SOUTHWEST MUSEUM PAPERS

Number Nine

THE PINTO BASIN SITE

BY

ELIZABETH W. CROZER CAMPBELL
AND WILLIAM H. CAMPBELL

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THE PINTO BASIN SITE

An ancient aboriginal camping ground
in the California desert

BY

ELIZABETH W. CROZER CAMPBELL

AND

WILLIAM H. CAMPBELL

With a geologic introduction by David Scharf
and a description of the artifacts by
Charles Avery Amsden

SECOND CONTRIBUTION FROM THE DESERT BRANCH

Published by the

SOUTHWEST MUSEUM

Highland Park, Los Angeles, California

March, 1935

Reprinted 1963

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FOREWORD

THE accompanying paper is the second report of progress of the work of the Desert Branch of Southwest Museum founded by Mr. and Mrs. William H. Campbell of Twenty Nine Palms and supported by them from its inception in 1928.

Making their home in the desert in 1925, Mr. and Mrs. Campbell immediately became interested in the vestiges of former aboriginal occupancy of their neighborhood and set about to know more of these remains, consulting the Southwest Museum for the information they desired. Untrained at the time in methods of archeological research, but with rare acumen and enthusiasm, it was not long ere their observations and studies revealed a world of knowledge of desert conditions and gradually much of the culture of the Indians who once occupied those arid stretches was unfolded to them. Ever having in mind not alone the gathering and preservation of these fugitive archeological evidences, but employing every endeavor to teach other desert residents the importance of leaving undisturbed the caches of pottery and other objects until they could be properly studied in place, Mr. and Mrs. Campbell conceived and developed the plan of establishing a museum that would display the primitive cultures of their local archeological area, and the Desert Branch was the result. In order that its treasures might be preserved for the benefit of students for all time, title to the collections was generously passed to the Southwest Museum by deed of gift, and subsequently the physical equipment and library of the Desert Branch were similarly assigned.

The first published product of the Desert Branch was An Archeological Survey of the Twenty Nine Palms Region, by Mrs. Campbell, published in November, 1931. This report was obviously preliminary, for it was issued while archeological work of the same nature as that of which the account treats was in active progress. In time, no doubt, we shall have a further report on similar phases of desert archeology based on subsequent investigations.

Meanwhile Mr. and Mrs. Campbell, having studied exhaustively the archeological remains within immediate range of Twenty Nine Palms, extended their researches into farther fields of the vast desert region, with the result that sites of very early occupancy about the shores of lakes and streams that had given up their waters perhaps 10,000 years ago were discovered and their difficult problems studied. The present paper is the first published result of the observations by Mr. and Mrs. Campbell on one of these places of occupancy so long ago. As the question of the age of the archeological remains involves a study of the geology of the region, the California Institute of Technology, asked to coöperate, generously proffered its aid, with the result that Mr. David Scharf contributed the report which forms an introduction to the accompanying memoir. Mr. Charles Amsden, ever in close touch with Mr. and Mrs. Campbell in their field work and personally representing the Southwest Museum in its intimate relations and coöperation with the Desert Branch, made frequent visits with Mr. and Mrs. Campbell to the ancient sites which they had brought to light and aided them in every possible way, especially by making a comparative study of the stone artifacts found thereon. The result is presented in Mr. Amsden's chapter on this phase of the investigation as an adjunct of the general account.

The research described herein is by no means ended. What the future studies of Mr. and Mrs. Campbell may reveal, one may not now conjecture. That the investigations in the interest of archeology thus far conducted by them are of prime importance cannot be gainsaid.

F. W. HODGE, *Director*

Southwest Museum,
January, 1935

ACKNOWLEDGMENTS

WE wish to express our deep gratitude to those persons whose services, in field or laboratory or both, are recorded at appropriate points in the text of this paper. Without their friendly help we should certainly have lacked both the courage and the knowledge to make this report on a site and an assemblage of artifacts so difficult of interpretation as these.

Our debt to California Institute of Technology is great. Dr. Chester Stock has shown a constant and very helpful interest in the paleontological aspects of our work, and we have been happy to deposit with him the purely paleontological materials recovered. He sent Mr. E. L. Furlong and Mr. H. Donald Curry to visit the site when we first suspected its importance to the record of ancient man, and later enabled Mr. Lawrence Bolles and Mr. David Scharf to do further work on its paleontology and geology. Mr. Furlong has since increased our obligation to him in many ways, for in Dr. Stock's absence we have consulted him freely and always profitably.

Geologists of the Institute have been no less kind and helpful. Dr. J. P. Buwalda has given hours of his time to a discussion of our geological problems. Dr. F. L. Ransome identified much of our stone material, and Dr. Ian Campbell reviewed the whole assemblage with Mr. Amsden to help him with his description of the artifacts.

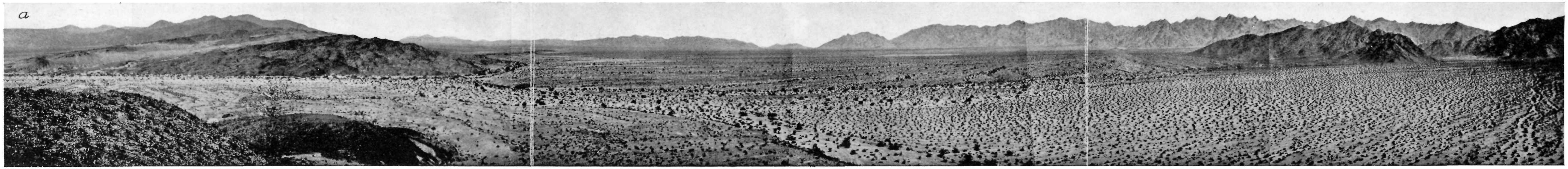
Southwest Museum, the parent institution of our Desert Branch, has given us all possible aid and encouragement, notably in authorizing Mr. Charles Amsden to participate in our work as much as his Museum duties permitted. Dr. F. W. Hodge, Director, has shown an ever-helpful interest, and we are very grateful to him for assuming the task of supervising the publication of this report.

Credit for the panoramic views in plates 1A, B, and of the artifacts in plates 7 to 14, goes respectively to Mr. David Scharf, our geological collaborator, and to Mr. Clifford Park Baldwin, staff artist of Southwest Museum, with the coöperation of Mr. Amsden who classified and arranged the specimens.

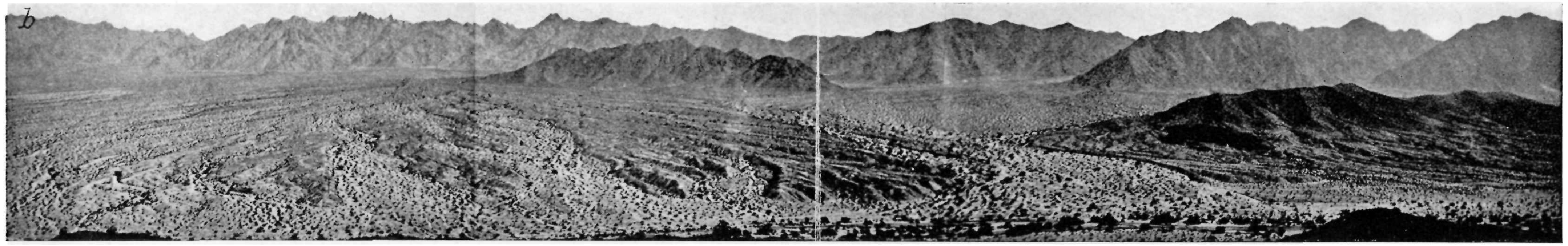
ELIZABETH W. CROZER CAMPBELL

WILLIAM H. CAMPBELL

DESERT BRANCH OF SOUTHWEST MUSEUM
Twenty Nine Palms, California



General view, looking west, northwest, and north; left foreground, coarse fanglomerate, lava, and lacustrine beds of Pinto formation; left middle distance, "anticlinal ridge," lava and lake beds of Pinto formation; left distance, Eagle Mountains; center distance, Pinto Mountains; right distance, Coxcomb Mountains.



Looking northeast from "anticlinal ridge"; center middle distance, dissected Later gravels; right middle distance, fanglomerate lava and lake beds of Pinto formation; Coxcomb Mountains in distance.

(Photographs by Mr. David Scharf)

PANORAMIC VIEWS OF LOWER PINTO BASIN AND SURROUNDINGS

THE QUATERNARY HISTORY OF THE PINTO BASIN

BY DAVID SCHARF

INTRODUCTION

THE primary purpose of the geological investigation of the Pinto Basin was to obtain some idea of its Quaternary history and to supplement with geological evidence the archeological data concerning both the time of the human occupation and the environment under which primitive man was able to inhabit the region, which, in its present arid aspect, would certainly not support primitive human existence today.

The Pinto Basin is a large, typical desert drainage system in the north-central part of Riverside County, California. It is bordered and fed by the Pinto Mountains on the north, the east end of the Little San Bernardino Mountains on the west, the Eagle Mountains on the south, and the Coxcomb Mountains on the east (pl. 1A, *a*). At its southeast corner the basin empties through a gap between the Eagle Mountains and the Coxcombs into Chuckawalla Valley to the south. The elevation of the floor of the basin varies from 1000 feet at its mouth to about 1800 feet in its upper portions. The crests of the surrounding mountain ranges have elevations of the order of 4000 to 6000 feet.

Properly applied, the term Pinto Basin refers to the whole drainage system, but since this report concerns itself chiefly with the lower third of the basin, for the sake of convenience of reference the name Pinto Basin will hereafter be used to refer specifically to that portion which extends westward from the Coxcomb Mountains for a distance of about seven miles.

