interest to include in the Supplement. It might be well to call them "Randon Notes from Tumacacori" to be continued from time to time when new bits of interest turn up.

The Mountain States Telephone & Telegraph Company has recently been putting on the covers of its directories drawings of Tumacacori and San Xavier missions. The Tucson directory has had two views of San Xavier and the Nogales directory two views of Tumacacori. The 1935-36 edition of each directory had one drawing and the winter 1937 has another.

Changes at the monument include the closing of the main gate for entrance to the grounds on foot and the routing of visitors so that there is no interference by them of the construction of the new building. They may now view the construction but cannot gain entrance to any of the work. Following Mr. Richey's suggestion, the restroom signs have been placed nearer the ground. Jim took out the posts, tarred them heavily and replaced them so that the signs are about 18 inches from the ground. Also the front gates were given a coat of linseed oil which makes them look like new again.

TUMACACORI (CONT.)

This is an interesting report and we are glad to note that the new administration building and museum construction is at last under way. We trust the rains will be kind enough to ease off now and let the contractor push his work.

We are glad to get the notes for the Supplement, Louis, and will look forward to more in future months. - F.P.

*****OOO*****

BANDELIER

By C. G. Harkins, Custodian

WEATHER AND ROADS

Our weather has been hot and dry all month, with the exception of a few light showers; the roads have been holding up fairly good, but are getting quite dusty the last few days. This is especially noticeable from Pojaque to the Detached Section. A chart of weather statistics follows:

Maximum -----	94	Aug. 10
Minimum -----	52	Aug. 16
Mean Maximum -----	88	
Mean Minimum -----	59	
Mean -----	73.69	
Range -----	28	
Days Clear -----	18	
Days Cloudy -----	5	
Days Partly Cloudy -----	8	
Precipitation -----	.67	

VISITORS

This month has been one of the best from a visitor standpoint. We had 3,825 visitors arriving in 1,018 cars from 44 states and six foreign countries; Washington, D.C., had 17 representatives. The six highest states by visitor count are as follows:

New Mexico -----	1,399
Texas -----	829
Oklahoma -----	517
Kansas -----	206
Missouri -----	104
California -----	93

219 trips were made through the ruins averaging 8.16 persons to the trip, and 84.17 minutes to the group; we have tried to give a little longer service per trip and to keep the number in each party around eight to 12, as the larger parties do not seem to derive as much from a trip

BANDELIER (CONT.)

as the smaller ones.

The trails are quite dusty, and some means of eliminating the dust should be worked out before another travel season, If we should be favored with a few good rains, this source of trouble would be over with for the time being.

The recent opening of the highway over the Jemez Mountains has had a tendency to increase our visitor count, but most of the visitors going through on that route drive in and look around and then go out without making a ruins trip. They are all contacted and talked to. On the other hand, we have a lot of picnic parties over Sunday who do not take a ruins trip. Our camp ground has been full nearly every Sunday. This month shows we have given ruins trips to 49.8% of the total visitors arriving at the monument.

Travel for this year is as follows:

This month -----	3,825
Total for the year -----	7,011
Travel to date -----	10,836

NEWSWORTHY VISITORS

July 25 - Madam Esther M. Dunchevesky, Sofia, Bulgaria.

July 27 - Mr. and Mrs. H. Waha, U. S. Forest Service, Albuquerque, New Mexico; Mrs. Elizabeth Pitt, U. S. Forest Service, Washington, D.C.; Mrs. Pitt is a former Park Service employee. This party made a short ruins trip as Mrs. Pitt was hurrying back to Washington by plane.

July 28 - Captain and Mrs. C. F. Burbank, Washington, D. C.

Aug. 9 - Mr. Frank Waldron, State land commissioner, and party of seven spent a few hours in the camp ground.

Aug. 8 - Juan Gonzales and Rainbird Gonzales. They worked here in the canyon when the present lodge was constructed, and again in 1909 with Dr. Edgar Lee Hewett when he excavated Tuyoni. Prof. and Mrs. Ray Hagerty, Chillocco, Oklahoma, Indian School.

Aug. 16 - Mrs. E. B. Butts of Round Mountain, Nevada, a personal friend of E. Z. Vogt, former custodian of El Morro National Monument.

CCC VISITORS

July 27 - Lyle E. Bennett, Associate Architect, Santa Fe, N. Mex.; Charles A. Richey, assistant regional landscape architect, Santa Fe.

BANDELIER (CONT.)

Aug. 8 - Miss Dorothy Fisher and Tom Conley, Santa Fe, N. Mex.

Aug. 5 - Mr. and Mrs. A. Stockman, CCC Inspector.

NATIONAL PARK SERVICE VISITORS

July 27 - Mr. Carpenter, San Francisco Office.

July 28 - H. S. Day, Washington, D. C.

Aug. 2 - Kenneth B. Disher, associate museum expert, Washington, DC.

Aug. 20 - Dale S. King, park naturalist, Southwestern Monuments.

NATURE NOTES

The beaver in the lower canyon have shown very little activity recently. Whether they have left or not is unknown, but no new cuttings are in evidence.

Deer and turkey sign are very plentiful in the upper canyon along the trail and down as far as the Ceremonial Cave.

MUSEUM

No accurate count of museum visitors has been kept this month due to the fact we were working in there finishing up some of the models. Beginning the 24th a regular visitor trip chart will be taken. Two more cases are expected any day. This will give us one room and two additional cases in the second room. Mr. Kenneth B. Disher, associate museum expert, from Washington, D. C., spent a few hours here August 2 going over the museum setup. Visitors so far have been very complimentary on the exhibits. Some spent 20 to 30 minutes in the museum while others only take a look and walk out.

RUINS REPAIR

The big kiva is nearly finished except for the clean-up and by September 15 it should be completed. Mr. Hendron is getting out a complete report on the project. A copy will be forwarded to your office.

This is a good report from Bandelier and we are glad to see the nice increase in visitors where a man is as well equipped to handle them as Cy is. This monument has not yet come into its own in the matter of attendance and we haven't much idea where the visitor curve is going when it really starts upward. - F.P.

*****OOO*****

BANDELIER CCC

By H. B. Chase, Project Sup't.

The garage unit of the hotel area development has been completed to parapet wall height. All vigas and roof sheathing is now in place and upon completion of the doors and mopping on the roof the unit will be completed.

Unit No. 1, dining room and kitchen of the hotel development, has progressed through the month to the point of interior finish. All kitchen cabinets have been constructed and in place, interior plastering completed and bench work of the doors and interior finish ready for installation. At the present time the flagstone floor of the unit is being placed.

The connecting of the water intake outlet with the canyon water main was completed this month, allowing the water intake project to function 100 per cent. A more adequate supply of water has been observed since connecting with the new unit.

The sanitary sewer project, throughout the hotel development area and connecting with the main line sewer, was started this month and constructed to 90 percent of completion. There remains one small line to be connected with Manhole No. 2.

The pipe line project, instigated for the water supply for the entire hotel development area, was started this month and the portion of the line running through the development proper is now in place, complete with all fittings. This project will continue up the canyon side with a feeder line and return line to a proposed 20,000 gallon water storage tank.

The gasoline tank and fittings has been installed in the gas and oil house unit, together with miscellaneous items, oil drum rack, shelves, and other service station apparatus, which leaves only the doors and windows to hang, making the gas and oil house a 100 percent complete project.

A crew has been in the forest all month felling timber for future viga and lintel requirements in the hotel development. The Soil Erosion Service offered the opportunity of securing this material from the Ramon Vigil Grant and was readily accepted by this camp.

A rocky quarry crew has been in progress all month, principally quarrying and shaping a particular type of stone used in the construction of flagstone floors .

Considerable time has been expended by Skilled Workmen Gardner (Electrician) with the aid of a small crew, in hooking up and completing the installation of our intercommunicating telephone system. A small amount of work yet remains to make this project 100 percent complete.

BANDELIER CCC (CONT.)

The final finishing work of stone walls, thus far set up and approved in the hotel development area, completed this project 100 percent until such a time additional plans have been received for the continuation of this project in conjunction with the entire development.

There has been a crew at work the entire month on the large kiva, under the ruins repair project, thoroughly cleaning the floor and building up the retaining walls high enough to eliminate water draining into the structure. Screening of the fill for artifacts has been finished and the work on this kiva is almost completed.

*****OOO*****

BANDELIER FORESTRY

By James T. Fulton, Forestry Foreman

GENERAL FOREST FIRE SITUATION

No fires have occurred this past month nor are we likely to be troubled with fires again until next summer. Fall rains and snows beginning in September will be certain to accomplish that.

INSECT CONTROL PROGRAM

This year, it was unnecessary to spray for the control of Web Worm here in Frijoles Canyon. No doubt the infestation has reached the end of its cycle and will not return again for some years. There were a few webs, but defoliation was practically nil.

MISCELLANEOUS

All this month I have had a crew of men engaged in cutting lintel and viga material on the Ramon Vigil Grant. In another two or three weeks I will have completed the work and can write a full account of the work in next month's report.

*****OOO*****

WALNUT CANYON

By Paul Beaubien, Jr. Park Archeologist

2,086 visitors were contacted, and 504 registered without being contacted. The increase over previous years may be attributed to less rain during the rainy season. The first August I was here, 1934, there was rain every day but two. Last year in August, I had to extricate several cars from mud-holes along the entrance roads. This year the roads have been in excellent condition.

Park Service visitors were Erik Reed, Carl Schmidt, Tommy Onstott, Ken Disher, Dale King and David Jones. Davy had only been here a few days before he could give any number of reasons why Wupatki was the

WALNUT CANYON (CONT.)

finest monument in the world.

I understand that the monthly report should record the happenings of a monument. In endeavoring to meet as many of the parties as possible each day, and cleaning up after them, there isn't much time for other happenings. Have received word that three new pickups have been shipped to Flagstaff from Detroit, August 20. If I get to keep one of them, I'll be able to record the first real happening that has occurred here in years.

Have received four pottery vessels from headquarters. Said vessels, with some Hopi corn, a Hopi basket and a Hopi rug, are being displayed on a card table in the office. I hope to secure one of the glass-topped display cases from the Casa Grande museum.

Several more steps have crumbled on the trail this month. The trail is still passable, so I'll wait till traffic declines before repairing with cement.

o

In the mail today we have a card telling us a carload of cars has arrived in Flagstaff so we take it Paul will have something to report next month. He and Davy and Milt Wetherill are each scheduled for a new light truck.

Also we have one of those display cases from Casa Grande marked for Walnut and the first time we get a chance, will send it up.

So things are coming your way at last, Paul.

*****OOO*****

CAPULIN MOUNTAIN

By Homer J. Farr, Custodian

My August report for Capulin Mountain National Monument shows we have had 7,000 visitors this month. Distribution of visitors from states appears to be whipping right back as in years before. I would say my check this month shows 60 percent from Texas, 20 percent from Oklahoma, ten percent from Kansas, and the balance fairly equally divided from half a dozen other states like Tennessee, Arkansas, Illinois, Colorado, Louisiana and a few from foreign lands.

Weather has been extra good to us all this month with a few light showers and real cool nights. As a whole this month has come through with the usual moisture and conditions in general are getting much better.

It has been repeatedly reported here that just a few miles east

CAPULIN MOUNTAIN (CONT.)

all month has been extra dry and hot and in fact shows almost a complete desert for about 200 miles east beginning just within ten miles of this monument.

All flora has put on a glad array this summer at our monument and during my 30 years of observation of this volcano I have never before witnessed more abundance in grass and flowers. Our squirrels are back with us again in numbers as in years before the drouth. I have not seen any deer this month but I see their foot-prints in the road every few days; I believe we now have about ten or 12.

We will have Mr. Wirt and Mr. Borell with us next Sunday studying the possibility of porcupine control for this monument. In my opinion these little animals do a great deal of damage to our trees and their activities should by all means be sharply curtailed. However, Mr. Wirt and Mr. Borell have had a decidedly different view of the matter. The porcupine is one proud, arrogant and stuckup son-of-a-gun. I have no use for it whatever, for after witnessing the damage he has done to our scarce and valuable young growing trees I feel that his tribe should be partly eliminated from this monument.

On Wednesday, August 11, I had the pleasure of making a lecture on this volcano before the Kiwanis Club of Raton. Raton has in the past been keenly appreciative of this volcano and its good businessmen have sent many visitors, some 70 miles off their route, to visit this monument, and I feel this little lecture will warm the friendship and good fellowship their city has had for our monument over again.

0

Again we would like to point out that porcupine damage at Capulin is a little worse than the same amount of damage on the average flat or rolling ground. Capulin Mountain stands at about a sixty percent angle and when you kill a dozen trees on that slope you can see them a dozen miles as you come across the flat country to the foot of the volcano. This is why we have helped Homer all we can in his porcupine protest.-F.P.

*****00*****

CHACO CANYON

By Lewis T. McKinney, Custodian

Things have been pretty busy at Chaco this month. The University of New Mexico and the School of American Research at their digs and repair work have kept me pretty busy along with keeping the stock out of the monument, the gates closed, and contacting visitors which have been coming in steadily the entire month.

1,313 visitors entered the monument this month in 479 automobiles, from 31 states, Washington, D. C., Canada and Hawaii.

CHACO CANYON (CONT.)

Cal Miller and his new ranger, H. Summerfield Day, were over on July 31 to see what a pueblo ruin looks like. Ranger Tom Onstott from the "Johnwill Faris" National Monument was over four times during the month. He can't stay away. Kenneth B. Disher, Museum Division, National Park Service, Washington, D. C., was out to look over our blacksmith shop and give us a few points. He couldn't find the museum.

The Prairie Trek Expedition, composed of boys from eastern states and headed by H. S. Howie, were overnight visitors on July 26.

On August 8 Dr. Byron Cummings returned to the Chaco with a group of 17 students from the University of Arizona. Rev. Victor R. Stoner, president of the Arizona Archeological and Historical Society, accompanied Dean Cummings.