Occupying the central and major portion of the basin is a large, almost flat area, through which the Pinto Wash runs in an easterly direction toward the mouth of the basin. This flat area is bordered on the south by the steep, rectilinear north front of the Eagle Mountains. To the west, north, and east the flat merges into the extensive alluvial apron which lies against the Pinto Mountains directly to the north, and the sharp, rugged Coxcomb Mountains to the northeast (pl. 1A, *a*, *b*).

STRATIGRAPHY

OLD CRYSTALLINE ROCKS—Only a very general description of the old crystalline rocks of the bordering mountain ranges is necessary or appropriate here. The core of the Eagle Mountains in the vicinity of the Pinto Basin consists chiefly of a granitic rock, quartz monzonite.[1] The Coxcomb Mountains are made principally

[1] E. C. Harder, Iron Ore Deposits in the Eagle Mountains, *U. S. G. S. Bull. 503*, p. 20, 1912.

of a coarse-grained granite. In the middle of the range, however, the light pinkish-brown color of the granite is sharply offset by a black mass of metamorphic slate and schist. There is a similar, larger mass of black metamorphic rock at the southern end of the Coxcombs in Chuckawalla Valley.

QUATERNARY DEPOSITS—Sediments representing four stages of Quaternary deposition are present in the Pinto Basin. These are, in their chronological order:

1. Pinto formation—Lacustrine clays, sandstones and gravels interstratified with basalt flows, and represented in part by a very coarse fanglomerate; folded.
2. Intermediate gravels—Poorly sorted coarse sandstones and gravels, composed chiefly of reworked Pinto formation material; tilted.
3. Later gravels—Coarse fan material derived chiefly from the Coxcomb Mountains; undeformed but dissected.
4. Recent alluvium—Sand-dunes, recent fans bordering mountains and material in beds of present washes.

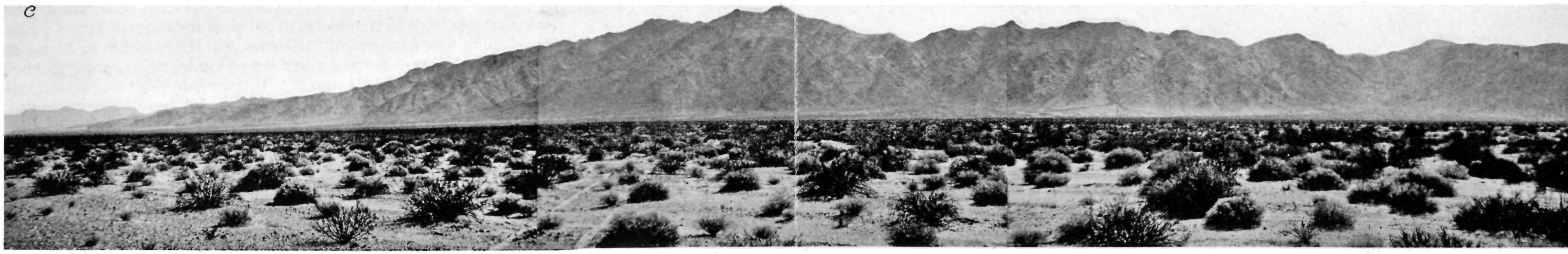
1. *Pinto formation* — The oldest alluvial deposits in the Pinto Basin are lacustrine clays and sandstones, interstratified with basalt flows, and in one locality represented in part by a thick deposit of very coarse fanglomerate. The name Pinto formation will be applied to these deposits. Horse and camel remains found in the Pinto formation date it as Pleistocene in age.

The Pinto formation is best described according to the three differing, though related, aspects which it presents:

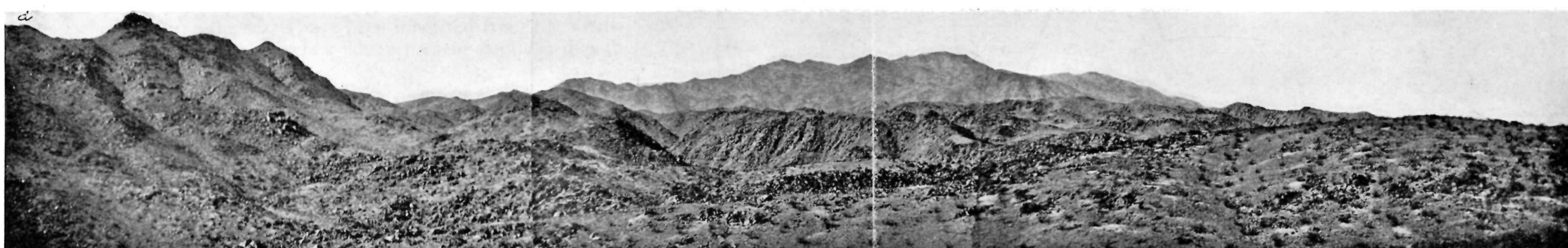
(a) The Eagle Mountains terminate eastwardly in a ridge about a mile and a half long and with an elevation of about 300 feet above the floor of the basin. This ridge is composed of Pinto lacustrine deposits interstratified with several flows of vesicular and amygdaloidal basalt. The lacustrine beds consist of well-bedded clays and sandstones, with small lenses of gravel. At the western end of the ridge, where it joins the Eagle Mountains proper, the beds rest on the eroded surface of the crystalline rocks of the Eagle Mountains. The gravelly lenses contain boulders and pebbles derived from these granitic rocks.

The Pinto formation has here been folded into an east-west anticline, and hence the ridge may be referred to as the "anticlinal ridge" (pl. 1A, *a*). Minor faulting of small displacement has accompanied the folding.

Wherever the basalt rests on the lake beds, the sediments are baked to a brick-red color. It is notable that nowhere do the lake beds contain any detritus derived from the lava. In many places, however, the sediments rest on decomposed lava. This would indi-



Looking south at fault-scarp on north front of Eagle Mountains



Old-age surface lying above fault-scarp of Eagle Mountains

(Photographs by Mr. David Scharf)

PANORAMIC VIEWS OF LOWER PINTO BASIN AND SURROUNDINGS cate that the surface on which the lava was extruded was a low-lying one, and that deposition was continuous and uninterrupted by the lava extrusions. The well-bedded, well-sorted appearance of the clays and sandstones is good evidence for water deposition. The lake must have been quite shallow, however, for the lava is not glassy nor is there any noticeable development of "pillow-structure," as might be expected if the lava had flowed into any considerable body of water. The lake was evidently a fresh-water one, for there are no considerable deposits of gypsum or other salts to indicate that playa conditions prevailed during the existence of the lake.

The absence of any very coarse detritus, even where the sediments rest directly on granitic rock, shows that the source of the material either had no very great relief or was far distant at the time. Since the boulders and sand grains are subangular and not well rounded, the former explanation appears to be the more logical. An examination of the Eagle Mountains to the west of the anticlinal ridge bears out this conclusion. For about ten miles westward from the anticlinal ridge the north front of the Eagle Mountains is a steep rectilinear east-west scarp, interrupted by only a few cañons of any size (pl. 1B, *c*). The scarp reaches a maximum height of 800 to 1000 feet in its middle portion, from which it decreases gradually in height both to east and west. Above this scarp lies a strip varying up to about a mile in width, which is a typical worn-down, old-age surface (pl. 1B, *d*). Behind this strip the mountains rise again to somewhat higher elevations. This old-age surface was probably the source which was furnishing the sediment for the western part of the Pinto beds. Since Pleistocene time it has been uplifted at least 800 to 1000 feet. The few cañons which cut into the scarp have been inherited from the worn-down stage of the previous cycle. Their present depth is due to rejuvenation by the uplift.

To the west of the scarp the uplift terminates and this portion of the Eagle Mountains ends in a line of low hills, which represent an undisturbed portion of the old-age surface. To the east the uplift is also subdued and is represented in the Pinto formation by an east-west anticline. Harder[1] has already noted this doming effect in his study of the crystalline rocks of the Eagle Mountains.

(b) The second aspect of the Pinto formation is presented in a hill which lies in the gap between the Eagle Mountains and the Coxcombs. This hill is about 300 feet high and about one mile long in a northwest-southeast direction. The present wash draining the basin turns southward at this point and runs through the gap (pl. 1A, *b*).

[1] E. C. Harder, op cit., pp. 22 and 27, 1912.

In the section of Pinto beds exposed in this hill, the lowermost bed consists of about 50 or 60 feet of lake deposits grading upward from coarse sandstone to fine clays and capped by a hardened crust of what appears to be highly gypsiferous mud. This is the only occurrence of gypsum or other salt found in the area. Above the lake beds lies a layer of basalt about 30 feet thick, which has baked the upper part of the underlying stratum to a brick-red color. Above the basalt, and making up the entire remainder of the hill, is a great thickness of exceedingly coarse fanglomerate, practically talus material. The boulders average 3 to 4 feet in diameter, but some are much larger. One boulder of solid granite measures 20 feet across. The boulders are predominantly of coarse-grained granite, derived from the Coxcomb Mountains. A small percentage are composed of black metamorphic rock and were evidently derived from the metamorphic mass in the interior of the range. The granite boulders are subangular, while those of the slate and schist are quite angular. The extremely coarse grain of the granite induces rapid weathering, and even the boulders now lying on the steep slopes of the Coxcombs are subangular to rounded in shape. The matrix of the fanglomerate is well consolidated and composed of smaller boulders and pebbles and coarse sandstone made of angular grains of quartz and feldspar. Some degree of stratification of the fanglomerate can be detected when the hill is viewed from a distance.

The lacustrine beds become coarser in texture toward the east, indicating proximity to the eastern border of the old lake basin. The comparative fineness of the material, however, suggests that here again the source was a region of low relief. Immediately following the extrusion of the lava a tremendous and rapid uplift of the Coxcombs must have occurred, as evidenced by the sudden appearance of the fanglomerate and the coarseness of the material. This portion of the old lake basin must have lain at that time at the base of a high, steep mountain range. There is a complete absence of lava detritus in the overlying fanglomerate. The lava had no chance to weather, but was immediately engulfed in a flood of detritus from the mountain slope.

The Pinto beds in this hill dip to the southwest and are an eastward extension of the south limb of the anticline which forms the anticlinal ridge. The north limb has been eroded away. A gentle north-south syncline is present as a cross-fold. The axis of the syncline would lie in the gap between the hill and the anticlinal ridge.

(c) The Pinto formation is also exposed in the banks of Pinto Wash. Here the beds lie practically horizontal and are the undeformed northward extension of the lacustrine beds in the anticlinal ridge. The maximum thickness exposed here is about 20 feet, of which the lower half is predominantly a gray clay, with minor lenses of sandstone, while the upper is composed mainly of brown sandstone, with minor clay. The sediments are fairly well indurated. The basalt is absent from this part of the section. Fossil remains of horse and camel found in place in the clays determine the age of the Pinto formation as Pleistocene.

2. *Intermediate gravels*—Near the east end of the anticlinal ridge there occur beds of gravels lying at an elevation between the top of the ridge and the general level of the basin (pl. 2, *a*, right foreground). These gravels truncate the folded Pinto beds, which in this vicinity are principally lava flows, with the lacustrine deposits subordinate. The gravels are composed of angular fragments of lava and poorly sorted sandstone. Included also are occasional boulders and pebbles of granitic rock, evidently derived from the gravelly lenses in the lacustrine Pinto beds.

The gravels have been tilted slightly toward the north and are now undergoing erosion. They are evidently intermediate in time between the Pinto formation and Later gravels and therefore may be termed the Intermediate gravels.

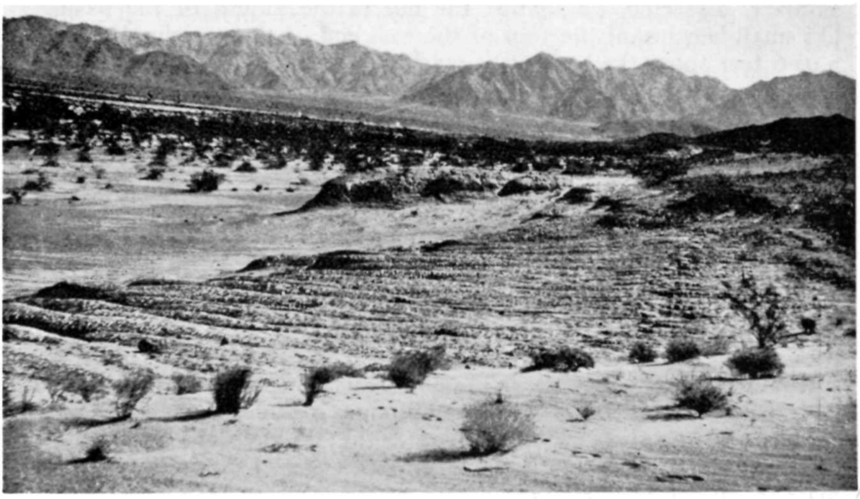
3. *Later gravels* — Just north of the mouth of the Pinto Basin lies a dissected deposit of fan gravels, now being cut into gullies and ridges (pl. 1A, *b*). Portions of this same fan deposit, similarly dissected, lie against the hill in the mouth of the basin. On small benches at the foot of the east end of the anticlinal ridge, 5 or 6 feet above the bed of the wash, are small piles of boulders of the same material as found in the fan. These are the remnants of the fan, which once filled the mouth of the basin and deposited detritus at the base of the anticlinal ridge.

The tops of the ridges formed by the dissection of the fan are all parts of a single flat, even surface. Only dissection toward a new baselevel has affected this fan since it was deposited. The gullies are cut to a maximum depth of 15 to 20 feet and their wide flat beds at their mouths indicate that this new baselevel has almost been reached.

The fanglomerate which we have just described will be called the Later gravels.

4. *Recent alluvium*—Recent alluvium includes the wind-blown sand, piled into dunes in some places, the alluvial fans now being built up along the mountain fronts bordering the basin, and the material in the beds of the present washes.

a, General view of camping area, indicated by bare white spaces paralleling Pinto Wash, marked by vegetation



b, South shore banks, showing lateral erosion of old lake clays, overlaid in foreground by drift sand. Coxcomb Mountains in distance

THE FORMER PINTO RIVER AND THE HUMAN OCCUPATION

The channel of the present Pinto Wash is in most places only a few yards in width and is confined between banks which reach a maximum of about 8 feet in height about midway between the upper and lower ends of the wash. Two or three miles above this point the bed of the wash rises almost to the general level of the basin floor and the wash becomes divided into numerous small rills draining from the alluvial surface bounding the basin on the west. Above the banks of the wash proper, along the middle 4 miles of its length, a flat bench has been developed which extends back from the wash to a second set of banks above which lies the flat floor of the basin itself. These banks have an average height of 6 or 8 feet. The bench merges with the floor of the basin at the upper end of the wash and with the bed of the wash at the lower end. The distance between the second set of banks is almost a mile near the upper end and narrows to about one-quarter mile near the lower end. The line of this set of banks is quite sinuous on the north side of the wash, forming bays and promontories in the general surface above these banks. In a general way, however, this second or outer set of banks forms a wide continuous channel extending in a westerly direction about 6 miles up the basin from its mouth.

The bench between the outer banks and those of the present wash forms the floor of the wide outer channel. This floor is flat and even, and devoid of any other channel than the narrow one which carries the present wash. It is cut on flat-lying lacustrine Pinto beds and is generally bare except for a very thin veneer of recent alluvium in some places. The general surface of the basin floor above the outer set of banks holds to the same level along most of the length of the outer channel, with not more than 2 or 3 feet drop from the upper to the lower end. This level is about 12 feet above the level of the top of the original surface of the Later gravels near the mouth of the basin.

The whole appearance of the outer channel suggests that it was formerly occupied by a shallow body of water, lake-like at its wide upper end, and narrowing to a shallow stream of very low gradient at its lower end. It seems highly improbable that the banks of the outer channel, with their general alignment paralleling that of the present wash, could be due to erosion by water draining into the narrow bed of the present wash from the sides. It also seems improbable that the present stream, flowing only after heavy rainstorms and confined to its narrow bed, could have cut the outer channel. The low gradient of the outer channel would have prevented it from being cut to any considerable depth. On the other hand, the water draining into it from the surrounding alluvial fans would have dropped most of its load of detritus before reaching the channel. As a result, although the upper part of the lake may have been rather marshy, but little sediment has been deposited in the channel.

Other evidence supports the conclusion that the outer channel was formerly occupied by a body of water. Where the south outer bank skirts the north base of the anticlinal ridge there are lying at the foot of the bank small compact mounds of boulders derived from the lava and gravels of the Pinto formation exposed in the ridge. The only apparent explanation for these accumulations is that they were dumped into a body of water by small gullies draining from the ridge. A gully draining into a quiet or slowly moving body of water would drop its load suddenly right at its mouth, whereas one dropping its load simply because of emptying onto a surface of lower gradient would scatter its detritus about over a larger area.

Archeological evidence also points to the former presence of a fairly persistent body of water in the outer channel. The old camp-sites are almost all found along the course of the outer channel, on top of the banks. A certain water supply was necessary to render human inhabitation of the locality possible. The close association of the camp-sites with the channel points to the latter as the only logical place for that water supply. The channel was not necessarily filled from bank to bank throughout the year. During the dry season the former Pinto River may have shrunk to marshy ponds in the wider portions and a small brook in the narrower stream-like part. However, the absence of any camp-sites in place in the channel-bed suggests that it was not desirable as a camping locality. Probably only during the spring freshets did the channel carry water from bank to bank.

Although the body of water assumed to have occupied the outer channel was probably as much lake as river, it will be more convenient to refer to it as the Pinto River, to distinguish it from the extensive lake in which the Pinto formation was deposited.

A considerable increase in the amount of moisture now being supplied to the Pinto Basin would be necessary to create a persistent body of surface water. However, there are numerous instances in other parts of the arid Southwest where the evidence points to a former water supply much greater than at present. The Pinto Basin drains an area of roughly 400 square miles and any increase in precipitation over this larger area would be concentrated by drainage into the comparatively small area discussed in this report.

It may be that the former Pinto River was itself a later phase or remnant of the body of water which existed at the time the Pinto formation was deposited, just as the dry Pinto Wash of today is the last remnant of the former Pinto River. In this case the decrease in precipitation has been in progress at least since Pleistocene time. Pleistocene glaciation is generally considered to have been a major cause of the wetter climates prevalent during that time. It may well be that the wetter climate postulated for the region of the Pinto Basin is closely related to the last glacial stage, and the ensuing desiccation followed the passing of that stage. Another factor which may have contributed to the decrease in humidity is the uplift of mountain ranges between the desert and the coast, cutting off the moisture-laden ocean winds.