Evon Z. Vogt, Jr., former ranger at El Morro National Monument, was a visitor on August 10.

Governor Morris, author, was a visitor at the monument, accompanied by Mrs. Morris.

A party of 20 students headed by Dr. Frank C. Spencer arrived at the monument August 16 and spent the two following days studying Chaco archeology.

Dr. W. W. Peters, medical director of the U.S.I.S. Navajo and Hopi areas was here August 19. With him were Lucy Wilcox Adams, director of Navajo education, Dr. Estella Ford Warner, medical director of District No. 8, and Edna A. Gerken, superintendent of public health education Indian Service.

The University of New Mexico has been working this summer on a small house site, just east of the one (Tseh So) excavated last summer; work was commenced August 2 by the general field session of the University. Nearly 40 students, representing some 20 universities and colleges, are in attendance at the four weeks' session. To date a number of kivas and other rooms have been uncovered whose masonry and artifacts indicate the culture period as being late Pueblo II. A considerable number of burials, whole pieces of pottery, fragments of textiles, and dendro-chronological specimens have been recovered. The students (who are divided into lower division, upper division, and research classes) are receiving instruction in such phases of excavation as burial removal, stratigraphy, and room excavation; and also in the various museum techniques of preserving, classifying, recording, etc. Dr. Leslie Spier, of Yale University, has been lecturing on Southwestern ethnology. The advanced students are carrying out special research projects under Dr. Clyde Kluckhohn, of Harvard University, Dr. Florence Hawley, University of New Mexico, and Dr. Donald D. Brand, University of New Mexico.

CHACO CANYON (CONT.)

I will give a report in detail on the work done by the School of American Research in my September report, as I don't have enough stuff as yet. I will also report something on Threatening rock by Dr. and Mrs. Keur.

WEATHER STATISTICS

Maximum temperature -----	99°
Minimum temperature -----	44°
Clear days -----	17
Cloudy days -----	1
Partly cloudy days -----	12
Precipitation -----	.07"

o

We think attention should be called to the University of New Mexico Bulletin, whole number 308, published June 15, 1937. It is a preliminary report on the work done on Tsch So, a small house ruin in Chaco Canyon during the summer of 1936 and is written by Donald D. Branch, Florence L. Hawley, Frank C. Hibben, and others. It is from the University of New Mexico Press at Albuquerque.

It is an excellent report, 174 pages with 22 plates, and not only covers the work done in the summer general Field Session of the Department of Anthropology of the University of New Mexico and the School of American Research, but also covers the whole historical, geological and biological background of Chaco Canyon. - F.P.

*****oo*****

NAVAJO

By Milton Wetherill, Park Ranger

August, the anniversary month for Betatakin and the Rainbow Bridge, brought Dean Cummings and his archeology class on his annual trip to the ruins and the Rainbow Bridge. John Wetherill brought Dean Cummings and his party into Betatakin August 9, 1909; from here they went to Ojato and then on to the Rainbow Bridge reaching there August 14, 1909. Dean Cummings was at that time with the University of Utah.

All trails on the monument are in good shape, but they are only a small part of the trails that we have to travel over to get from one section to the other.

Word went out last month that the roads were impassable and for that reason very few visitors to the monument for the month. A truck trail is about all it is now, and a poor one at that. Had one party walk in from Marsh Pass and the last few parties have left their cars this side of the Hogans and walked about two miles into the ruins.

The Rainbow Bridge Expedition will write the final chapter to the 1937 summer work when they leave Marsh Pass on the 22nd.

*****OOO*****

GRAN QUIVIRA

By George L. Boundey, Custodian

Visitors for August, 892. From what I learn from tourists, 40 per cent came this way thru the reports of past visitors.

The older inhabitants call this the hottest summer they have ever experienced in this country, and at times the roads have been very bad and still we have had quite an increase in visitors over other months.

We have always noticed the absence of any house trailers at the ruins. We find that owing to high centers in the desert roads, the people of the surrounding towns advise leaving the trailers behind when visiting Gran Quivira; this undoubtedly discourages some of them but find that many are doing this.

Messrs. Disher, Reed and Russell paid us a short visit late in the evening of the second. I tried to show them the ruins by aid of the headlights on the car but am afraid it was not very satisfactory.

Mr. and Mrs. Kruse of Minneapolis and Miss Cook of Bismark, North Dakota, spent some time at the monument and visited some of the other ruins in the vicinity.

A few showers have saved a portion of the bean crop and has also aided the grass to some extent.

Farmers report many indications of a very early winter. Our heaviest snow last winter was on the 27th of September and by the way the rattlesnakes are coming in to hibernate, believe cold weather is not far away.

Our birds and animals are so used to watering here that even in wet weather they seem to come in just the same. We are beginning to notice quite a few of the northern birds are already drifting south, and some of the birds which have been with us all summer are losing their bright colors.

O

Mr. Boundey points out an interesting thing when he says that about 40 per cent of his visitors came to see his monument upon the report of past visitors.

We know this is the case at many of our monuments. We are advertized

GRAN QUIVIRA (CONT.)

by our loving friends, sometimes, at monuments where we want to hold attendance down, to our dismay. Some time ago one of our very good Park Service friends was putting us on the spot for an increasing visitors' curve at one of our poorly protected monuments. We rather jarred him by telling him it was not us but him and people of his type who were responsible for that upward curve. Upon further discussion, it developed that in the year since he had visited that monument he had told at least 15 or 20 friends that if they came through the Southwest they just must see that wonderful out-of-the-way place. It hadn't occurred to him that a lot of other visitors were doing the same thing and the visitor curve was rising and raising problems for us because of it.

We had a pleasant little visit later on with Mr. and Mrs. Kruse and Miss Cook at Headquarters where Assistant Superintendent Miller showed them around between six and nine o'clock in the evening. They were loud in praise of their treatment at Gran Quivira. - F.P.

*****OOO*****

PIPE SPRING

By Leonard Heaton, Acting Custodian

Again it is time to gather together the facts and history of the monument, put them on paper, and get them into your office.

To start with I will report the travel for the month which has not been as much as last month, from the standpoint of visitors conducted through the fort; 111 people were given guide service. Though the local travel has been rather heavy, I would estimate that there has been some 350 to 400.

Among the visitors there were Dr. H. E. Gregory, U. S. Geological Survey, Washington, D. C. He came in to start a party to map the country between Kanab, Utah, and Canebeds, Arizona, including the Pipe Spring area. Also E. A. Goldman, Biological Survey, from Washington, D. C., out on rodent control.

I gave two talks this past month, one July 26 to the CCC boys on the monument and what we were trying to do here and asked them to help protect the wildlife and monument. I believe it had some beneficial results. The other talk was at Moccasin, where I gave an illustrated talk on the Southwestern Monuments. About 50 attended at Moccasin.

CCC activities

July 26 I turned four CCC boys back to the camp as I could not keep work outlined for them to do. After keeping another three for two weeks more for cleanup work, I had to let them go also, for I found it impossible to obtain a truck to haul dirt.

PIPE SPRING (CONT.)

According to Superintendent Draper we will not be able to get any material or truck till next month and maybe not then, as he says they are cutting him short on funds.

GENERAL

Since the boys left I have been spending most of my time cleaning up, straightening up the grounds around the fort and camp grounds. I have also been making war on the red ants within the camp grounds and by the fort. Have been using gasoline, pouring about a quart down each hole and then covering it up good with dirt. The result is that all the ants that are within the hole are killed. Have had to apply gas to the hill a second and third time. It gets the ants that were out at the first application.

The weather has been very hot during the day, reaching 112 on two days; the nights have been colder than would be expected with such hot days. We have not had any rain here at the monument the past month, though there have been a lot of storms south and east of us, making water run and doing a lot of good.

NATURE NOTES

The other day I was back on the hill and found that the pinyon nuts were plentiful this year, so our squirrels and chipmunks will have their dens full of nuts this year; I hope that I will be able to gather a lot for myself.

There have not been many snakes or lizards around this summer. I think the reason is that the boys are catching the lizards and sending them home, and killing the snakes for their hides.

The fish are growing very fast and I am beginning to wonder if within the next three or four months I will have to put a night guard to keep the fishermen from catching them. There have been several wanting to catch them now. There are a few fish that are six or more inches long. Come up for fish next spring.

Trees and shrubs, as well as the flowers, have made wonderful growth this summer. Hundreds of Rabbit Brush and Grease Wood came up this year on the northeast corner of the monument. The trees in the camp ground have put on the average of five feet growth. Two more years will see them giving a lot of shade.

There are a few new birds here now; believe they have just come in for water rather than coming from the north. Think I will get my bird traps out this next month and try my luck at banding birds again.

HISTORY

Was told by a Mr. Palmer that his Grandfather Palmer who was a blacksmith in Ceder City, Utah, made some steel arrow points for some Indians in the early days and that the same points were found in the bodies of the three Berry people that were killed by the Indians at Short Creek, Arizona, in the summer of 1868.

There are a lot of cattle buyers in this section now, buying and contracting the steers for fall delivery. They are about a month early and are giving fairly good prices too. The range condition is fair now and we are in hopes that it will get better before fall and winter sets in.

We are confronted with a new problem at Pipe Spring caused by the location of a new highway line just outside and parallel to our south boundary.

It will cause a restudy of our master plan with the possibility of relocating our residential area in the northeastern corner of the monument.

This will be taken up through the regular channels but is mentioned here as one of the recent developments of major interest. - F.P.

*****OOO*****

HEADQUARTERS

BRANCH OF EDUCATION

By Park Naturalist Dale S. King

A field trip which is described below occupied the whole of the time of Park Naturalist King after the completion of the July Monthly Report.

Junior Park Archeologist Steen aided with the July report and then hurriedly finished the preliminary installation of Casa Grande exhibits in the new cases. Although far from a completed job, the Casa Grande museum now presents a neater appearance than ever before, and artifacts are arranged in logical order by cultural periods. Eventually the cases must be paneled in, as they now give the impression of having been set carelessly in the room, rather than forming an integral part of the museum. Many graphic exhibits must be worked up before the Casa Grande display attains praiseworthy status. August 24 Steen traveled to Gallup to take charge of the Southwestern Monuments exhibit at the Gallup Ceremonial grounds.

FIELD TRIP BY KING

August 13 Park Naturalist King, accompanied by newly appointed Park Ranger David Jones left Headquarters by car at 8:20 a.m., arriving at Walnut Canyon National Monument at 6:15 p.m.

Wupatki National Monument

August 14 Jones was introduced to his new post, Wupatki National Monument, and immediately fell in love with the place, being impressed with the monument's sprawling size, quantity and excellence of ruins, and, last but not least, the quaint and interesting quarters in two reconstructed rooms of Wupatki Pueblo.

The monument was found to be in spick and span condition, Clyde Peshlakai, Navajo caretaker, apparently having spent an enormous amount of labor repairing roads, picking up loose stone, and polishing up the place in general. No vandalism had occurred during the time Peshlakai was in charge. The Citadel and Wukoki portions of the monument were visited also, and if Davy could possibly remember the Niagara-like flood of San Francisco Mountain archeology and Park Service detail which Beaubien and I poured in his ears he would be one of the best informed new rangers who ever came into the Southwestern Monuments. However, that would be too much to expect from any man.

Baubien transferred to Jones on this trip a large pottery chart, about four by six feet, which had been shipped from the Berkeley Office. It portrays the comparison between Tusayan pottery and that of the region around Zion National Park. Although too complicated for most visitors, it will form a valuable display for Wupatki when the Zion data is replaced by that of the Wupatki phase of the Tusayan province.

Sunset Crater National Monument

This monument was also visited August 14 and its chronic condition found still to be in effect---visitors swarming all over the place wondering what the monument was all about. More than 20 visitors were met during the 15 minutes our car stopped there. The wooden signs installed last year give a certain modicum of information, but some sort of a way-side shrine must be experimented with in an attempt to satisfy visitor curiosity until such a time as a permanent resident ranger geologist can be stationed there. Sunset attracts as many, perhaps more, visitors than Walnut Canyon---somewhere in the neighborhood of 11,000 a year. It is extremely interesting geologically, and, hooked up with Wupatki and Walnut, helps form one of the most absorbing ecological and archeological one-day trips I know. These three monuments through unavoidable circumstance have lagged behind in general improvement, but they must receive attention soon. Sunset Crater at the present is not a monument of which Southwesterners can be proud.

Walnut Canyon National Monument

Junior Park Archeologist Beaubien was found somewhat submerged by visitors but busy with plans for permanent improvement of his monument, particularly if fiscal arrangements make it possible for him to remain there on a 12-month basis.

Shortage of book funds curtails expansion of Walnut's official library (as it does for every other monument also) but Beaubien has made many excellent additions to his personal library along the lines of natural history and anthropology. He is gradually accumulating a small museum exhibit by supplementing his almost non-existent government material with some prize personal Hopi handicraft. Several of the old Casa Grande cases can be used to good advantage at this monument if we are sure Beaubien will be there for protection in winter months.

Walnut's road entrance signs can now be said to be seriously defective in design. The westernmost is completely lost in a brilliant maze of gasoline station and cottage camp billboards and must be made much larger and more striking to obtain any attention whatsoever. The eastern sign has no competing structures to divert attention of travelers, but the iron support on top so discolors the lettering that it is practically invisible. Since painting even once a week would be ineffective, a new scheme is being worked out at Headquarters, and we shall, attempt to salvage what theoretically should be attractive entrance markers.

August 15 I left Gallup by train at 11:30 a.m., arriving at Gallup at 6 p.m. I was met by Custodian McKinney of Chaco Canyon the next morning and talked with Messrs. Woodward and Van Devanter of the Gallup Chamber of Commerce about the monument Ceremonial exhibit and the proposed monument area west of Gallup, respectively. We then drove to Chaco, 11:30 a.m. to 2:30 p.m., spending the rest of that day looking over various changes at that monument.

Chaco Canyon National Monument

August 17 and 18 were spent at this monument.