From the relative elevations of the outer channel-bed and the surface of the Later gravels near the mouth of the basin, it seems that the stream in that vicinity may once have flowed at or near the level of the surface of the Later gravels. However, becoming constricted at this point and perhaps reënforced by drainage from the Coxcombs, the stream was able to cut its channel downward. This down-cutting into the Later gravels probably initiated the cutting which has dissected the whole surface of the Later gravels.

QUATERNARY HISTORY IN SUMMARY

During Pleistocene time the Pinto Basin was part of an extensive shallow lake, bordered by low mountain ranges. The eastern shore lay along the ancestral Coxcomb Range. The then low-lying Eagle Mountains formed part of the western shore. Other limits of the lake have not been determined, but it probably extended southward into Chuckawalla Valley and northeastward to the Pinto Mountains. During the existence of the lake, basalt lavas were extruded onto the surface of the lake sediments. The source for the lava was not located, but since the lava is thickest near the east end of the anticlinal ridge, the vent may have been in that vicinity. Immediately following the extrusion of the lava, the Coxcomb Mountains were uplifted and the coarse fanglomerate phase of the Pinto formation was laid at their base.

The Pinto beds were then uplifted and folded into an east-west anticline, with the development also of a gentle north-south syncline crossing the anticline where the mouth of the basin is now situated. At the same time the Eagle Mountains were uplifted along an east-west fault. This fault and the folding of the Pinto beds are closely related and were probably brought about by the same tectonic forces.

During this uplift the drainage of the Pinto Basin through the gap just east of the anticlinal ridge was established. There is no evidence to indicate that the uplifted block impounded water to any great depth in the basin for any length of time. The location of the gap was probably determined by the north-south syncline which crosses the east-west anticline at this point.

Toward the close of the period of uplift there was a pause and the Intermediate gravels were deposited on the eroded Pinto beds of the anticlinal ridge. Following this there was a further uplift, raising and tilting the Intermediate gravels as well as the Pinto beds.

Following the close of the period of uplift the Later gravels were deposited. A stream, possibly the remnant of a larger body of water, flowed through the outer channel of the Pinto Wash. During the existence of the stream a primitive people camped along its course. About this time also, the dissection of the Later gravels began.

Decrease in the amount of precipitation supplied to the whole area was probably the chief factor leading to the disappearance of the stream and the substitution in its place of the present dry Pinto Wash. With the disappearance of the water supply, the region was no longer habitable by primitive man.

It is impossible to date the human occupation in any definite terms, but some idea of its age may be had from the change in climate, supposedly related to the last glacial stage, which has occurred since the occupation. It is estimated that some 15,000 or 20,000 years have elapsed since the Wisconsin, or last glacial stage. The age of the human occupation would therefore fall a certain amount, difficult to determine, below that given for the Wisconsin glaciation.

Map has been removed from the electronic edition in an effort to protect sensitive cultural resources.

MAP OF CAMPING AREA SHOWING LOCATION OF SITE

BY WILLIAM H. CAMPBELL AND WALTER KETCHAM

THE PINTO BASIN SITE

BY ELIZABETH W. CROZER CAMPBELL AND WILLIAM H. CAMPBELL

PINTO Basin is situated in the northeastern part of Riverside County, California. Bounded on the north and east by the Pinto and Coxcomb Mountains, on the south by the Cottonwoods and Eagles, and hemmed in on the west by the Piñon Range, its great barren expanse greets the approach as an unreal valley of lavender tints (pl. 1A, B). Its eastern end is the most spectacular part, for there the Eagle Range of black diorite and lava forms a forbidding contrast to the Coxcombs on the north with their jagged spires of pink granite. This isolated basin reflects a quiet beauty at all times, but when sunsets turn the Coxcomb Mountains to deep rose and fill its bays and cañons with purple shadows, the Pinto Basin becomes a thing of loveliness few desert valleys can equal.

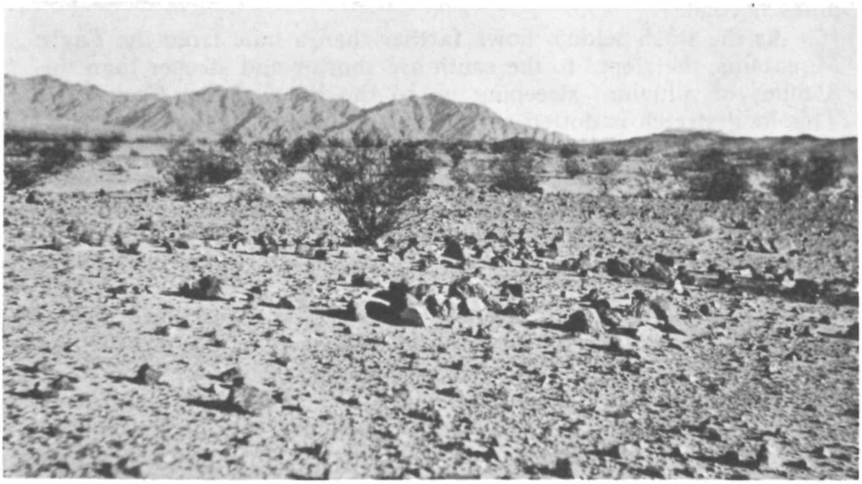
The western part of this basin is cut with numerous cross washes coming at all angles from the alluvial fans without any main wash being apparent, but all this accumulation, as well as the drainage from the eastern slopes, finally merges and forms one main wash that drains the basin into the valley below. This main wash, conspicuous with its palo verde and willow trees, flows close to the northern base of the Eagle Mountains, passes through a semi-gorge between the eastern end of the Eagles and Coxcombs, then flows southeast to terminate in Palen Dry Lake or Playa some miles beyond.

As the wash seldom flows farther than a mile from the Eagle Mountains, the slopes to the south are shorter and steeper than the 8 miles of alluvium sweeping up to the base of the Coxcombs. This long stretch is dotted with creosote bush throughout its sand-colored extent, while the gradient to the south, though sandy in patches, is composed mainly of black rock benches (pl. 4) appearing to have been rolled out flat by some mighty hand. To the east these benches are lost altogether in the lava flow that crowds to the very edge of the wash and forms the eastern end of the Eagle Mountains.

The whole district is barren in the extreme, very little growing on the alluvial slopes besides stunted creosote bushes and clumps of galleta grass with a few smoke trees eking out an existence in the broader washes. Up in the bays of the Coxcomb Mountains the growth is greener, cacti and yuccas dotting the hills, and catclaw, desert willow, smoke trees and lavender bushes appearing in profusion in cañon washes; but from the base of the mountains down to the main wash all of the desert growth is low and brown, a decided contrast to the large trees that make the main wash a conspicuous green ribbon through the surrounding aridity (pl. 2, *a*).

Because of the lack of inhabitants in the Pinto Basin it is doubtful if any accurate rainfall records are obtainable. During

a, Rocky bench of south shore, looking toward Eagle mountains



b, South shore camp, grouped stones suggesting fire hearths

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the last three years however, men working for the Metropolitan Water District have camped nearby and a partial record has been kept. Information regarding running water in the wash was obtained by the kindness of Mr. John Powell and Mr. Ray Clifford, whose diaries show that during the past three years this wash has been a wet one but three times. Heavy thunder showers in the higher mountains have preceded the flow each time, causing a river varying in depth from a few inches to a foot which flowed once for forty-eight hours, once for sixteen, and once for eight or nine hours' time. It was during the summer of 1934 that the river flowed for forty-eight hours. We had visited the place several times before and were familiar with all its topography, but it was so changed after this storm that we had difficulty in recognizing our trail as we approached the place at dusk. During these two days and nights the river cut away its banks for yards to a depth of four or five feet, uprooted trees, made new channels, and left its soft sandy bed covered with a smooth deposit of clay up and down which our cars traveled as on a boulevard. Judging from the transformation, this storm might well have caused as great a flow as any to be expected in years.

For the last ten years the authors have lived in the adjoining drainage basin of Twenty Nine Palms where the average rainfall seldom exceeds three or four inches. Twice during that period of time there have been long droughts, once when there was no precipitation for eighteen months and another period when only a trace of rain fell in two and a half years. This drainage basin is slightly higher than the floor of Pinto Basin, but weather conditions do not vary a great deal in the two drainages.

ARCHEOLOGICAL DISCOVERY—From the eastern end of the Eagle Mountains to a point 6 miles west, the green clay banks of the wash make conspicuous shore lines on the landscape (pl. 2, *b*). According to Mr. Scharf this clay was not laid down during the time with which this paper deals, but at a former age when an ancient lake of enormous size covered this valley and other parts of the district as well.

We had done some archeological work in the Coxcomb Mountains and had driven to within a mile or two of the main wash, but credit must be given to Mr. Jack Meek, desert prospector, and Mr. Samuel Bailey of Pasadena, who in prospecting a mile or two farther than we had explored, reported the finding of fossil bones and worked flints. A brief reconnaissance of the district revealed old camp-sites strewn with stone artifacts and fossil bones. These lie on the shores atop both banks from a point opposite the lava flow to the termination of the banks more than 5 miles west.

Hope of finding association between the fossil bones and human artifacts led to the formation of the combined expedition of California Institute of Technology and the Desert Branch of the Southwest Museum. Dr. Chester Stock of the Institute very graciously assigned Mr. E. L. Furlong and Mr. H. Donald Curry to aid us, and permitted Mr. David Scharf and Mr. Lawrence Bolles to study the paleontology of the site, as well as laying aside other plans to give Mr. Scharf the time to survey and write on the geology of the region. Mr. Edgar B. Howard of the University of Pennsylvania visited the site and gave us valuable suggestions, saying that it reminded him of the place near Clovis, New Mexico, where he found artifacts and fossil animal remains in unquestioned association.