School of American Research excavation on Talus Unit No. 1 had practically stopped and some stabilization work had been done. Although the repair work contemplated may take care of this small ruin through the winter it is my feeling that much work is immediately necessary on Chetro Kettle. The west court kiva is in terrible shape with water from every ra in washing out walls and floor features and the "Great Sanctuary" is almost as bad. Custodian McKinney was given instructions to contact the School to see if these badly needed projects cannot be accomplished before the end of the field session.

Visits were made also to the General Session of the University of

BRANCH OF EDUCATION (CONT.)

New Mexico's dig near Tseh So, to Wijiji, and to Shabikeschee Village. Near the latter place it was painful to see perfectly good pueblo ruins and pithouses washing rapidly into arroyos. A special report will be made of this under separate cover.

It was especially pleasant at various times during my Chaco stay to meet and talk with Drs. Brand, Fisher, Hawley, Kluckhohn, Spier and others of the University of New Mexico staff.

Custodian McKinney has moved his small collection of artifacts from a reconstructed room in Pueblo Bonito to the old blacksmith shop back of his quarters. This move I thoroughly approve because (1) three times as much space is available, allowing a much neater arrangement of artifacts; (2) light is much better; (3) the custodian has better control of visitors for he can see them from his desk and intercept them before they reach Pueblo Bonito as was the former case; (4) the collection is less liable to theft, being nearer the residence; and (5) circulation of visitors is improved by having the museum near the start and finish of their trip.

Fencing of the Chaco has resulted in a very noticeable improvement of vegetation within the boundaries and Soil Conservation planting in the arroyo itself is coming along very nicely. However, some 70,000 exotic tamarisk cuttings were planted by the SCS. It may be possible to have these removed by the SCS and used in plantings elsewhere, for the native willows are proving just as efficient in controlling erosion. If such work is done this year or next, the project will not be very large, but three or four years growth will so thoroughly establish tamarisk in the Chaco that it will be ineradicable without the expenditure of huge sums of money.

Mobile Unit

Foreman Robert Harris' crew of 19 men established a neat camp, hidden as well as structures can be hidden in the barren Chaco, and have done excellent work in augmenting water supplies and gathering building stone. Instructions were given for Harris to start excavating in Pueblo Bonito the dirt-filled corners which occur when a round kiva was built in a rectangular room. These corners were, of course, excavated by the National Geographic expedition of 1921-6, but were backfilled and have since caused much damage to kiva walls. They were capped poorly with concrete which cracked and allowed moisture into the earth column, and hence out through the kiva wall, completely deteriorating the softer sandstone masonry.

When the ground level in these corners is taken down to that of the kiva floor, walls will be capped and masonry repaired. Experience has proven this the only practical solution of the difficulty.

BRANCH OF EDUCATION (CONT.)

Foreman Harris and Junior Archeologist Steen, who went to Chaco August 28 to aid in supervision until the appointment of an archeologist foreman, will also remove all cement capping on Bonito, for this capping proved to be a detrimental rather than a beneficial measure. Re-excavation of kiva corners and recapping by a new method will occupy the crew's time for several months.

The morning of August 19 I met with Custodians McKinney, Miller, and Budlong and Ranger Onstott in Gallup concerning the monument exhibit for the Gallup Ceremonial. At 5:30 p.m. I left by train for Santa Fe, being met there at midnight by Custodian Harkins who took me by car to Bandelier where I arrived at 1:30 a.m., August 20.

Bandelier National Monument

August 20, 21 and 22 were spent at Bandelier. The CCC ruins stabilization crew under Foreman J. W. Hendron has done a fine job on the big kiva of Tyuonyi. The stabilization work is authentically done and the kiva should hold for some time with no further work. Interesting was the discovery during the work of two viga sets with the original charred viga ends in place. These may furnish a dendrochronological date. In cleaning the badly deteriorated floor upright stones were seen which proved to be sub-floor cists antedating the kiva, according to Hendron. His report will cover these features at a future date.

The Bandelier work has been confined, as I hope all Southwestern Monuments ruins repair work will be, solely to stabilization, with no reconstruction unless absolutely necessary; i.e., to keep an old wall from falling. Hendron's crew will now repair the roofs of the Talus House, Ceremonial Cave kiva, and one other roof of buildings reconstructed by the University of New Mexico and School of American Research in past years. He will then start bracing walls of Tyuonyi ruin.

Bandelier's museum installation still limps, although Custodian Harkins has effected the placement of available displays in the first room so that many visitors receive 15 minutes or so of museum contact. Other displays are being shipped from the Western Museum Laboratories at Berkeley, but there is so much to do that a Headquarters Naturalist must be sent to Bandelier for an extended period in the near future, certainly before the next summer season.

August 23 I left Lamy at 11:30 a.m. and arrived at Gallup at 5 p.m.

Gallup Ceremonial Exhibit

August 24 was spent in assisting Custodians McKinney, Miller and Faris in installing an exhibit at the Gallup Ceremonial grounds. It consisted of six booths: two for Chaco artifacts, maps, and photographs; one for Aztec Ruins artifacts and photographs; one for paintings of

BRANCH OF EDUCATION (CONT.)

Canyon de Chelly very kindly loaned by Artist Leigh; one for a mileage map of the Southwest and to provide a place for distribution of information circulars by the attendant; and one for the northeastern Arizona pottery chart which was borrowed from Wupatki for the occasion. Although very hurried in conception and hit-and-miss in execution, the exhibit I thought to be satisfactory. If such a step is taken again next year I hope we shall have the opportunity to plan and prepare carefully for it. There is a chance at the Ceremonial for the National Park Service to reach thousands of really interested visitors and to reach them in very economical fashion. I think the attendants at the booths will agree that many visitors almost intensely desired information about the monuments and other tourist attractions of the southwest and were greatly pleased at finding a place where such information was available.

I was relieved by Archeologist Steen and left Gallup by car August 26 at 11:30 a.m., reaching Flagstaff at 6 p.m. I left Flagstaff August 27 at 10:35 a.m. and arrived at Headquarters at 5:45 p.m.

BOTANICAL COLLECTION IN RAINBOW BRIDGE AREA

Hugh Cutler of Milwaukee, Wisc., in July collected Tradescantias and a few root tips and anthers in fixative to use in chromosome counts. This work was done around Rainbow Bridge National Monument with permission of Superintendent Frank Pinkley. Cutler will furnish us identified lists and other printed lists in the near future.

REPORT OF THE HEADQUARTERS LIBRARY

By Gertrude F. Hill, Student Technician

From July 28 to August 28, work was confined primarily to the cataloging of geological, botanical, and zoological materials in the library. During the early part of August the writer assisted with the assembling of the Monthly Report, prepared two order lists of archeological publications for the custodian at Casa Grande, and handled several miscellaneous bits of reference work for outsiders and for personnel of various monuments.

That once out of the way, our main project involved the cataloging of the library's remaining files of periodicals - The American Anthropologist, The New Mexico Historical Review, El Palacio, The Masterkey, Museum Notes, Natural History, American Antiquity, and others. Plans have been made to type author and subject analytics for the outstanding articles in several of these publications later on when press of duties has lessened somewhat.

Stenographic work consumed a generous portion of the librarian's time this month. Since our apportionment for book purchase is pitifully small, numerous letters were written in quest of free materials which could be utilized in our reference work. Attempts were also made to

BRANCH OF EDUCATION (CONT.)

fill in missing numbers of various publications in the library files, such as Indians at Work, Southwestern Lore, and the Bureau of American Ethnology Annual Reports and Bulletins. Consequently, new material has flowed into the office in an almost steady stream, as indicated by the following record from August 1 to August 28:

Periodicals -----	38
Pamphlets -----	31
Books -----	11
Reprints -----	2

Repairing of our books was greatly facilitated by the acquisition of a new steel table, the mending record showing a marked increase over that for the two months previous.

The writer spent the entire morning of August 16 rearranging the shelves and otherwise making room for the rapidly expanding collection. From the 11 cases occupied last month, the number has increased to 18, with five shelves of uncataloged material, chiefly old reports and other publications not particularly needed at present, awaiting cataloging when time permits.

Summary of activities from July 28 to August 28:

Books cataloged -----	351
Cards made:	
Author -----	201
Subject -----	425
Title -----	107
Joint author and cross reference -----	37
Shelf list -----	636
Total cards made	1,406

Books repaired -----	58	(this included new covers for many of them)
Letters written -----	53	

Time expended:
 Library activities: 182 hours, 55 minutes
 Stenographic duties (including work on assembling the Monthly Report): 14 hours, 50 minutes.

*****000*****

MOBILE UNIT

By Robert S. Harris, Engineering Foreman

The excavation for the pipe line was completed for a total distance of 1,800 feet. The tower for the storage tank was erected and the tank

MOBILE UNIT (CONT.)

placed in position. 900 feet of pipe have been laid, two faucets placed in the camp ground, and connections made to the custodian's residence. The completion of this project awaits the arrival of pipe which has been ordered by the Indian Service.

Six tent houses, size 14 x 16, and one tent house, size 18 x 24, have been erected. These houses are of the portable type and were fabricated by the Indian Service at their mill north of Ft. Defiance.

Approximately 20 cubic yards of stone suitable for ruins repair work have been gathered by sorting thru the dumps of previous excavations.

Excavation of back-fill material in the triangular areas adjacent to kivas situated in rooms was started and 12 cubic yards of material removed.

Official visitors for the month include K. B. Disher, of the Washington Office, National Park Service; Dale S. King, of the Headquarters office; and C. H. Powers, conservation supervisor of the Indian Service.

0

We are starting a very interesting experiment with this Indian CCC Mobile Unit on stabilization of ruins in the Southwest and we all hope it will work out successfully. If it does, we have years of work ahead for such a crew. As soon as we get some experience in this unique departure from CCC work and learn the size of gang needed and other details, we may take up with you the matter of putting another of these units in the field.

*****000*****

VISITOR STATISTICS

By the Boss

August is the peak of our year and this one was no exception.

Field Trips

We gave 1,940 guided field trips this month as against 1,648 last month and 2,410 a year ago this month. These trips were attended by 12,259 visitors this August, 8,933 visitors last month and 13,735 a year ago in August. The average party was 6.3 persons staying 51.6 minutes. Last year it was 5.7 persons staying 39.1 minutes.

We haven't had as many field parties this year as last and we haven't had as many visitors in the total number but we gave more time to them this year, 100,239 minutes against 94,286 minutes last year.

Visitor Statistics (Cont.)

Aztec gave 16 more trips than last year to 141 more visitors, had 8.2 persons to the party, exactly the same as last year and the average party was 1.7 minutes longer.

Bandelier gave 17 less trips to 20 less visitors. The average party increased from 8.1 to 8.7 and the time lengthened from 71.3 per trip to 84.7 per trip.

Canyon de Chelly - Increase from 18 to 54 trips, from 69 to 320 persons and the average trip came from 253 minutes down to 143 minutes.

Casa Grande - came down from 270 trips to 219, up from 1,468 visitors to 1,593. The average party came from 5.4 to 7.2 and the average party time from 31.7 to 34.0.

El Morro - Came up from 78 trips to 94, from 408 visitors to 517. The average party fell from 5.9 to 5.5 and the average time went from 65 minutes per trip to 96.8.

Gran Quivira - Had 141 trips last year as against 167 this August. Visitors increased from 730 to 892. Average party increased from 5.1 to 5.3. The average time of party dropped from 58.9 minutes to 55.3 minutes.

Montezuma Castle - Came up from 175 field trips to 261, from 1,064 visitors last year to 1,175. The average party dropped from 6.0 to 4.5 persons and the time dropped from 48 minutes to 29.9 per party.

Tonto - The number of trips increased from 50 to 58, the number of visitors increased from 203 to 226. The average party decreased from 4.0 persons to 3.8. The average time decreased from 72 minutes to 52.5.

Tumacacori - Number of trips increased from 177 to 184. Number of visitors increased from 912 to 1009. The average party increased from 5.1 to 5.4 persons. The trip time increased from 28.2 minutes to 36.8.

Walnut - Number of trips dropped from 186 to 148. Number of visitors rose from 890 to 1009. Average party rose from 4.7 persons to 6.8. Average time dropped from 21.5 to 18.5.

Museum Lectures

We gave 1,094 museum talks in August as against 1,051 in July and 1,117 in August last year. They were given to 6,894 visitors as against 5,518 last month and 7,049 August a year ago. The average party increased to 6.3 from 5.2 last month and 5.9 in August last year. Average museum party time was 19.08 minutes as against 20.8 a year ago and 17.3 last month.

VISITOR STATISTICS (CONT.)

Aztec - Gave 331 museum talks as against 294 a year ago and gave them to 2,954 people as against 2,585 last year. The average party came from 8.7 last year to 8.9 this year. The average time rose from 16.2 to 19.7 minutes.

Casa Grande - Gave 152 talks this year as against 239 last to 1,174 visitors this year against 1,483 last. The average party has come up from 6.2 to 7.7. The averaged time dropped from 24.9 last year to 19.9.

Montezuma - Gave 238 talks this year against 239 last to 1,146 visitors this year against 1,449 last. The average party was 4.8 this year as against 6.0 last year and the average time was 18.1 minutes this year as against 22.4 last.

Tonto - Gave 66 talks this year, 65 last. Had 233 visitors this year against 273 last. Averaged 3.5 per party this year against 4.2 last. The museum party time was 11.1 minutes this August, 11.7 last month and 21.5 a year ago.

Walnut - Gave 148 museum talks as against 261 last year. Had 1,077 visitors as against 772 last year. Averaged 4.5 persons per party against 2.9 last year and had an average trip time of 19.6 minutes as against 20.3 last year.

In General

Out of about 40,000 visitors last month we missed giving our informational service to 26,198, or 65.44%, as nearly as we can check up. The table shows clearly where we missed getting in touch with them; White Sands, Capulin, Sunset and Bandelier account for about 22,500. Give us four more men and we can take out a lot of this slack.

We did make 19,153 'educational contacts' out of 40,000 visitors which compares with 20,996 contacts out of 40,942 visitors last year, so it looks like we are holding our own, but there is plenty of room to expand if we could get a few more men.

It looks like the boys at Aztec worked pretty hard to get 5,753 contacts with two men on the job 2,876 per man. Paul at Walnut Canyon came next with 2,086 per man.

When it comes to time per man, Aztec seems to be in the lead with 10,200 minutes per man. Paul has 7,380 minutes. It is here the lone-post boys show up strong because, being in the back country, their visitors stay much longer; Gran Quivira with 9,249 minutes and Bud at El Morro with 9,100 are examples.

*****000*****

VISITOR STATISTICS FOR AUGUST, 1937

SOUTHWESTERN MONUMENTS

MONUMENTS	Employees		GUIDED TRIPS				MUSEUM LECTURES				Unattended	Total Educa'l Contacts	Total Travel	Per cent con-tact			
	Per. Temp	No.	Att'd	Time	Av. Att'd Time	No.	Att'd. Time	Av. Att'd. Time	Av. Time								
Arches																	
Aztec	2		339	2799	13872	8.2	40.9		531	2954	6530	8.9	19.7	102	5,753	3,056	188
Bandelier	1	3	219	1908	18557	8.7	84.7							1,917	1,908	3,825	49
De Chelly	1	2	54	230	7775	4.2	143.							107	230	337	68
Capulin Mt.														7,000		7,000	
Casa Grande	2		219	1593	7445	7.2	34.0		152	1174	3025	7.7	19.9	211	2,767	1,804	153
Chaco Canyon	1	1	85	416	7261	4.8	85.0		71	310	1621	4.3	22.8	561	726	1,313	55
Chiricahua	1	2	59	303	2553	5.1	43.2							774	303	1,077	28
El Morro	1		94	517	9100	5.5	96.8							42	517	559	92
Gila Cliff																	
Gran Quivira	1		167	892	9249	5.3	55.3								892	892	
Hovenweep																	
Montezuma	2		261	1175	7815	4.5	29.9		238	1146	4330	4.8	18.1		2,321	1,175	197
Natural Bridges	1																
Navajo		1	22	71	3210	3.2	145.								71	71	
Organ Pipe																	
Pipe Spring	1		31	111	825	3.5	26.6							350	111	461	
Rainbow Bridge																	
Saguaro														561		561	
Sunset Crater														1,193		1,193	
Tonto	1		58	226	3049	3.8	52.5		66	233	735	3.5	11.1	60	459	296	155
Tumacacori	2		184	1009	6783	5.4	36.8							70	1009	1,079	93
Nut Canyon		1	148	1009	2745	6.8	18.5		236	1077	4635	4.5	19.6	504	2086	2,590	80
White Sands		1												12,329		12,329	
Wupatki		1												417		417	
Yucca House																	
Headquarters																	
TOTALS			1940	12259	100239	6.3	51.6		1094	6894	20876	6.3	19.0	26,198	19,153	40,035	34.56

CLOSING

By the Boss

Chief, we have been getting out the estimates this month and that is generally a time for overhauling our plans and getting a bird's-eye view of our job.

We knew, of course, that we were handling over a thousand square miles of reservations, a little over 1,100 square miles in fact, scattered in 26 places in four states.

In checking up for estimate purposes we find we have seven administration buildings, 25 residences and 22 utility buildings. That would make a pretty good layout if you put them all together.

The trouble is we need eight more administration buildings, 16 more residences and 24 more utility buildings.

We have ten water systems and we need 15 more in order to keep our employees as well as the visiting public from drinking bugs, polliwogs, mineral water and so forth.

We have nine sewage disposal systems and we need 16 more before we can look Harry Hommon in the eye and dare him to come in and hunt for trouble from the public health standpoint.

We have 222.62 miles of roads, good, bad and indifferent, mostly the latter, and we need several more miles for proper operation.

We have 123.87 miles of trails in operation and we need several more miles before the system is complete. These trails are not all for the public use, nor are the roads mentioned above; we have several fire problems among these monuments.

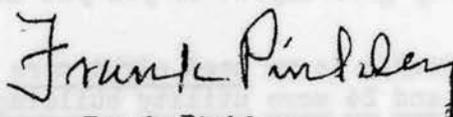
With all this investment, you would think we should have a lot of visitors to make the investment worth while, and we have had them. Three hundred thousand visitors in the fiscal year just closed according to the boys who cast up the figures, and that, you will admit, is a lot of people. Whether we like it or not, we are in the big-park class with a lot of these problems of visitors, buildings, roads, trails, and so on. And it doesn't look like the visitor's curve is going to level off in the next ten years, either.

In our dumb way we thought we had an answer. To protect such lovely and intensely interesting places as Canyon de Chelly, Chaco, Navajo, and several other prehistoric monuments, from a too heavy visitation of little interested visitors, we worked pretty hard to have an archaeological reservation made along a transcontinental highway and a transcontinental railroad, near a good-sized town where good facilities were available to the traveling public. The reservation was worthy of preservation from a scientific standpoint and stood on its own feet archaeologically speaking.

CLOSING (CONT.)

but one of the fine angles which appealed to us, was that we could arrange it to stand a heavy visitation with little damage and thus double shoot the turn by showing archeology to more people per year and at the same time relieve the visitor-pressure on several of these gem monuments where it is going to do a lot of damage in the next 20 years if something like this isn't done about it. That particular proposed reservation seems to have fallen through but we still think we had a good idea about making it; something like this will be the final outcome.

Cordially,



Frank Pinkley,
Superintendent.

*****OOO*****

(LAST MINUTE ARRIVALS)

WHITE SANDS CONSTRUCTION

By A. E. Underhill, Road Oiling Foreman

The following report of my activities for the month of August will inform you of the progress of the entrance road at the White Sands and what was accomplished at Zion and Bryce.

The Oak Creek road, camp ground roads, cabin loop, cross roads, residential road, and utility area were all oiled and processed when I left Zion on August 7. The rock crushing plant was moved to Bryce but not set up as the contractors, Hayner & Burn, were waiting to clay plate the White Sands road and it was necessary for me to leave Zion and Bryce to look after the White Sands work.

The grades are now completed at White Sands and the subgrade is in first condition, being hard and well compacted and conforming to the grades established by Mr. Clark.

The end of this week all of the base course of rock will be in place and rolled ready for the blotter coat of asphalt.

The crushing and placing of the wearing surface will then follow as rapidly as possible and I have hopes of having the job completed by the 10th of September.

At the present time I have two checkers on the road and two weigh masters at the crushing plant.

WHITE SANDS CONSTRUCTION (CONT.)

During the month the contractor has completed all subgrade, hauled and processed 10,000 cubic yards of sand and clay and 4,000 cubic yards of crushed rock.

The contractor has scales set up under his hopper and the materials are being weighed in place of truck measurement. There was constructed a cubic yard box and five weights taken to get the average weight per cubic yard. This method of procuring the average weight is taken once a day and the trucks weighed every morning for the tare on each load....

*****000*****

TUMACACORI MUSEUM

By Frederick D. Nichols, Inspector
(week ending Aug. 14, 1937)

There were several changes on the museum drawings to be checked, and the prices of various materials to be had, so I decided to remain in Tucson until they were completed. Work on the new building was to begin on August 9, but due to the recent rains, it was impossible for them to begin until the following Monday, so I decided to devote the remainder of the week to Historic American Buildings Survey work.

I got in touch with Mr. Maguire and Mr. Eastman and we visited old Fort Lowell first. It was built in the 60s and most of it is in ruins. However, several of the officers' houses are still being lived in. They are very open, simple residences with a sparing amount of Victorian detail. From copies of the original drawings, we could determine the layout of the fort and the original uses of the ruined walls. Measurements of one of the houses, with a general plot plan on the cover sheet and a possible restoration of the hospital would be sufficient with a data book and photographs.

We then spent some time driving through all the old quarter of Tucson and the immediate vicinity and found some very fine things, many of which I photographed. The finest things, which should be measured are: The old priests' house at San Cosme Mission - a fine example of early domestic architecture in Arizona with a moulded brick cornice, plaster walls, a broad portal with solid wood arches and a fine mesquite beam and ocatillo ceiling. The two interior rooms contain handsome ceilings of moulded beams with the ocatillo savinos laid in herring-bone fashion. Across the road are the ruins of the Mission school and a few traces of the church itself, which should be recorded as they are soon to be destroyed.

Another notable residence is on south Fifth Street in Tucson. This is one story adobe plastered, with moulded brick cornices. The facades are enriched with pilasters which have moulded brick capitals. The portal is similar to the above.

TUMACACORI MUSEUM (CONT.)

On Friday we drove to Tumacacori. We first visited Tubac, a charming old Mexican village which has a remodeled church. We were joined by Mr. Caywood at the mission and proceeded to Calabasas. The ruins of this old mission are most interesting and definitely should be measured. Guevavi was next on our list, and we found it even more ruinous than Calabasas. The day was clear and fine and we were able to get some good pictures and Mr. Caywood added to the mission collection of arrowheads and pottery fragments. The next buildings we saw were Forts Buchanan and Crittenden. Many of the walls were remaining and it was possible to make out the plot plan.

We then drove to the Babacomari Ranch, and photographed an old house, but we were unable to look for an older one as our motor was not functioning properly and we decided to return to Nogales, where the water pump had to be repaired.

There is a noteworthy example of early ranch house construction at the Leon Ranch, just west of Tucson. It seemed advisable to measure it before I left Tucson, so with the assistance of Mr. Maguire and Mr. Eastman this was accomplished, over the week-end.

San Xavier del Bac was also visited. It was most interesting to compare its detail with that of Tumacacori. It is in an excellent state of repair, although somewhat restored, but it is a fine example of early Spanish church building in this country. Nearby, in the Papago village are some examples of wattle-and-daub Indian houses. We took photographs of these.

*****OOO*****

BANDELIER RUINS STABILIZATION

By Jerome W. Hendron

The Bandelier ruins report for last month terminated with a description of the sipapu found almost in the center of the kiva, and mention that the ground plan drawing had been completed in pencil. At this point I wish to backtrack a little regarding the sipapu, since it was removed while searching for the plastered floor level. The slab of tuff as the top is eight inches by six inches, at the bottom it is $8\frac{1}{2}$ inches by $5\frac{1}{2}$ inches on one side and $8\frac{1}{2}$ by six inches on the other. The total length of the slab varies from 10 inches to $11\frac{1}{2}$ inches. In the top side is a hole three inches in diameter and seven inches deep into the stone. It is two inches in diameter at the bottom. Two inches down from the top side on the inside of the hole is a boring $\frac{3}{4}$ of an inch in diameter extending upward in a westerly direction to the outside. Just above this side boring and on the outside is a partially completed boring which was apparently the first attempt.

In order to locate the plastered floor of the kiva a trench had to be run into the north wall. After removing about four inches of debris

BANDELIER RUINS STABILIZATION (CONT.)

a hard plaster floor was struck having three different hard plastered coats. The coats were no more than one half inch thick altogether; underneath was about nine inches of sand and some mud which might pass as a crude form of plaster. Below this point seems to be the bottom, the material is very hard, large chunks of tuff mixed with riverwash. A thorough cleaning and examination of the floor showed that the plastered coats have entirely disappeared with the exception of a small strip around the wall on the north half of the structure. In no other place was a portion of the floor found.

On August 3 the screening of the fill around the outside of the kiva was completed and actual stabilization work was begun. At this point it may be well to give a brief resume of the situation. It appears that the original builders constructed a high retaining or secondary wall in back of the main inside wall. This wall was approximately ten or 12 feet wide all around and was squared off at the top so that the roof could be layed on. After abandonment of the kiva the roof was either burned or caved in by itself, the inside wall began to crumble, the stones falling to the inside, then the retaining or secondary wall began to fall, that it, with the disintegration of the inside wall the retaining wall had nothing to hold it and being of poorer construction than the inside it would not last long and as the stones fell the wall was turned into a runway or rainfall. Year after year more debris accumulated on the inside, the west entrance and the ventilator shaft on the east crumbled and the entire wall was rounded off making the kiva a catch-all. It was not until the summers of 1908, 1909, and 1910 that the ruins of Frijoles canyon were worked upon by Hewett. In this program an excavation was carried on at the large kiva. Since that time the walls have continued to crumble until the skeleton of the structure would have lasted only a few years longer.

The present project consisted of removing all of the debris from the outside and cutting the wall down to a point where there would be a solid base to tie to in order to set this retaining wall back in place. This meant cutting it down about three feet and screening all of the fill, and stacking all of the rocks in piles away from the job until they were needed.

Reconstruction of the retaining wall or secondary wall was begun about two feet from the inside wall, this gap being left to set the stones in cement, that is, a line of cement to be poured in back of the visible stones of the retaining wall all around the structure. The portion around the outside was layed with chunks of basalt and tuff and filled with the screened dirt and also the gravel removed by the screen. The dirt was wet down as it was filled in because it would form a tighter pack and also because a greater amount of it could be utilized. This process was continued until it was about three feet high all around the outside. The next step was to put the outside or retaining wall in shape so that it would hold the weight of its original height. The joints were brushed out, that is, all of the loose dirt or plaster being removed and replaced with mortar consisting of one part cement, four parts sand and one part screened fill. This mortar

BANDELIER RUINS REPAIR (CONT.)

was forced far back into the cracks and chinked with small chunks of tuff. After it dried the loose and conspicuous portions were cut away.

The laying of the main portion of the wall was then begun, the two feet strip around the inside being layed in with building stones as nearly as possible like the original wall. The ends headed in toward the inside of the kiva and cement mortar was used as a tie for the back ends toward the outside. This was built up a few inches higher than the remaining or back portion of the outside wall previously layed so that drainage would be to the outside. After the cement had set the joints to the inside were cemented, again forcing the mortar far back in so that it would not be too conspicuous. Stabilization of the entire outside wall is complete to date and at this writing the cracks between the building stones are being filled with mud from the screened fill taken from around the outside.