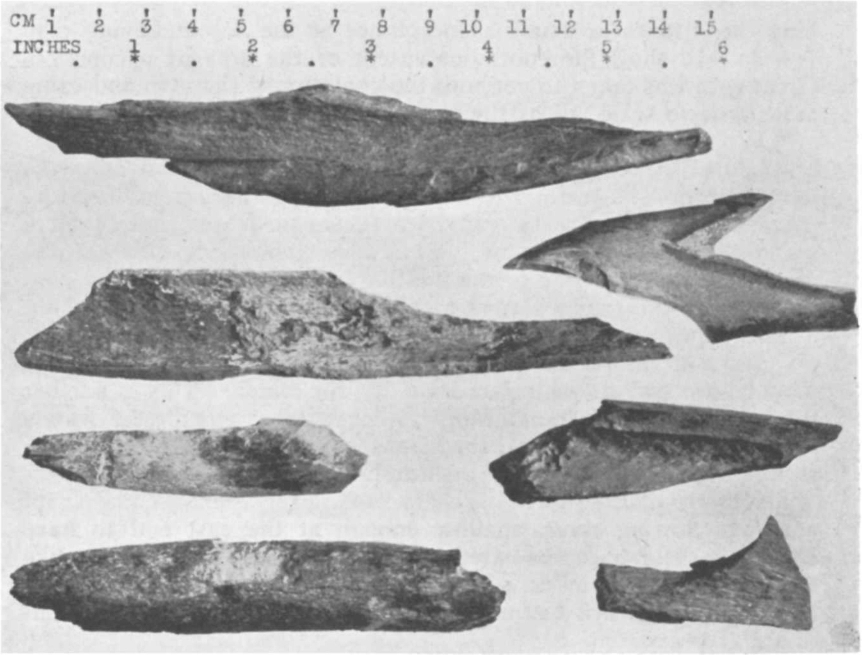
As a result of this work we are agreed that thus far no association of human artifacts and fossil bones can be proved, as the fossil bones, mostly camel and horse, appear to be weathering from a level somewhat lower than the camp-sites. We are not convinced, however, that all of these bones necessarily antedate the human occupation, this for several reasons.

Plate 5, *a*, shows several bones of Pleistocene camel and horse which indicate irregular splitting characteristic of fresh cleavage rather than the breakage of long weathering. On this point we have two opinions of the highest authority, those of Mr. M. R. Harrington of Southwest Museum and Dr. Barnum Brown of the American Museum of Natural History. Only carnivorous animals or men could have done such splitting, and animals do not habitually crunch the bones of their victims. Two of the bones illustrated show definitely the scar of a heavy blow or of the tooth of some powerful animal. Most of the split bones are marrow bones, a fact worthy of note, although it is true that the longer bones are most subject to natural splitting because of their length and hollow structure, and these are the ones most prized for the marrow.

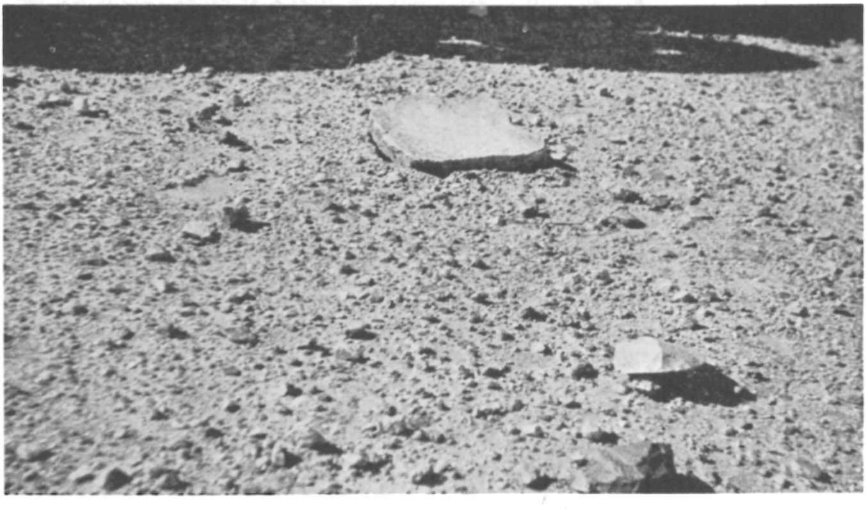
Another circumstance we find it hard to explain is that the bone fragments lie in many instances on camp-sites and were not in any instance found farther back than the area of occupation, although we ran several small trenches back under the drift sand enclosing sites where bones had lain. These of course were not exhaustive tests in view of the large area involved. The only bones found in articulation were those of the foreleg of a camel, one of the least tempting morsels we can imagine, and they lay just below one of the largest camps, near the surface of the lake clays and the south bank of the later river which flowed over those clays.

It is well within the bounds of possibility that some of these fossil bones were thrown into the river by men, sinking into the old lake sediments which the river kept moist and muddy by its flow.

A later camping trip was made for the sole purpose of map-



a, Fossil bones of Pleistocene camel and horse, species not determined
Both Dr. Barnum Brown and Mr. M. R. Harrington thought these bones were split while green, possibly for their marrow, by men. The two at the lower left are deeply scored as by a blow



b, Metate and chopper as found on a camp-site ping the district in detail. One glance at the accompanying map (pl. 3) will show the enormous extent of the area of occupation. Great care was taken to get both the contours of the map and camp areas true to scale, all of the outlines being measured with a tape.

While the banks extend only a trifle more than 5 miles air-line before losing themselves in the washes cutting down from the mountains to the north, we find by following the general bend of the river that the area covered by camps measures more than 6 miles in length, while a few scattered flint chips and camp stones are found even farther to the west.

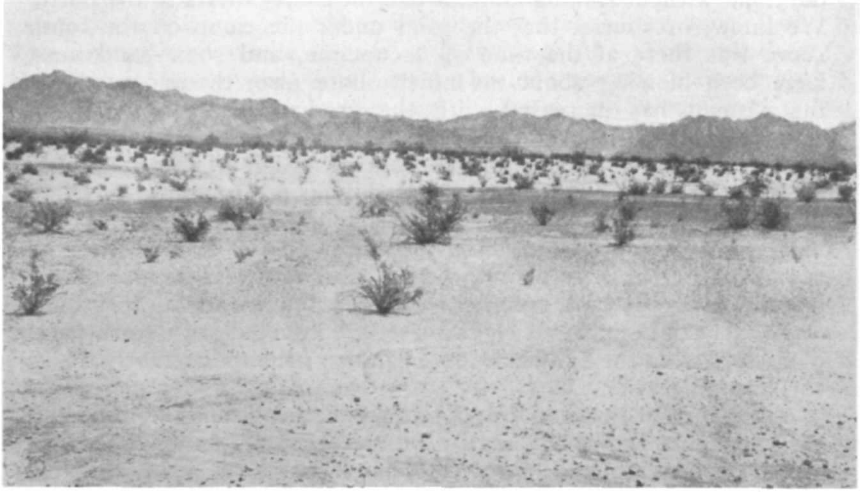
Clearly the camps spread too far to have been clustered about a spring or water-hole, for even though a spring had once been obligingly at the center of the site, those people living at the ends would have had to walk 3 miles daily for water. This is farther than we have ever found camp evidence from any desert water-hole. The uniform level of the camps is further evidence that their situation was determined by a shore-line.

Here, according to Mr. Scharf, was never a sink or playa, but a slowly flowing river, shallow enough at the east end to have somewhat held back the stream into a broad flow or lagoon-like stretch for several miles. This would imply a climate very different from that which has made this region an arid desert for hundreds of years.

Because of its isolation and the great distance from any watering place, as well as the difficulties of crossing such rough and sandy country, this district has escaped the ravages of pot-hunters. Thus a virgin site of great importance has been spared us down the centuries, one of those things for which the good archeologist searches long and hopefully.

Mr. Scharf's argument that the flow of the river was very gradual is borne out by a study of the camps through the transit telescope which shows the top of the banks to be on one level for miles. On the north shore at the eastern end the camps fall 3 to 6 feet below this main level, while one or two camps 5 miles west are 6 feet above. We presume all camps were originally upon the banks, as the only artifacts found at their base appear to be tumbling down with the general erosion of years, and no groups of campfire stones have been found below.

On the north shore all camps rest on green lake clay, most of these being grouped about slight depressions or bays resembling miniature dry lakes (pl. 6, *a*), although a few camps are found scattered about on flat surfaces crowning the bluffs which bound the present narrow channel. Between these camps occurs sand overgrown with galleta grass hummocks. Only one camp has been found on sand and that is on the south shore at the two-mile line. This sand is harder and more compact, firm enough to support



a, An inlet of the old shore line, with drift sand surrounding the clay-surfaced camp-site

b, Sand-covered banks of the ancient river bed

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the tread without sinking and not like the floury drifts to the north. We know, of course, that the sand under the camp on the south shore was there at the time of occupation, and some sand must have been blowing about the north shore also, though no doubt the amount has increased with the gradual desiccation of the country. Camps may exist beneath this sand, but on such an extensive site it is not practicable to trench through all these stretches to see what lies below. With the exception of the two-mile camp on the south shore, nothing has been found on sand, not even a flint chip. If we exclude this one camp on the south shore, all camps are on benches cut into the old lake clays. Here also camps rest either on the bare green clay or on a few inches of rocky soil overlying it. Perhaps all clay areas were covered with some form of grass during the age of the river and so made particularly desirable camping sites.