The outside wall has a definite slope to it and it has been packed with fill so that the greater percentage of rain water will run to the outside.

The west entrance to the structure has been set back in place and likewise the ventilator shaft, not as a reconstruction job but as a means to protect the rest of the kiva. These two features if left like they were found would certainly have shortened the life of the structure a good many years.

The question of the height of the retaining wall is one that has been asked several times, and there are three answers to this. First, while cutting down the retaining wall on the north side, two of the viga sets were found and the wall could not have been much higher than the vigas; second, a very large stone stood to the left of the ventilator shaft which appeared to be one of its corners; and third, all of the loose building stones in the fill and to the inside would certainly have revealed its height, of course, leaving out an adequate supply required by the thin inside wall.

Drawings to scale have been worked up in the field showing all of the features of this structure and are now ready for inking.

It looks very much like I will have to complete the report on the kiva next month since there are still a few odds and ends of a trivial nature to clean up.

*****OOO*****

THE S upplement

S. M. MONTHLY REPORT

METEOR CRATER, ARIZONA

By Vincent W. Vandiver,
Associate Regional Geologist.

INTRODUCTION

It is the purpose of this report to summarize some of the various theories which have been advanced, during the past 35 years, to account for the origin of Meteor Crater. To outline some of my observations regarding this phenomena of nature which has attracted scientists from all parts of the earth for many years. Efforts to exploit the meteoric mass by commercial interests in which large sums of money have been expended will be noted. Briefly it is proposed to bring up to date our present knowledge of Meteor Crater for the Park Service records and the possible interest for various members of the staff concerned.

The noted Astronomer, Arrhenius, is said to have declared that Meteor Crater is the most fascinating spot on earth. The interesting fields for investigation in this area are innumerable. Facts may be disclosed which to an astronomer might give concrete evidence as to our theories of origin and the building up of our solar system. Should the crater be definitely proven the result of a meteoric impact, the geologist will be interested to have the evidence to be found in the behavior of rocks under sudden stress, not to mention the later effects of chemical reactions underground. From the point of view of the physicist and chemist the various features prove none the less interesting. The average visitor stands in amazement when the great pit is viewed from the rim for the first time.

LOCATION

Meteor Crater is situated in Coconino County, northeastern Arizona, in the southern portion of the Colorado plateau, amid many National Parks and National Monuments which have been reserved for preservation by the Government. The crater may be reached on U. S. Highway No. 66 by traveling 23 miles west of Winsow and thence seven miles southeast. The loop road south to the crater is taken at the Sunshine station on the main highway. The feature is most accessible to transcontinental tourist travel, being located near one of the main highway routes through the Southwest. Stops may be made and visits arranged for at Winslow or Flagstaff situated on the Santa Fe Railroad.

METEORS AND METEORITES

Very few meteors reach the Earth's surface as meteorites and still fewer meteorites give rise to meteoric craters. Meteorites, as is known from studies of those that have been seen to fall, are bodies which before their striking the Earth were pursuing independent orbits around the Sun, usually in an elongated form similar to comets. Their velocity averages

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

around 26 miles per second and with the Earth moving 18 miles per second in its own orbit, the meteorite can strike at any speed from eight miles per second if it overtakes us, to 44 miles per second if it meets us squarely. At even the lesser speed the meteorite is subject to great friction as soon as it enters the Earth's atmosphere, some 80 to 100 miles distant, which heats the surface of the body and the air about its track. Small meteors appear as shooting stars and large ones as fireballs.

A few of the most important meteoric craters thus far discovered are listed as of possible interest.

The Texas crater is situated about nine miles southwest of Odessa in Ector county. It is a shallow depression, roughly circular in outline, with an average diameter of 530 feet. The steep inner slopes show the limestone dipping 20° to 30° away from the center. Fragments of meteoric iron have been found and some have been located mixed with the limestone and sandstone debris forming the rim. Although this crater is now generally recognized to be of meteoric origin, various suggestions have been made to account for it; namely, - volcanic explosion, salt dome, expansion by hydration of anhydrite, explosion of gas, etc.

The Henbury craters in central Australia are located about seven miles southwest of Henbury, on the Finke river. Much meteoric iron has been collected from this area and within an area of a half square mile 13 craters have been mapped. The largest crater is 220 yards by 120 yards across, and 50 to 60 feet deep. In this area there must have been not a single mass, but a shower of large masses of iron that formed this group.

The Wabar craters, discovered in 1932, are located in Arabia. Two distinct craters have been mapped with the indications of others buried in the sand. The larger of the craters is approximately circular in outline, has a diameter of 100 meters, and a depth of around 10 meters. The rims of the craters appear to be built up mainly by silica-glass. A few pieces of meteoric iron have been collected from the outer slopes of the craters. It has been suggested that the reason for the unique occurrence of silica-glass is no doubt that large masses of iron fell on clean desert sand.

The group of craters in Estonia, 20 kilometers northeast of Arensburg, were first described in 1827. They have been considered as being earthworks made by man, to be the result of gas explosions, oozing out of a bed of clay, weathering of limestone, expansion of anhydrite, but recently detailed borings and trenches undertaken by the Inspector of Mines, has resulted in their being identified with the fall of a shower of iron meteorites. The main crater is occupied by a lake, with a diameter of 92 by 110 meters, and depth of 15.5 meters. The steep inside walls show beds of Silurian dolomite dipping from the center of angles of 30° to 40° .

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

No meteoric iron has been found in the locality and this is explained by the fact that the ground has been tilled since time immemorial.

The Siberian craters are said to be rather disappointing, showing only a series of small pools in a swamp. It is certain that some catastrophic event occurred there on June 30, 1908, but the exact nature remains doubtful. It is stated that a fireball had been seen and that loud explosions were heard over a wide area, blasts of hot air were felt, and earthquakes recorded at several points. Pine trees were felled outwards for a distance of 37 miles from the center. Numerous round depressions have been found in a swamp area but no meteoric iron has been collected, although it is rumored that natives have collected pieces of iron in the central area of the fallen forest.

The Campo del Cielo craters of the Gran Chaco, Argentina, are now considered meteorite craters. Native iron has been known in this district since 1576. Transparent glass has been found. There are no volcanic rocks in the surrounding pampa, and the Andean volcanoes are 500 miles away. One of the craters has a width of 183 feet and a depth of 16 feet.

Direct observation as to how the larger craters are formed seems to be out of the question. Meteorites which have been seen to fall have been comparatively small in size. They make small holes usually only a few feet in depth. The largest meteorite which has been observed to fall is of the stony type, which weighed 820 pounds, and fell near Paragould, Arkansas, in February 1930. This stone penetrated the soil to a depth of only eight feet. The largest known iron meteorite is the Hoba meteorite, discovered protruding from the surface in Southwest Africa in 1920, and weighing 60 tons. It was not seen to fall and there is no sign of a crater in the vicinity.

GEOLOGY

The surface geology of Meteor Crater and vicinity is comparatively simple. The sediments of the surrounding region lie practically horizontal and as the crater is approached, the beds may be seen to dip away from the center in all directions, at angles of from 10° to 80° . One is astounded by standing on the rim and peering into the high crater for the first time. The irregular rim of up-thrown rocks rises over 150 feet above the surrounding plain. The main portion of the rim is more than 1,000 feet in width with scattered remnants of debris as much as six miles from the crater. The floor of the crater is flat and is approximately 1,500 feet across. The elevation at the cabin on the north rim is 5,860 feet above sea level.

The upturned sediments of the rim consist of from 0 to 60 feet of Moenkopi (Triassic) sandstone; around 250 feet of Kaibab (Permian) limestone; and 150 feet of Coconino (Permian) sandstone. From the drill records a total thickness of the Coconino sandstone is given as 660 feet.

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

Below the Coconino sandstone is the Supai formation, also Permian in age, and from records of drill holes and sections in surrounding region it is believed to be around 1,000 feet in thickness. It is also assumed from drill hole records that the Supai was apparently not disturbed by the forces responsible for the crater.. The Redwall limestone, of the Mississippian, underlies the Supai formation. For a generalized stratigraphic section see following:

STRATIGRAPHY OF THE METEOR CRATER AREA

ARIZONA

SYSTEM	SERIES	FORMATION	THICKNESS: (FEET)	CHARACTER
CENEZOIC	RECENT AND PLEISTOCENE	LAKE BEDS, ETC.	90 to 500	Lake beds containing some lignite, fresh water fossils and thin bed of rhyolitic ash. Talus consisting of sand, gravel and boulders. Limestone and sandstone blocks representing material thrown out of the time of the impact. Some meteoric fragments found in debris.
	TRIASSIC	MOENKOPI	0 to 60	Chocolate brown sandstone
CARBONIFEROUS	PERMIAN	KAIBAB	250	Grey limestone with some thin sandstone members.
		COCONINO	660	Light colored cross-bedded sandstones.
		SUPAI	1000	Uniformly red to buff sandstone and red sandy shales.
	MISSISSIPPIAN	REDWALL		MASSIVE, Grey, fossiliferous limestone.

The masses of rock which are upturned consist in the main, therefore, of Permian sediments with the exception of a variable thickness of thin

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

Moenkopi outliers. There is observed on the rim much debris and fragmentary rock materials which have been classified as Quaternary in age. Comprized in this group is the meteoric shale, meteoric rock fragments of the original formation, and metamorphosed masses of Coconino sandstone (rock flour). On the floor of the crater is some recent stratified rocks, consisting mainly of crushed limestone and sandstone fragments, which have been identified as lake beds, indicating that the interior was once occupied by a lake, at a time when the climatic conditions of the region were much humid than at present. These lake beds are around 90 feet in thickness and are considered to be of Pliocene age. They contain fresh water fossils.

The crater rim is capped by material thrown out of the crater. Land slides along the rim have removed portions of the Kaibab limestone and Coconino sandstone. Limestone and sandstone blocks are present on and surrounding the rim. They range from small fragments and fine dust up to 25 feet or more in thickness. Most of the coarser material is limestone since the sandstone is more easily crushed.

Regionally the rocks lie nearly horizontal with dips of only a few feet to the mile. Angles of dip along the rim of the crater vary from 10° to 80° with an average perhaps of around 30° . The dips are all in rough radial fashion from the center of the crater and has been stated previously, they become increasingly greater from a point on the north rim, until the arched portion of the rim at the south is reached. A dozen or more faults may be seen on the inner walls of the irregular rim but due to the debris they cannot be traced to any extent. The regional structure is broken by Sunshine mountain, 12 miles southeast of the crater.

AGE OF THE CRATER

D. M. Barringer, Jr., has considered briefly the age of the cone. He states that it cannot be less than 700 years old, since a cedar tree with that number of annual rings was found growing on the rim. He also concludes that it cannot be more than 5,000 years old, from the lack of erosion, particularly of the chemical erosion on the limestone blocks, and finally infers that the true age will no doubt be found between these two limits. Mr. Barringer mentions the legends of the Navajo Indians, who are said to have a story about the crater which coincides very closely with what actually occurred. A hole in the ground would not likely stir the imagination of the Indians, since they are familiar with the many volcanic craters of the San Francisco mountains, 50 miles or so away, and attach little importance to them. But about Meteor Crater they are said to have marked superstitious beliefs, and they are supposed to have a legend which describes the descent of one of their gods from the sky, in clouds of fire, to bury himself in that particular spot. I do not attach much weight to such traditions among the Indians since it is generally considered as improbable that legends

REPORT ON METEOR CRATER (CONT.)

could be carried down for more than a few centuries by such primitive people. Professor Elihu Thompson (29) mentions these Indian legends which state that a number of their tribe were killed when the body fell and that they now send to the crater and secure the white silica dust to sprinkle around when they have their ghost dances, indicating that they still retain some superstition in regard to this natural phenomena. Mr. Barringer states that the Indians will not carry away any of the iron, however, I have been informed from other sources that there was quite a traffic in this material for many years and that tons of it was collected by the Indians and sold to traders.

On the basis of the effects of erosion Tilghman favored an age of not more than 10,000 years and probably less than 5,000 years for the crater.

According to the geologist attached to the geophysical survey the age of the crater is estimated at 50,000 years. This figure was arrived at upon consideration of the sedimentary deposits, conditions for deposition of same in arid climatic regions, is recognized as an extremely slow process. The proof of a very considerable period of erosion.

The most exhaustive study of the age of the crater which has come to my attention was made by Professor Eliot Blackwelder (7) in 1930. He lists five factors which have a bearing on the determination of the age of the crater as follows:

(1) - The lake deposits at the bottom of the crater, shown by drilling to be from 70 to 90 feet thick, comprise stratified sand and quartz flour with many lacustrine gastropod shells and diatom frustules. This is interbedded with platy fresh-water limestone, lignitic beds, diatomite and a single layer of rhyolitic ash $\frac{1}{4}$ to 3 inches thick (12). The characteristics of the deposit are such as to indicate a body of water of many years duration, rather than a seasonal pond of playa. This in turn suggests a climate distinctly cooler or more humid than the present one, for there has been no pond in the crater since it first became known to white men. At present the water table is about 200 feet below the floor of the pit, whereas during the presence of the lake it must have been somewhat above it.

(2) - The bed of volcanic ash is plainly the record of an explosive eruption in the southwestern arid region. No such eruption (rhyolitic ash) is known to have occurred since late glacial or Pleistocene times.

(3) - Both upon and beneath the lake beds are wedge shaped alluvial deposits built out by streamlets descending the crater slopes. The lower fans are said by Tilghman (3) to extend under the lake deposits, although not to the center of the crater, as indicated by exploration in shafts and drill holes.

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

(4) - Most of the limestone blocks upon the parapet are deeply cavernous and corroded by the effects of solution. As this process works rather slowly in an arid climate, the advanced stage of solution pitting indicates a long period of time. A study of the ravines and graded valleys on the parapet indicates that the latter has suffered more erosion than the latest (Tioga) glacial moraines, but hardly so much as those of an older epoch.