A glance at the map (pl. 3) shows the heaviest camping about the wide part of the river. If the stream was shallower in this broad stretch, perhaps there were marshes; if so, some form of cattails or tules and larvae, as well as fowl, would have been more abundant here. This would have produced a better food supply than the lower end with its uncompromising lava flow.

Such ancient camps are necessarily hard to find, frequently being detected only by larger stones brought together (pl. 4, *b*). Time has so flattened and weathered the outlines of these that only the presence of flint chips, scrapers, points, or metates prove that these were fireplaces. All stains of fire-blackening and all charcoal seem to have leached away. If one could ascertain how long it takes charcoal to disappear entirely from contact with the elements, we might have a clue to a possible age limit for our camps. We soon learned to look for the stone heaps just described, as artifacts were always more numerous surrounding them. In many cases metates and manos were buried, but it was impossible to tell if this had been done by the owners or by the deposits of years.

Surprisingly few objects are present, dart-points, drills, knives, manos, pestles, metates, hammerstones, and several kinds of scrapers being all. These same artifacts were found on both shores from one end of the occupation to the other, without variation in their forms. It is the most uniform culture we have ever found in the desert.

A study of the map shows that camp areas are staggered along the shores of the river, heavy camps being opposite blank or light occupational spaces, though the sand in between may cover camps that are hidden at present. It is possible that more camps used to be in the extreme western part, having been eradicated by the erosion of cross washes caused by the drying up of the country and the resulting loss of vegetation.

With a few exceptions very much the same amount of material was obtained from all camps. More metates and manos, both fragmentary and whole, were found west of the three-mile line and a great many more snub-nosed (keeled) scrapers came from the south shore than from the north. Dart-points were found on both shores along the entire line of occupation, and their forms did not vary, both leaf-shaped and stemmed, large and small, being found everywhere; but on the camp area on the north shore immediately west of the turn of the trail to Twenty Nine Palms, more whole dart-points were found in one small space than in any other given area. Here on a camp only a hundred yards across we found in an hour's time forty-eight perfect points and a few fragmentary ones. Fewer thin scrapers of the retouched flake type were encountered on the south shore than on the north, and the longest points of the stemmed type were found on the north shore between the one-mile and three-mile lines. Most of the knife blades came from the north shore in the center of occupation, and nearly all of the leaf-shaped points were found at varying distances along the north shore, only a few being found anywhere on the south-shore camps.

Flint chips were on all camping areas, but two camps on the north shore just west of the two-mile and the four-mile lines possessed flakes much larger in size than were encountered at any other camps. No flakes as large as these were discovered elsewhere, but it must be remembered that this was the only instance where at least some things of the same kind were not found everywhere. A few small hammerstones came from here and there along the line of occupation, but many camps contained none whatever, and as a whole we felt they were conspicuous by their absence, as they usually abound at most desert camps. The proportion of broken artifacts was very small for such a large area as this. Usually we find more broken objects than entire ones, but here, despite the great age of the place, more artifacts were recovered nearly whole than otherwise, which gives rise to the thought that perhaps these people did not have the Yuman custom of "killing" or breaking a person's possessions at his death.

Only stone objects remain, and some of these made of softer stone, such as coarse-grained granites, are in the last stages of decomposition. Many small objects are made of banded cherts, obsidian, rhyolite, red and brown jasper, milky quartz, rock crystal, and highly silicified slate, most of which Mr. Scharf did not encounter in the valley or the surrounding mountains, so the aborigines must have brought them in, probably in some cases from a great distance.

We searched in vain for anything corresponding to rings of stones that might mark the places where houses or rude brush shelters might have been, but did not find anything that could have been construed as such. Nothing remains to mark the dwellings of a remarkably large ancient population but a few scattered implements grouped around small heaps of weathering stones, and these lie bleak and bare along the banks of a wide dry wash, desolate under a desert sun.

CONCLUSIONS—That the Pinto Basin Site is one of great antiquity is established by both the archeologic and geologic evidence.

With the exception of a few casual sherds and one smashed pot, which are of the prevailing type of desert red ware and certainly could have been left by a late Indian, all camps are pre-pottery and pre-arrowpoint. The projectile points are too thick and too large to be classed as arrowpoints, so they must fall into the dart-thrower or atlatl group.

No artifacts have been preserved save those made of durable stone such as chert or fine-grained granite. Many metates and manos made from coarse granite have almost entirely decomposed; in some instances their fragments adhering to one another prove what they are, in others the loose outline of granite suggests without proving their identity. Some of the smaller objects made of chert, slate, etc., are so sand-blasted that the secondary chipping is not noticeable unless held in the sunlight. This sand blasting would indicate a considerable passage of time.

How many years are involved in the eradication of all traces of charcoal and fire-blackening about hearth-stones is problematical, but it is not beyond the bounds of good reasoning to suppose that this might have taken hundreds of years. Surveyors bury important boundary stakes in charcoal because of its resistance to decay.

The artifacts differ considerably from those usually found in the Southwest. They must either be assigned to an older period or assumed to be a group quite unlike any of the usual cultures dated over the last two thousand years.

Mr. Scharf's argument, set forth in the introduction to this paper, regarding the existence of a river here in geologic times is supported by the archeological evidence. First it must be remembered that the transit proves the camps along the bluffs to be on one level, which shows that the people certainly lived along the shores of some body of water, and secondly the finding of the same kinds of artifacts from one end of the site to the other proves that a large number of people all lived here at one period rather than a few people over many periods, in which case artifacts would very likely have changed in style. This eliminates the theory that a group of people might have followed a retreating lake for years, and the camps are too extensive to associate them with a spring.

No mountains surround this valley that are comparable in any way with the Sierra Nevada in which our desert river, the Mohave, finds its present source, so we must turn to the theory of a much moister climate than any existing in this region today. Nothing else could produce a flowing river in a district such as the Pinto Basin.

At the lower end of the occupation area the Metropolitan Water District has drilled a well on the bank of the main wash. Here the water level stands at 97 feet, which is a far cry from the level of our old river along whose shores so many people lived for miles.

A reconstructed picture of the place in the time when man lived here might include somewhat greener growth on the alluvial slopes, a few piñon pines and desert junipers on the heights of the Coxcomb Mountains, a sparkling river winding slowly through the lowest part of the Basin along whose bed might have appeared trees, bushes, and reeds similar to the growth along the Mohave River today. On the shores between the trees or above them grass probably grew, and on these smooth green patches for 6 miles up and down the stream could have been seen the brush shelters or other evidence of the camp settlements. Animals such as antelope and mountain sheep, and possibly others now extinct, must have been plentiful in this valley, and undoubtedly ducks and other fowl would have been encountered about the marshes.

The age of this verdant picture we must leave to the judgment of the geologists, but certainly such a change in climate must involve not years but centuries.

THE PINTO BASIN ARTIFACTS

By CHARLES AVERY AMSDEN

EVERYTHING recovered from the site was found on the surface; under such circumstances only stone and pottery would long endure, and this culture knew no pottery. All the artifacts are of stone, divisible into two groups, smoothed and flaked. In the following descriptions the exact number of specimens of a given type will not always be specified; this because types tend to merge together, further complicated by the presence of many broken and rejected implements. An exact count would require much arbitrary, hence probably erroneous, decision.

Smoothed Stone Implements

Metates.—The metates fall into two groups, by size and to some extent by form. The first group, comprising three specimens, is represented by a heavy flat slab with a very shallow, almost flat grinding area of longish-oval form. Two show pecking over the whole surface, the other none; this was done both to fashion the stone and to roughen the grinding area. Similar in all respects to metates of the historic period (and very possibly dating from late aboriginal times), their like is well illustrated (pl. 44) in Mrs. Campbell's earlier report as listed under works cited herein.

The second group comprises 21 specimens, of which 10 have grinding surfaces nearly intact, the others being fragments. Curiously small and flat (see pl. 7, *a*, for largest, 7, *c*, for smallest), they suggest portability and the grinding of small or soft seeds, certainly not the tough mesquite beans for which metates were used by the later desert peoples. Grinding areas hardly visible in some, worn to depth of an inch (2½ cm.) in others of softer material; generally broadly oval, suggesting a circular grinding movement. Few show pecking, but most are too heavily weathered to have retained this feature.

Sizes range from 6 to 15 in. (15 to 38 cm.) long, 5 to 12 in. (13 to 30 cm.) wide, 1 to 4 in. (2½ to 10 cm.) thick, most of them not exceeding the first figure by very much.[1]

Materials, granitic rocks and schists: granite, andesite, pegmatite, gneiss; mica, quartz-mica, and quartzite schist; vitrophyre. These apparently were chosen primarily for their slab form with little regard to suitability of material.

Manos (hand-stones) number 23, 15 of them whole or nearly so. A few are fully fashioned in oval-rectangular form (pl. 7, *e*) with double grinding face. The majority show only partial shaping or none, being stream-worn stones chosen for size and shape, any flat face being used for grinding. The better specimens show pecking on the grinding faces.

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[1] It will be observed that the measurements in centimeters are approximate.

Sizes vary widely, lengths ranging from 3 to 6 in. (8 to 15 cm.), widths from 2 to 4 in. (5 to 10 cm.), thickness from 1½ to 3½ in. (4 to 9 cm.).

Materials, granitic rock of varying fineness, coarse-grained preferred for its roughness: granite, granite gneiss, grano-diorite, muscovite granite; andesite; quartzite. None is of lava, a favorite material in this class of implement because of its roughness. Yet a lava flow occurs nearby, as Mr. Scharf notes.