(5) - As a fifth source of evidence, the present condition of the talus slopes within the crater affords instructive suggestions regarding the physiographic history. A close scrutiny of the talus shows that it is no longer growing but has extensively eroded into a series of ravines between which a few wedge-shaped remnants of the talus still remain. The talus is therefore the product of an earlier age, long since past. It is a well known fact that talus formations is particularly favored by the wedge work of ice (frost action) and that aridity tends to prevent it.

Dr. Blackwelder summarizes his points by stating that it seems very significant that the evidence along these five independent lines points to a long period of atmospheric action and also rather definitely to climatic changes from warmer and drier to colder and moister and back to dry again. From these considerations he is led to suspect that the crater was made during the last interglacial (or Post-Tahoe) epoch, perhaps 40,000 to 75,000 years ago. He concludes that no finality can be claimed for this estimate, but as a counterbalance for the current view, that the crater is only a few thousand years old, it has considerable value.

CANYON DIABLO METEORITES

It has been stated by Mr. Barringer that a far greater number of iron meteorites have been collected from the debris around the crater rim and a short distance from it than have been found in all the rest of the Earth's surface. By looking over a map showing the distribution of some of the material collected up to 1908 one cannot fail to be impressed with the concentration of meteorites as the rim is approached. This fact alone, it seems to me, presents some evidence that there is a connection between the meteoric material and the crater.

But how do we know that this is meteoric iron? All of the meteorites collected give what is known as the Wiedmanstätten figures, that is if they are etched, they will show after smoothing a peculiar internal crystalline structure which is characteristic of those iron meteorites which have actually been seen to fall upon the earth's surface. Iron meteorites are so unlike the normal rocks of the Earth's crust that they are easily recognized.

Mr. Barringer gives this description of the meteoric material

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

found at or near the surface in the vicinity of Meteor Crater. The chunks of solid nickel-iron, known as Canyon Diablo meteorites and which may be observed in most of the large museums, are irregular shaped fragments of metallic nickel-iron, with the surface, which is characteristic of many iron meteorites, looking as though thumb-prints had been made all over it when it was soft. When cut they reveal a bright, silvery surface, which will rust only very slowly if at all. If the surface is etched, the so-called Wiedmanstater figures of crystallization may be plainly seen. The composition of the unoxidized fragments is roughly as follows: iron, 92%; nickel, 6%; carbon, (both crystalline and amorphous) phosphorus etc., 2%; cobalt, copper, etc., traces; platinum, iridium, palladium, etc., about four-tenths of an ounce per ton. The pieces so far discovered range in weight from less than an ounce to about 1,400 pounds.

Dr. L. J. Spencer (26) considers a point of interest about the Canyon Diablo irons in the presence in some of the masses of small diamonds, both black and white; and it is stated that doubtless this observation suggested to H. Moissan his experiments on the artificial production of diamonds. Moissan also detected in the iron the presence of native carborundum (silicon carbide), which as a meteoric mineral has been named moissanite. Other rare constituents of this meteoric iron are platinum metals. One assay yielded platinum 3.65 and iridium 14.95 grams per metric ton, but some other later trials gave negative results.

There has been much speculation as to the magnitude of the meteor which would be required to form a crater of this size. One of the first methods of calculation used by the Barringer interests and suggested in an old handbook of artillery, was to a formula for computing the probable effect of bombarding masonry with round-shot. This formula stated that where the diameter of the shot was 1, the depth of the hole would be about 2, and the diameter of the hole about 7. Applying this to the observed features of the crater it was estimated that the diameter for the projectile would be around 550 feet.

Tilghman (3) has calculated that the debris now represented in the parapet would, if replaced in the crater, fall short by millions of cubic yards, of filling the cavity. The difference may well have been removed by erosion. Gilbert (16) has estimated the capacity of the crater at 82 million cubic yards. Dr. Elihu Thompson and Dean Magie of Princeton have made a number of calculations, considering the speed of the projectile, the amount of work involved in throwing out of the hole some 350,000,000 tons of rock, and arrived at a somewhat smaller figure for the diameter of the projectile than that calculated by Barringer. The latter conclude d that a sphere about four hundred feet in diameter, which is probably a conservative estimate, would weigh in the vicinity of 10,000,000 tons.

Professor Thompson (29) makes the following calculations, - assuming that one ton of material in the meteor was capable of displacing thirty tons of rock when it struck, then the mass of the meteor should have been

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

approximately at a low estimate, say, five million tons. By using a figure of six-tenths of an ounce of platinum and iridium per ton, with an estimate of three million ounces, at a value of \$30 to \$35 per ounce, the total value would be in the vicinity of \$100,000,000. Various estimates of this type have been made and there is little wonder that extensive exploration work has been undertaken to locate the ore body, for this would represent only one of the valuable constituents of the mass, as indicated by assays.

HISTORY OF EXPLORATION "METEOR CRATER"

Army scouts first visited the site of Meteor Crater in 1871 and called it "Franklin's Hole". It was 15 years later that Mexican sheep herders gathered some of the metal and gave it to railroad contractors, who in turn sent it east, where it was identified as meteoric iron. Thus the first known example of a supposedly meteoric crater was discovered. Thousands of specimens of the meteoric iron were collected and shipped to museums in all parts of the world as well as to other interested parties. "Canyon Diablo" meteorites, as these fragments have been called, range in weight from a few grains up to 1,400 pounds. It has been stated that more iron meteorites have been found in this locality than have been discovered thus far in all of the remainder of the Earth's surface. The circular ridge forming the crater rim, which may be observed as a range of low-lying hills for miles around, had been referred to as "Coon Butte", "Crater Mound", "Meteor Butts", "Crater Mountain", but it is now generally called "Meteor Crater". The meteoric iron which is supposed to exist beneath the crater, and which has been found in large quantities in the vicinity, has been called the "Canyon Diablo meteorite", from the Canyon Diablo nearby, and also the "Barringer meteorite" from the Barringer family, who have been interested in exploration for many years.

In 1903 Mr. D. M. Barringer, of Philadelphia, became interested in the commercial prospects of the locality, and was among the first to advocate the theory of meteoric origin. Briefly Mr. Barringer and his associates reasoned as follows, - as one approached the crater the amount of meteoric iron became greater and it was also noted that the size of the fragments increased in this direction; that the fragments of metallic iron and pieces of iron oxide (which by their structure and composition was considered to have been derived from terrestrial oxidation) were found to be intimately admixed with the material excavated from the hole - the conclusion being that the excavated material and the meteorites got there at the same time. They likewise assumed that the hole was made by a meteorite or a cluster of meteorites, or else the juxtaposition of the hole and the meteorites was accidental. If accidental, there remained the coincidence of an unprecedented fall of meteorites hitting the same spot on which suddenly appeared an unprecedented crater in the sedimentary rocks, and hitting it at the same instant of time in which the crater was made. Prominent scientists who critically examined the locality and agreed to the meteoric origin as advanced by Mr. Barringer were Professor Elihu Thompson, of Boston, and Dean William F. Magie, of Princeton.

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

Mr. Barringer interests at first reasoned that since the hole was round, the meteorite must have fallen vertically, and therefore the main mass must be in the center of the hole. On this assumption they started a shaft at the center and expected to run radial drifts, like the spokes of a wheel, after reaching the required depth and until such time as they encountered the main mass. They assumed that the meteorite had not penetrated more than 1,300 feet below the surface of the plain since none of the fragments of Red Beds, which lie around this depth, had been thrown out of the crater. At 200 feet they encountered soft Coconino sandstone, which had been so shattered by the impact as to be in the form of fine white dust, so fine that 55% of it would pass through a 200 mesh screen. This silica dust had become mixed with water from the rather large catchment area of the crater and formed a quicksand through which they were unable to drive their shaft.

They next proceeded to sink drill holes in the bowl of the crater in an effort to locate the meteoric mass. The central portion was explored by this method to a depth of 1,000 feet. Although they failed in the main purpose of the work some interesting facts regarding the crater were ascertained. To a depth of some 90 feet there occurred stratified lacustrine sediments. Below this depth and for a distance of six or eight hundred feet there was encountered a jumble of large and small fragments of limestone and sandstone (unstratified), which was considered to be material thrown into the air at the time of the impact, immediately falling back into the hole. Two types of metamorphosed Coconino sandstone were found in the drill holes. The first type, which is also found on the rim of the crater, appeared like unaltered sandstone. Upon close examination, however, it was found that nearly every individual sand grain had been cracked and shattered so that it could be rubbed to dust between the fingers. The conclusion was that a shock wave, of sufficient intensity to crack the sand grains, ran through the solid rock ahead of the impacting meteorite. The second type of metamorphosed sandstone was considered to be due to heat caused by the friction of the advancing meteorite. The heat was so intense as to fuse the silica and it was stated that the only other case known in nature of pure silica being melted without a flux, occurs when lightning strikes a bed of sand, producing folgurite glass.

According to the Barringer interests the two types of meta morphosed sandstone presented additional proofs of the meteoric theory. The shattered sand grains show the effect of a sudden terrific blow, rather than the effect of any volcanic explosion. The millions of tons of finely pulverized sandstone (rock flour) which is found abundantly on the rim in the crater and in the drill holes could not have been produced by a steam explosion. Likewise it is stated that no volcanic action has ever been known to fuse pure silica.

At depths of around 800 feet the drill holes were said to have encountered unaltered "Red Beds" sandstone. This gave them a clew as to

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

the maximum depth at which the meteorite must lie buried and also presented additional proof that whatever caused the crater came from above and not below. The work was suspended in 1908, since the drill holes failed to locate the whereabouts of the meteorite, and most of the funds available for the search at this time had been exhausted.

An intensive study of the physical features of the crater was then undertaken by the Barringer interests with the hope of finding some clue as to the direction of approach of the meteorite, since from the results obtained by explorations to this date, the evidence seemed to point that the meteor had not fallen vertically at all. They observed that by firing a rifle into mud an excellent replica of the crater could be made, that the rifle need not be fired in a vertical direction downward, but that it might be held at an angle even less than 45 degrees from the horizontal. A detailed study of the walls of the crater finally revealed what was considered an important fact. The rocks exposed in the walls were seen to dip radially away from the hole and it was observed upon plotting these dips that their magnitude increased rapidly until a point on the south rim was reached. They then reasoned that as the southern portion of the rim was approached the projectile was plowing deeper and had therefore bent back the rocks more steeply on either side, with its lifting force eventually spent, the mass was lodged in the southern sector. Factors tending to strengthen this theory were given as follows, - the north rim is lower than the south, which is due in part to the lower dip of the strata, but chiefly due to the fact that far less volume of excavated material has been deposited on the north; the amount of ejected material increases progressively towards the south, on both sides, until the greatest volume is found on the southern rim, where the greatest arching and uplifted strata appears.

Due to lack of funds, the theory of oblique approach of the meteorite, was not acted upon until 1920. A churn-drill hole was then sunk on the southern rim, as near as possible to the center of the great southern arch, and after many difficulties the drill eventually reached a depth of 1,376 feet where it became permanently stuck. At a depth of around 1,200 feet it was stated that small fragments of oxidized meteoric material were found mixed with the shattered sandstone. As the hole was drilled deeper this material increased rapidly in quantity until it composed about 75% of the mass and in all respects it answered the description of the oxidized meteoric iron found at or near the surface. It was assumed that it would have been impossible for a small amount of this material to drive itself to this depth in the rocks had not a much larger mass have plowed the way for it. It was considered almost certain that the drill had at last encountered the main mass of the meteorite. Since the mining company had greatly exceeded the estimated cost of drilling the hole and were unwilling to go to further expense, they abandoned their lease at the termination of the drilling in 1924.

Besides the interest of the Barringer family in exploration up to

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

this time the Standard Iron Company, the United States Smelting and Refining Company, the Mining Exploration Company had been associated with various projects to discover the meteorite. In 1927 another company, the Meteor Crater Exploration and Mining Company was organized, obtaining a long-term lease on the 2,369 acres formerly owned in fee by the Standard Iron Company.

GEOPHYSICAL SURVEY

The Meteor Crater Exploration and Mining Company who I am told now own the lease, instigated a geophysical survey of the area by the International Geophysicists, Incorporated, of Los Angeles, in October, 1930. It was stipulated that independent surveys were to be made by three different groups of their staff and that separate reports were to be submitted by each group. A geologist examined some 1,000 acres at Meteor Crater and vicinity; the Magnetometer party, consisting of three members, surveyed some 5,000 acres; and the electrical survey party, of two members, reported on 700 acres. The details of the various surveys was presented in a paper by Mr. J. J. Jakosky (17) at a meeting of the American Institute of Mining and Metallurgical Engineers in New York City. While I have not had an opportunity as yet to review this paper, Mr. George M. Colvocoreshes, general manager of the Meteor Crater Mining and Exploration Company, of Phoenix, Arizona, kindly permitted me to read a copy of their formal report. The objective of the geophysical survey was to obtain information about the origin of the crater, the advisability of continuing with exploration work, and if the latter was to be undertaken the location where such exploration work should be directed.

The factors governing the choice of geophysical methods were as follows: (2) The electrical conductivity of the unoxidized meteoric material was over a million times greater than the surrounding country rock. If sufficient quantities of this material existed underground the electrical studies would indicate its presence (assuming no other electrically complicating factors) by a decrease in the effective resistivity. (b) The magnetic permeability of the unoxidized meteoric material was also over a million times greater than the surrounding sedimentary series and should cause a magnetic anomaly if the material existed in sufficient amount at its depth, and again assuming no complicating magnetic factors.

In the magnetometer survey two factors were watched closely, - (1) anomalies which would indicate presence of meteoric materials; (2) anomalies which would be caused by an igneous intrusion or any change in the basement complex. This data was later desirable in connection with the possibility of a steam explosion being the cause. Should such a steam explosion have occurred, its origin and source would probably be indicated, by magnetic anomalies associated with deeper structural effects.

From a study of the results obtained in the magnetometer survey it was concluded that the crater is of meteoric origin in view of the following:

REPORT ON METEOR CRATER (CONT.)

(1) Magnetometer work does not show a change of regional gradient which would account for a buried igneous mass from which the steam might have emanated. (2) If the steam explosion were the cause one would expect some evidence of hydrothermal action which is not in evidence. (3) It is doubtful that, in a steam explosion, temperatures, sufficient to account for the formation of Le Chatelierite (1625° Centigrade) would obtain. (4) The intimate association of meteoric fragments with the ejected debris is undisputable evidence. (5) The fact that previous magnetometer surveys did not show anomalies due to the buried meteoric material has long been cited by those favoring the steam explosion theory. This was because their instruments were not sufficiently sensitive and also because such work was not carried out in sufficient detail to allow differentiation between regional gradient, increases anomalies due to a buried mass, decreased anomalies due to pulverizing and shattering of the fill material, and topographic attitude effect.

The results of the electrical work were as follows: (1) The water level inside the crater (about 180 feet beneath the present dry lake-bed) and level outside the crater about 550 feet below the level of the plateau are of the same elevation. (2) A well defined electrically conductive area occurs in the southwest quadrant of the crater. This calculated to be caused by two factors, (a) a deeper fragmatized or shattered zone underneath the area, and (b) such meteoric fragments as may be mixed with the field material in this zone. This zone is the area wherein all future exploration efforts should be directed. (3) No such area exists in any other part of the crater. (4) Sub-surface structural conditions are quite uniform through the crater area. (5) The crater is undoubtedly of meteoric origin. (6) The electrical effect would be classed as moderate to fair.

Briefly the geological report considered the crater to be formed by the impact of a meteor or a swarm of meteoric material. The possibility of a steam explosion is not probable. The age is estimated at 50,000 years. The latter figure is arrived at since there is a series of sedimentary deposits originating in arid climatic conditions, under which conditions of sedimentation is recognized as an extremely slow process. The record in these beds of a volcanic disturbance in the vicinity, probably at Sunshine mountains. The proof of a very considerable period of erosion. From a geological study of the crater there appears to be foreign material in the southern portion of the crater.

By way of summary the magnetic survey pointed to the presence of an area of continuous magnetic material in the southern portion of the crater, at depths of 200 feet and more, with concentration probably increasing with depth. By this method it was regarded that the mineralized area appeared to be as much as 600 feet in length and possessing appreciable depth and breadth. The electrical survey indicated the presence of an area of high conductivity in the southwest quadrant, between the center and the rim of the cone, at a depth of approximately 700 feet. That the original and

GEOLOGICAL REPORT ON METEOR CRATER (CONT.)

altered material found in the area indicated that the zone of higher conductivity cannot be due to rocks in place, or to their products, or to fill material. The conclusion advanced by this group infer that the material is almost certainly of metallic character. The geologist observed that the regional conditions are more or less simple, with flat sedimentary beds lacking in igneous intrusions or structural deformation, except local faulting caused by the impact. It was concluded that the absence of such complicated factors were indicative of the presence of meteoric material. Evidence warrants drill-hole exploration and five tests are recommended. The general location of the areas within which magnetic highs was located, agrees with the locations obtained in the electrical surveys, wherein a higher conductive zone was found. The magnetic high is also in the same general area as the location obtained from geologic data.

The results of the geophysical work are not considered sufficiently definite, in view of the complicated factors involved, to warrant calculations or predictions regarding the tonnage or mass of material which may be present. The chief result of the work has been to definitely delineate the area wherein future development work should be concentrated.

DRILLING OPERATIONS

Many trial shafts, six or more in number, and some 25 test holes have been put down in an effort to locate the meteorite. The results obtained in the deepest test hole, which reached a depth of 1,376 feet, have been described. Mainly upon the recommendations of the geophysical survey, the present management, the Meteor Crater Exploration and Mining Company, in the last few years made another attempt to locate the supposedly buried mass. Since considerable difficulty had been encountered in previous tests due to pulverized material and debris it was decided to sink a 1,500-foot compartment shaft, on the south rim of the crater, outside of the crater and then cross-cut to the location of the main mass as determined by geophysical methods. This shaft reached a depth of 713 feet. Large amounts of water, 1,000,000 gallons per day, were encountered at around 650 feet from cracks and fissures in the Coconino sandstone, and the operation had to be abandoned at the above depth. Some have suggested that it might be possible to cut an underground tunnel for the transportation of this water to the Salt River valley some hundred miles to the south, however, we are interested to know that work on this venture has not started as yet. It is stated that approximately \$600,000 have been expended in efforts to exploit Meteor Crater up to the present time. No work is being carried on at present. The Mining Company has a custodian of the crater to show visitors around for which a fee of 25 cents is charged. An observation tower has been erected on Highway 66 recently and is called the Meteor Crater Observatory. True little can be observed from this point.

GEOLOGICAL REPORT ON METEOR CRATER (CONT.)

THEORIES AS TO ORIGIN

As may be seen from the partial bibliography at the end of this report, the literature has contained many articles on Meteor Crater during the past 35 years. While I do not mean to imply that I have read all of these references I have perused many of the more recent ones and there seems to be only two real theories as to origin, namely, meteoric or volcanic. The limestone sink idea has been well disproven as will be noted from the following page.

Meteoric Theory of Origin

The Meteoric theory for the origin of the crater which was first propounded by Ballinger has since been agreed to by G. P. Merrill (19); J. J. Jakoski (17); Elihu Thompson (29); L. J. Spencer (27); C. L. Longwell (18); Eliot Plackwelder (7); H. N. Russell (25); C. O. Lampland (30); H. S. Colton (31); and others. Some have argued that the meteorite was in the form of a single projectile and others that it was a swarm of meteoric material but all consider the crater the result of a meteoric impact of some sort. There has also been some disagreement among the above writers as to whether there was an explosion accompanying the impact. Most of the authors seem to favor the idea of an explosion.

Some of the main ideas advanced which tend to prove this supposition are as follows:

1. The actual presence in the debris around the rim and for miles around of much meteoric iron. The fact that concentration of this material increases as the center of the cone is approached. That the meteorites, admixed with the debris, must have had something to do with the formation of the crater or else they must be assumed to have fallen at exactly the same time and precisely the same spot on which a crater was being moulded, however formed. Such a double coincidence they contend would be next to a physical impossibility.

2. No evidence whatsoever of volcanic activity has been noted in the immediate vicinity of the crater.

3. Borings show that the crater is filled to a depth of about 700 feet with debris shattered by the original disturbance. The sandstone has been crushed to powder or "rock-flour" and some has undergone fusion, indicating a temperature of around 1,500^o Centigrade. The temperature of a steam explosion which may have accompanied a volcanic intrusion, as inferred by the opponents of meteoric origin, would not be high enough to produce the silica-glass.

4. The structural features of the crater, the dip of the strata, with notable increase in dip towards the arch on the south rim, seems to be of considerable significance, with such an arrangement not probable.

under volcanic origin.

5. The results of the geophysical survey as conducted by three independent parties have been detailed on the preceding pages and they all point to a meteoric impact.

6. The argument that to date no meteoric mass of any size sufficient to have produced the crater has been located and that therefore it could not be meteoric in origin, means no more than the assumption that there are no oil pools in certain areas because of the fact that many dry holes have been drilled, or that there are no commercial ore deposits in certain localities since much prospecting has been undertaken.

7. If the crater were formed by a steam explosion from hot solutions or gases coming from underneath the present sedimentary strata then there should be evidence of hydrothermal action. Also from the results of borings and geophysical work it was observed that the underlying Supai red beds are in undisturbed position.

Volcanic Theory of Origin

The theory that the crater was produced by a volcanic steam explosion in the Coconino sandstone was first advanced by Gilbert (16). He arrived at this conclusion since the feature is in the midst of an area of volcanic activity, with many recent volcanic cinder cones at no great distance, and its similarity to these latter features. But there is no evidence of volcanic activity at Meteor Crater such as is present at these other localities. I have been informed that Mr. Gilbert leaned toward the theory of meteoric origin prior to his death although he refrained from publishing anything in this regard. Darton (10) has been one of the few prominent scientists in recent years to hold to the theory of volcanic origin and the writer is frank to admit that he does not present much evidence in support of same. It is most certainly difficult to conceive of huge chunks of limestone being blown for miles around the crater, and to visualize the force involved in such a blast, with no semblance of volcanic rocks left behind. I might add also that the surrounding countryside has been pretty well looked over in search for meteorities.

LIMESTONE SINK THEORY

In Science, Jan. 9, 1931, Mr. F. S. Dellenbaugh (11) suggests that the great pit of Meteor Butte is a sink formed by ground water solution in the Kaibab limestone. The geologic facts as enumerated by Mr. Chester H. Longwell (18) disprove Mr. Dellenbach's theory conclusively. The former agrees that the Kaibab limestone of this region contains many sinks, which receive much of the drainage of the Kaibab plateau, but states that it would be a wonder indeed to find in a semi-arid country a sink, almost circular in plan and nearly a mile in diameter, occupying the entire top of a hill, where the only water available for solution consists of the

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

scanty rain that falls directly on the area of the pit. Meteor Butte is a hill with the ground sloping away from the very edge of the rim on all sides and hence no outside drainage can enter the depression. Mr. Longwell mentions further the following points which are considered sufficient to remove the sink hypothesis from consideration, -

1. A limestone sink does not reach deeper than the base of the soluble formation in which it is formed. The Kaibab limestone here forms less than half the height of the walls. Beneath the Kaibab is the Coconino sandstone which is one of the most insoluble rock formations known. Any suggestion that the Coconino sandstone may have been caved owing to solution directly beneath it is ruled out, because the sandstones rest on red shales and sandstones many hundreds of feet in thickness.

2. At the top of the pit the slopes on all sides are littered with fragments of the Coconino sandstone. These fragments range in size from minute bits of broken sand grains to blocks of large size; and they are mixed with similar debris derived from the Kaibab limestone. How were these pieces brought up from their normal position hundreds of feet below? Obviously by a great force that acted upward and was explosive in character.

3. Although the rock strata are practically horizontal beneath a wide surrounding area, in the walls of the crater these strata are tilted and otherwise disturbed. On the south side, where the wall is steepest, the beds dip directly into the wall, at a high angle. There is no haphazard arrangement, such as would be expected if the disturbance were due to slumping into a solution pit. The tilt is consistent in direction and indicates that a powerful lifting force acted inside the pit, with concentrated action on the south side.

4. In places the quartz sand in the Coconino sandstone forming the lower part of the walls has been fused to glass (lechatelierite). This is astonishing in view of the high melting point of quartz (nearly 1500° Centigrade). Evidently the crater has been subjected to intense heat, such as could be generated only in an exceptional way.

Mr. Dellenbaugh sees support for his hypothesis in the fact that both inside and outside slopes of the crater show effects of erosion. Whatever its origin, the crater has been outdoors since its formation, and modification of its slopes by erosion has been inevitable, the fate it shares with every other landscape feature.

CONCLUSIONS

The writer has conversed with numerous geologists, astronomers, mining engineers, and has communicated with geophysicists who are familiar with and have examined Meteor Crater. After reviewing many of the various theories advanced to account for the origin of the crater and after studying

GEOLOGICAL REPORT ON METEOR CRATER (CONT.)

the situation on the ground I can see no other solution than that it was formed by a meteoric impact. I was skeptical at first due to the fact that to date, despite many years of work in exploration, no large mass of meteoric material has been found buried in the crater. But this does not alter the fact that more meteorites have been found outside of the crater than have been discovered to date in all the rest of the earth's surface. As the crater is approached the meteorites are more concentrated and some of them have been found mixed with the debris on the rim; therefore, if the crater is due to some cause other than meteoric impact it must have been formed at the identical moment that a mass of meteorites struck the spot. With the world for a target and in consideration of the time element it does seem that such a double coincidence would be improbable. Then there is the matter of intense heat which fused the sandstone, the large blocks of limestone scattered for miles around the crater, the arrangement of dips along the rim becoming increasingly greater at a point on the south, not to mention the general form of the crater with no evidence of volcanic activity it now appears that practically all of the real evidence points to meteoric origin. The consensus of opinion of most of the leading scientists is that the crater is the result of a fall of a meteorite. -

Regardless of the origin, however, the crater contains much in the way of inspirational appeal, and would doubtless make a most important addition to the National Park Service chain of monuments throughout this region. Due to the fact that considerable sums of money have been spent in exploration it is not known if satisfactory arrangements could be made in this regard. If the cone is the result of an impact of a meteor, as is now generally conceived, it is the largest known crater in the world formed by such a phenomena.

BIBLIOGRAPHY

1. Alderman, A. R., The Meteorite Craters of Menbury, Central Australia: Reprinted from the Mineralogical Magazine, Vol. XXII, No. 136, March, 1932, pages 19-32.
2. Barringer, D. M., Coon Mountain and Its Crater: Proc. Acad. Nat. Sciences of Philadelphia, December, 1905.
3. Barringer, D. M. and Tilghman, B. C., Coon Mountain and its Crater: Proc. Acad. Nat. Sci., Philadelphia, Vol. 57, pp. 861-914, 1906.
4. Barringer, D. M., Meteor Crater of Northern Central Arizona: Nat. Acad. of Science, Nov. 16, 1909.
5. Barringer, D. M., Further Notes on Meteor Crater, Arizona: Nat. Acad. of Science, Philadelphia, Vol. 66, pp. 556-565, 1915.

GEOLOGICAL REPORT ON METEOR CRATER (CONT.)