Distribution—Large oval metates and oval-rectangular manos are types widespread in the desert Southwest, seemingly an invariable accompaniment of the non-agricultural horizons. The small portable metate is a rarity, and it may have a critical value comparable to that of chipped implements. At a guess, I should consider the large metate and the fashioned mano later comers to our scene (for a few potsherds and a small pottery-horizon camp in the present bed of the wash indicate a fugitive later occupation), with the small portable metate and the extemporized mano representative of the culture associated with extinct Pinto river.

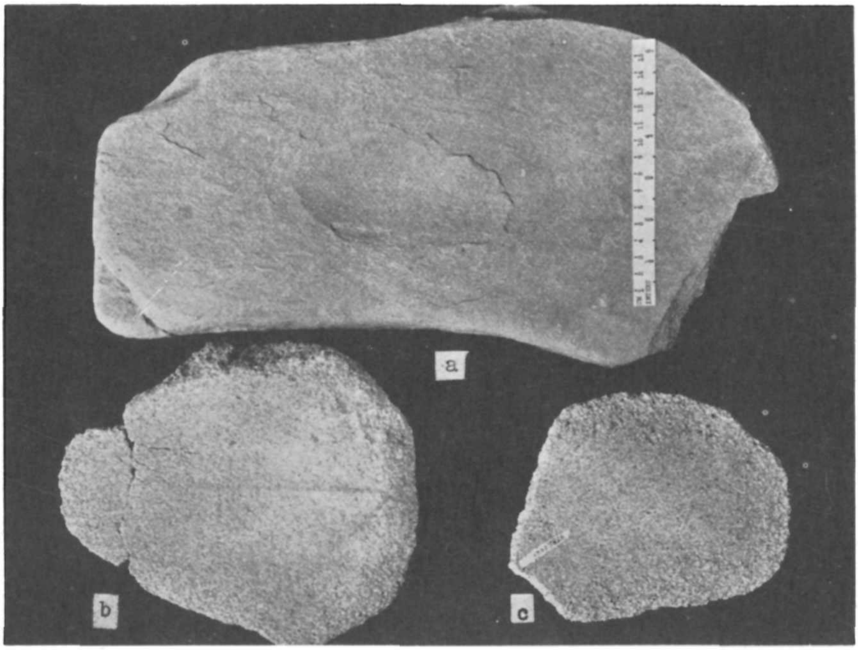
PESTLES—One whole pestle (pl. 7, *h*) and one fragment in every way identical were found. No mortars or mortar-holes, a necessary accompaniment, were found. These two specimens are of granite gneiss. Size is well shown in the illustration (pl. 7, *h*). They probably are later intruders, the type being a common one in this region (see Campbell, pl. 45).

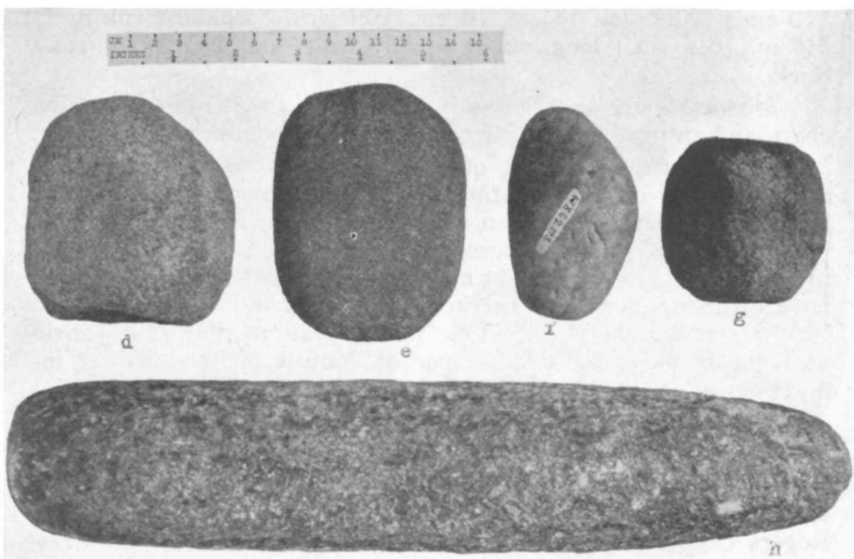
HAMMERSTONES—More than the manos, these lack special character. Some are manos in a secondary use, revealed by battered ends; some conveniently shaped chipping cores; others (pl. 7, *f*) natural water-worn stones. Nothing in the group suggests a specific type; any hard roundish stone, convenient to the fist, served the purpose.

FLAKED IMPLEMENTS

Flaked implements range in size and apparent function (function being in many cases an assumption, not a proved fact) from large choppers down to projectile points. The descriptions to follow have benefited greatly by the coöperation of an expert flint chipper, the only man who to my knowledge has succeeded in producing the Folsom type of dart-point—Mr. Joseph Barbieri. He has gone over the collection with me, group by group, pointing out technical details apparent only to one whose knowledge is derived from experience rather than observation.

CHOPPERS—Eight large and coarsely flaked implements (pl. 8) fall into no generally accepted category unless it be that of hand-





SMOOTHED STONE IMPLEMENTS

a, Metate of mica schist; *b*, *c*, Metates of granite; *d*, *e*, Manos of granite; *f*, Hammerstone of quartz; *g*, Hammerstone of granite; *h*, Pestle of granitic gneiss axes, and I prefer to call them choppers to avoid any connotation of the celt or the *coup-de-poing*. Uniformity of fashioning proves them a type, and their practical value in hard service is attested by battered edges. Obviously they were held in the fist and used in chopping, possibly dart-shafts, bones, joints of meat. A slight difference in structure divides the group into two parts. The simpler (pl. 8, *a, b*) are flat slabs of granitic rock broken into roughly circular form and worked around two or three edges by striking off large flakes from the flatter face. Plate 8, *a,* shows a lower surface, *b* an upper, of two typical specimens. The cutting edge is irregular and dull. Force rather than dexterity would make the implement effective. Only one specimen in the group is worked really carefully into a true cleaver blade, but only from one face, the lower.

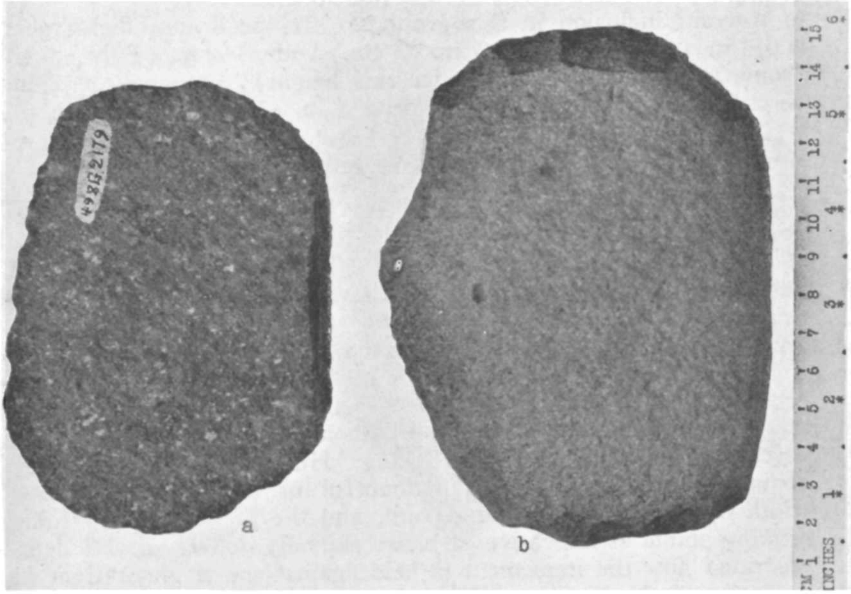
The second group (5 of the 8 specimens) is one of large percussion flakes, similarly worked from the struck-off or flatter surface. Plate 8 illustrates in *d* an upper or flaked face, in *e* a lower or working face, and in *c* a cutting edge with a Z-twist, common to this group, resulting from the strike-off blow. That the twist was not desired is proved by flaking from opposite sides as a corrective. It is important to note, however, that the flaked areas are always alternate, never opposite; the idea of double flaking, from each face, is not present.

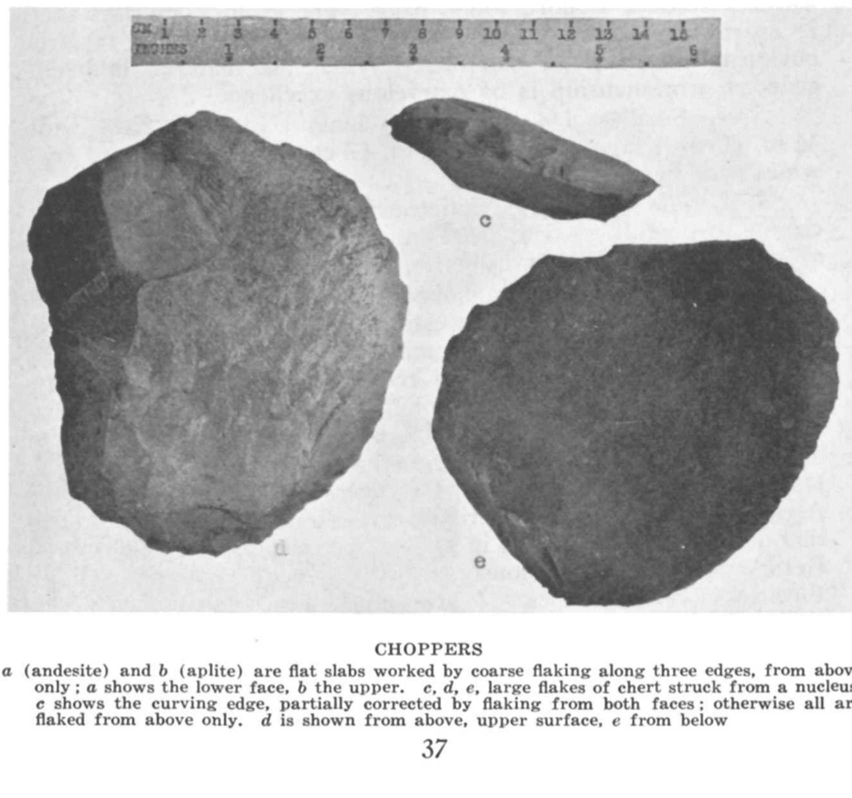
Size—The largest (pl. 8, *b*) is 5½ in. (14 cm.) long, 4 in. (10 cm.) wide, and 1½ in. (4 cm.) thick; the smallest (pl. 8, *c*) 2½ in. (6¼ cm.) long, about equally wide, and 1 in. (2½ cm.) thick.