6. Barringer, D. M. Jr., The Meteor Crater of Arizona: Science, July, August, September, 1927.
7. Blackwelder, Eliot, Age of Meteor Crater: Reprinted from Science, December 16, 1932, Vol. 76, No. 1981, pp. 557-560.
8. Boutwell, W. D., The Mysterious Tomb of a Giant Meteorite: National Geographic Magazine, Vol. LIII, Jan.-June, 1928, pp. 721-30.
9. Brown, F. Martin, Note in Science regarding Age of Meteor Crater: Science, Vol. 77, No. 1992, March 3, 1933.
10. Darton, N. H., A Resume of Arizona Geology, Crater Mound; Bulletin of the University of Arizona No. 119, Geological Series No. 3, page 198.
11. Dellenbaugh, F. S., Meteor Butte, Science, New York, 1931, Vol. 73, pp. 38-39.
12. Fairchild, N. L., Origin of Meteor Crater (Coon Butte), Arizona: Geol. Soc. of Am., Bull., Vol. 18, pp. 493-504, 1907.
13. Farrington, O. C., Catalogue of the Meteorites of North America, Memoirs of the National Academy of Sciences, Vol. XXIII, pp. 87-93.
14. Fletcher, L., A Search for a Buried Meteorite, Nature, 1906, Vol. 74, pp. 490-92.
15. Foote, A. F., A New Locality for Meteoric Iron with a Preliminary Notice of the Discovery of Diamonds in the Iron; Am. Jnl. Sci., 1891, ser. 3, Vol. 42, pp. 413-17.
16. Gilbert, G. K., The Origin of Hypotheses, illustrated by the Discussion of a Topographical Problem. Science, New York, 1896, Vol. 3, pp. 1-13, and Presidential Addresses. Geol. Soc. Washington, 1896, pp. 2-24.
17. Jakoski, J. J., Geophysical Examination of Meteor Crater, Arizona, N. Y. Meeting of the Am. Inst. of Mining and Metallurgical Engineers, Feb., 1931.
18. Langwell, C. L., Meteor Crater is not a Limestone Sink: Science, Feb. 27, 1931, p. 234.
19. Merrill, G. P., The Meteor Crater of Canyon Diablo, Arizona: Its History, Origin, and Associated Meteoric Irons, Smithsonian Miscellaneous Collection, 1908, Vol. 50, pp. 461-98.

GEOLOGIC REPORT ON METEOR CRATER (CONT.)

20. Wininger, H. H., Notes on the Oxidation of certain Meteorites; the Formation of Meteorites; Trans. Kans. Acad. Sci., Vol. 32, 1929.
21. Nininger, H. H., and Figgins, J. D., The Excavation of a Meteorite Crater near Haviland, Kiowa County, Kansas; Proceedings of the Colorado Museum of Natural History, Vol. XII, Number 3, Nov. 14, 1933.
22. Nininger, H. H., Our Stone-Pelted Planet, Houghton-Mifflin, CHAPTER XII, 1933.
23. Nininger, H. H., Meteor Crater vs Steam Blowouts: Pan American Geologist Vol. LX, No. 4, November, 1933, Geological Publishing Company, Des Moines, Ia.
24. Rodgers, A. F., A Unique Occurrence of Lechatelierite or Silica Glass; Am. Jnl. of Sci., 1930, Ser. 5, Vol. 19, 195-202.
25. Russell, Henry N., Meteor Crater: Museum of Northern Arizona Notes, Vol. 4, No. 3, September, 1927.
26. Spencer, Dr. L. J., Meteorite Craters: Reprinted from Nature, Vol. 129, May 28, 1932, pages 781-784.
27. Spencer, Dr. L. J., Meteorite Craters as Topographical Features on the Earth's Surface; Reprinted from the Geographical Journal, Vol. LXXXI No. 3, March, 1933.
28. Spencer, Dr. L. J., Meteorite Craters: Reprinted from the Geologists' Association, London, Vol. XLV., Part 4, 1934, Pages 407-411.
29. Thompson, Elihu, a Hunt for a Great Meteor: Supplement No. 1896 to Sci. Am., May 4, 1912.
30. Lampland, C. O. Astronomer Verbal Communication - Lowell Observatory
31. Colton, H. S., President - Museum of Northern Arizona-Verbal Communication.

*****OO*****

MONTEZUMA BIRDS

By Betty Jackson

Birds seen this month are as follows:

Arizona Cardinal	Killdeer
Mourning Dove	Arkansas Kingbird
White-winged Dove	Ashy Ruby-crowned Kinglet
Red-shafted Flicker	American Merganser
Vermillion Flycatcher	Western Mockingbird
Arizona Blue Grosbeak	Texas Nighthawk
Red-tailed Hawk	Arizona Hooded Oriole
Green Heron	Gambel Quail
Treganza Blue Heron	Cliff Swallow
Black-crowned Night Heron	Hepatic Tanager
Rufous Hummingbird	Abert Towhee
Black-chinned Hummingbird	Turkey Vulture
House Finch	Cactus Woodpecker
Wood Ibis	Canyon Wren

The Mockingbirds came in flocks the last week of July to enjoy the wild grapes which grow so plentifully on the Monument. I had planned wild grape jelly, but didn't get even a glass of it. As each grape ripened, they disposed of it, and I didn't have a chance.

There is a new record for the monument. I mentioned a Canyon Towhee last month, which I had seen at a distance, and which resembled the one that had been around before. I got a good look at him this month, from not more than ten feet away, and he is the Abert Towhee. The black lores and chin are diagnostic.

The Hummingbirds have been kinder this month, the males coming near enough to be identified. On July 31 a male Rufous came close to the window, enjoying our Rocky Mountain Bee Plants, and since August 17 a male Black-chinned has come daily. The females are still regular visitors too.

On July 28 an Arizona Blue Grosbeak was seen flitting through the trees for just a moment.

Nearly every morning since July 31 a pair of Green Heron have come to feed on our fish. In fact, the creek looks like a real bird sanctuary between dawn and eight o'clock, with herons, ducks, quail, doves, Flycatchers, and Killdeer, all in it or on the banks.

Early in August Norman saw a Hepatic Tanager. I neglected to enter it in my notes at the time, so haven't the date.

On August 17 a Red-tailed Hawk startled us with his screams. We hear sounds like a small boy tooting on a tin whistle, three times, then

BIRDS AT MONTEZUMA CASTLE (CONT.)

a pause, then three times again, and so on for quite a while. I understand it is an alarm call, but we couldn't see anything from below the cliff that could have disturbed him. He may have a nest above the cliff, but he hasn't been around regularly enough to make me suspect it.

The same day Norman got a good look at five Wood Ibis on the Verde River. As far as we know, none have been seen before in the valley. They were probably migrating.

On August 20 Mrs. Jennings saw some young Mourning Doves, which must be second brood. I have at last located one nest, which is now empty.

On the 22nd, 12 ducks were feeding on the creek at seven o'clock, and one of them got a fish right in sight of Jess and Jane Jennings. Seven of them were there at the same time on the 23rd. They are American Mergansers, probably the brood we saw being raised.

The Quail are becoming more friendly now that their young are more capable of taking care of themselves. Nearly every morning for a week or two there has been a covey of 19 of them, scratching for seeds on our "lawn." I shouldn't be surprised if they were enjoying depleting our ant population, too. There are two more coveys, of approximately the same numbers, that stay further away from the houses.

Three young Kingbirds were around most of the month, though I haven't seen them for a week. They would spend the day circling our house, from bush to bush, and making noises which for a while were entertaining, but which became definitely irksome after eight or nine hours of steady repetition every day.

Today, the 24th, I heard a cheerful song, and found our friend the Ashy Ruby-crowned Kinglet back again, and very happy.

The cliff Swallows have not been seen for about three weeks.

*****OOO*****

RIO GRANDE GLAZES

By Earl Jackson

The following information was obtained from Mr. Glen Lukens, a ceramics instructor from Los Angeles, California. He very generously took considerable pains to see that we thoroughly understood his explanations.

The glaze used on Rio Grande pottery is a layer of litharge (red lead oxide) put on the dried pot, which combines with the silica in the clay of the pot itself to form a glass at a low temperature (980° F.).

POST-MORTEM ON RIO GRANDE GLAZES (CONT.)

For example take a red shale pot. It is made up of the following:

1. Clay base (Al_2SiO_3).
2. Iron Oxide (FeO).
3. Calcium from sea shells.
4. A few insolubles.

When this pot is fired at a low temperature it comes out red, because of the physical reaction of the iron and the calcium. When it is dried and decorated with litharge (PbO), the litharge combines with the silica in the clay base to form PbSiO_2 , or a true glass, at as low as 980°F . Thus PbO plus the SiO_3 (in the Al_2SiO_3) equals PbSiO_2 plus O_2 which goes off in the flame.)

If the pot is tempered with mica, it will not take the glaze, or will take it unevenly, since the mica prevents the union of the litharge and the silicate. Glazed pots are therefore tempered with ground up potsherds, which fulfill the function of keeping the pot from cracking in the heat, and still do not retard the chemical action that makes the glaze.

*****OOO*****

TUMACACORI

By Louis R. Caywood

When opportunity offers, on days off or upon the arrival of National Park Service officials or interested visitors, I have taken the time to visit historic and prehistoric points of interest in the Santa Cruz Valley and surrounding country. Besides exploring the better known sites of old Calabasas and Guevavi missions and Fort Crittenden and Fort Mason, I have located several large Indian ruins on the mesas adjacent to the river bottom. These valley ruins have long been known to the cowboys and others since very early days but have never been seriously pot-hunted or vandalized. On the high points of the Tumacacori Mountains west of Tumacacori are found a number of "trincheras".

These trincheras are usually strategic cone-shaped hills or sometimes mountain passes heavily fortified by terraced walls. That they are prehistoric and pre-mission is readily seen upon examination. However, the Apaches, Opatas and Papagos may have used them for defenses at various times and have left their cultural remains.

The trinchera culture, if one might call it that, has long been thought of by archeologists as belonging to the late red-on-buff or Hohokam period with some slight differences in pottery.

The large Santa Cruz valley pueblos belonging to the Hohokam culture must slightly precede the trincheras. After disposing of such

RANDOM NOTES FROM TUMACACORI (CONT.)

theories about the trincheras as agricultural terraces, or places of worship it is believed that they were places of refuge. Perhaps because of incessant attacks from an invading nomadic people the large valley pueblos (mesa) were abandoned in favor of the fortified trincheras.

The Recent period in the valley is represented by an undecorated pottery and camp sites either in the river bottom proper or on the low mesas or even reoccupation of the large valley pueblos on the mesas. This period is definitely pre-Mission. Consequently when the Jesuit priests arrived these villages were being occupied. The village of Tumacacori was one of these occupied villages. There were numerous others in the vicinity according to the old Jesuit records. It is too bad that we cannot locate the others today and apply the names as the priests did.

The Sobaipuris belonged to the same linguistic stock that the Papagos and Pimas belong to and were found in the San Pedro and Santa Cruz valleys. Sometimes they were called Sobaipuris and sometimes Papagos showing that both tribes were represented or that they were very closely related then. At that time most of the Apache raids and fighting occurred in the San Pedro Valley with people belonging to Chief Coro's village. However, as the priests brought in more and more agricultural products and domestic animals there seemed to be a greater demand for these products and animals by the Apaches. So Chief Coro had to finally move to Sonoita and the fighting and raiding often took place in the Santa Cruz Valley. Had these early Indians remained poor and with no Spanish contacts the Apaches would seldom have raided them. Finally many Spanish troops had to be brought in to protect the Indians and Spanish settlers. The Apache scourge remained with the country until after American times when in 1886 the last of them were rounded up and taken to Oklahoma and a few of the worst to Florida.

*****OO*****

RUMINATIONS

By the Boss.

In our slow growth over the years we have had a problem which used to bother us not at all but has gradually come to worry us more and more. It relates to vacations.

I suppose it is the theory of the Government that when a man takes his vacation his fellows will take over some of his work and the remainder will pile up and be waiting for him when he returns; that somehow we will muddle through. I suppose this because, although we are ordered to give vacations, no arrangements have ever been made for the extra funds needed to pay additional help to handle the jobs while the men are gone.

Here is our situation: at each of 11 isolated posts we have only one man on duty. If each of these men is to receive his annual leave which, under the law, must be granted, it would take all the time of one man for 11 months to relieve successively these 11 lone-post men. The 12th month would be used for his own leave, so this means one full-time job as a relief man. The other alternative, if these 11 men are to get their leave, is to simply abandon each post for one month in the year and take our chances on vandalism, theft, fire, etc., to say nothing of the lack of service to the public for that length of time. Assuming that we want to have continuous service and protection at these 11 lone-post monuments, we need one extra man.

At each of four monuments we have only two men on duty. Heavy travel and size of physical plant makes it as serious to leave these places with only one employee as to leave one of the lone-post places with none. Your lone man trying to hold down a two-man post must go to town for mail and supplies and on official business; he has to work a seven-day week; he has to lock the public out during his meal hours. When there are only two men on the job it is impossible for one to perform all the duties of both for a month. If it were possible for him to do this without being overworked, then why have the second man at all, for in the statement of the case you make it a one-man job. If you agree with me, then the relieving of these eight men on these four two-man monuments will take eight months of another relief ranger's time if your monuments are going to function uninterruptedly.

We have not yet made provision for sick leave in the case of these 19 employees, all of whom must be relieved when they are absent, nor for extended absences on official business, normally a week to ten days annually for each custodian. This readily adds up to three more months, making another total of 11 calendar months of absolutely necessary leave time. The 12th month is the extra employee's own annual leave and we thus account for another full-time relief ranger.

There is nothing academic about this discussion: the situation is very real and very painful and we are stuck with it! The only out

RUMINATIONS (CONT.)

we see is to set up two full-time relief ranger positions.

It seems to me the way to handle this would be for the Budget to recognize that it costs something to give a man a vacation and so let us set up one and one-twelfth salaries per year on these jobs, This would allow us, in our own particular case which is worrying us, to hire the two extra men who would do nothing but relieve these 19 employees. It is an item easy to foresee and compute and we would think it would be a very proper item for the estimates.

Suppose we try it next year and see if the Budget thinks it shouldn't cost anything to give 19 employees their annual leave in the circumstances outlined above; or that the cost should fall in poor service or no service to the public and vandalism and theft at the lone-post monuments; or that it is a regular and normal item of expense to be handled in the budget like any other item we can foresee and estimate on.

Cordially,

The Boss,