Materials are andesite and aplite in the first group, quartzite, chert, and an iron-stained silica in the second, chert predominating.

Distribution—Nothing quite identical has been discovered in a hasty review of the literature of stone implements, although the large scrapers from near San Diego, California, figured in Rogers' (see works cited) plate 29, are very similar. This is not to say that the type is a great rarity. It may be widespread, but too crude to have aroused interest or merited illustration by writers obsessed by the esthetic aspects of stone flaking. A possible Old World analogue is the large side scraper of Mousterian and earlier industries.

KEELED SCRAPERS—Merging into the chopper group is one of smaller implements, very similar in material and workmanship. A tendency toward a high central keel (pl. 9) and a more extensive worked edge, with less of fist-hold, suggests that they are, as Rogers calls them, scraper-planes, useful in fleshing skins. His reference, above cited, is the only one entirely applicable to the group that I have noticed. Of sufficiently well-defined character





CHOPPERS

a (andesite) and *b* (aplite) are flat slabs worked by coarse flaking along three edges, from above only; *a* shows the lower face, *b* the upper. *c*, *d*, *e*, large flakes of chert struck from a nucleus. *c* shows the curving edge, partially corrected by flaking from both faces; otherwise all are flaked from above only. *d* is shown from above, upper surface, *e* from below to warrant inclusion in this group are 22 specimens; the largest is 6¼ in. (16 cm.) long, 2¾ in. (7 cm.) wide, 1¼ in. (3 cm.) high (some shorter ones run to twice this height); the smallest 2 in. (5 cm.) long, 1½ in. (4 cm.) wide, 1¼ in. (3 cm.) high.

Materials are mostly gray-green chert and gray-blue quartzite, stones suitable to coarse flaking but not to fine work.

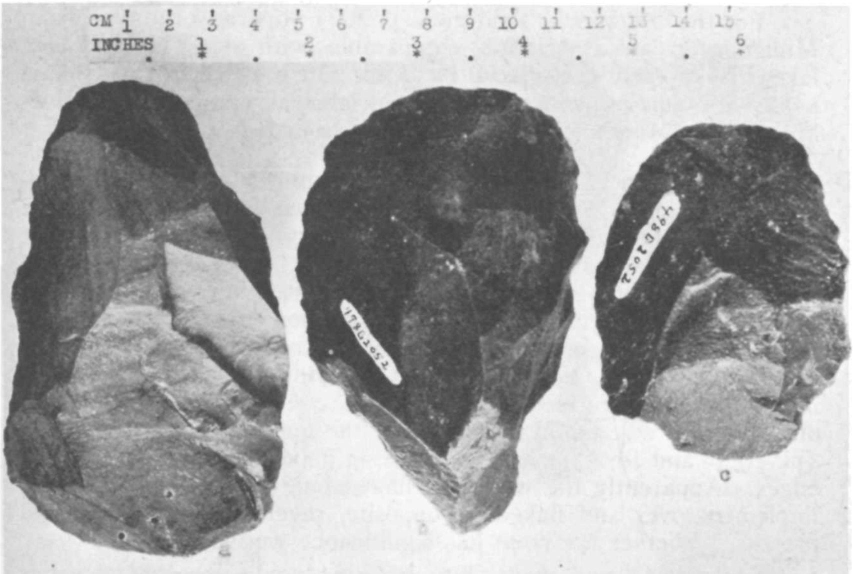
Fluted Keeled Scrapers—These are a specialization and refinement of the preceding group. Material and workmanship are alike finer, and size smaller. Plate 9, *d* to *g*, illustrate some of the better specimens as seen from above, sidewise, and bottom up. Long, slender flakes extend from edge to keel in the best examples, giving a fluted effect. The lower face with its bulb of percussion is never worked.

For all their fineness and length, Mr. Barbieri is convinced that these flakes were struck off with a blunt bone or antler, by percussion and not by pressure flaking. He pointed out the absence of fine retouch (except in a few doubtful instances), the depth and width of flake at the striking point, and the fine battering of the striking points as indicative of blows skilfully delivered. He demonstrated how the implement is held against the thigh or tight in the palm of the hand to achieve length and thinness. This pressure keeps the force of the striking blow from flowing rapidly outward to produce a short, round flake. The group comprises some 75 specimens, only a dozen of them nicely keeled. Poor material obviously was a great handicap. When the material is homogeneous, workmanship is of marvelous excellence.

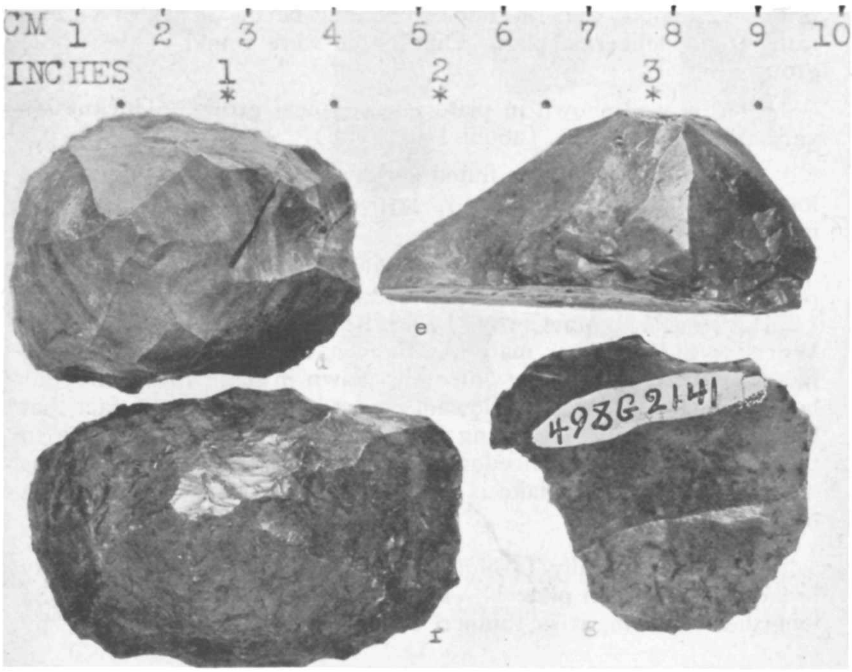
Size—Smallest 1¼ in. (3 cm.) long, 1 in. (2½ cm.) wide, ¾ in. (2 cm.) high. Largest 2¾ in. (7 cm.) long, 1½ in. (4 cm.) wide, same height.

Materials — The finer siliceous stones — chalcedony, jasper, chert—are mainly used in these implements, with a little obsidian of coarse texture, non-translucent.

Distribution—Rogers, above cited, found this type near San Diego; Ray (p. 110, pl. 18) in western Texas, and Mr. Frank Bryan has recently sent to us some comparable material from the same region. Kidder (fig. 19) figures keeled scrapers from Pecos, saying they are usually of banded dolomite from the vicinity of Amarillo, Texas. He remarks that this is essentially a Plains type of implement on the basis of its distribution as then known. Mr. M. R. Harrington tells me that keeled scrapers are known to both the Algonkian and Iroquoian horizons of eastern United States, and that he found them in Cuba in early historic cultures (see his Cuba Before Columbus). Obviously then this general type has persisted through many centuries. I suspect, however, that the flaking changed from bone percussion to pressure as time passed.



a-c, The large, coarsely flaked type, made of chert



c-g, The fluted type, shown from above in *d* and *f*, from the side in *e*, from the bottom in *g*. Materials, jasper and chalcedony

KEELED SCRAPERS

For the Old World, Andrews (p. 309) illustrates the type from Mongolia in an association comparable with ours, around dry lakes and in early post-glacial horizons. In western Europe this is one of the type implements of the Aurignacian culture stage (Burkitt, 140 ff; MacCurdy, I:163, fig. 80; Osborn, 309, fig. 150).

RETOUCHED FLAKES—This group, numbering some 60 recognizable specimens, is characterized by a lack of fashioning. The workman proceeded directly from a primary strike-off to a sharpening of the most suitable edges; in some specimens it is hard to say if the edge was retouched or nicked by use, but where retouching is obvious it is usually by bone percussion rather than by pressure flaking. The resultant implement had one or more serviceable cutting or scraping edges, but lacked definite form and size. It might be a thin, knife-like blade or a heavier scraping tool. Only one face was worked, most commonly the upper. Three specimens (pl. 10, *c*, and 14, *k, l*) have retouch on opposite faces of alternate edges. Apparently the workman flaked one edge, then turned the implement over and flaked its opposite, reversing the face in the process. Whether the point has significance we cannot say.

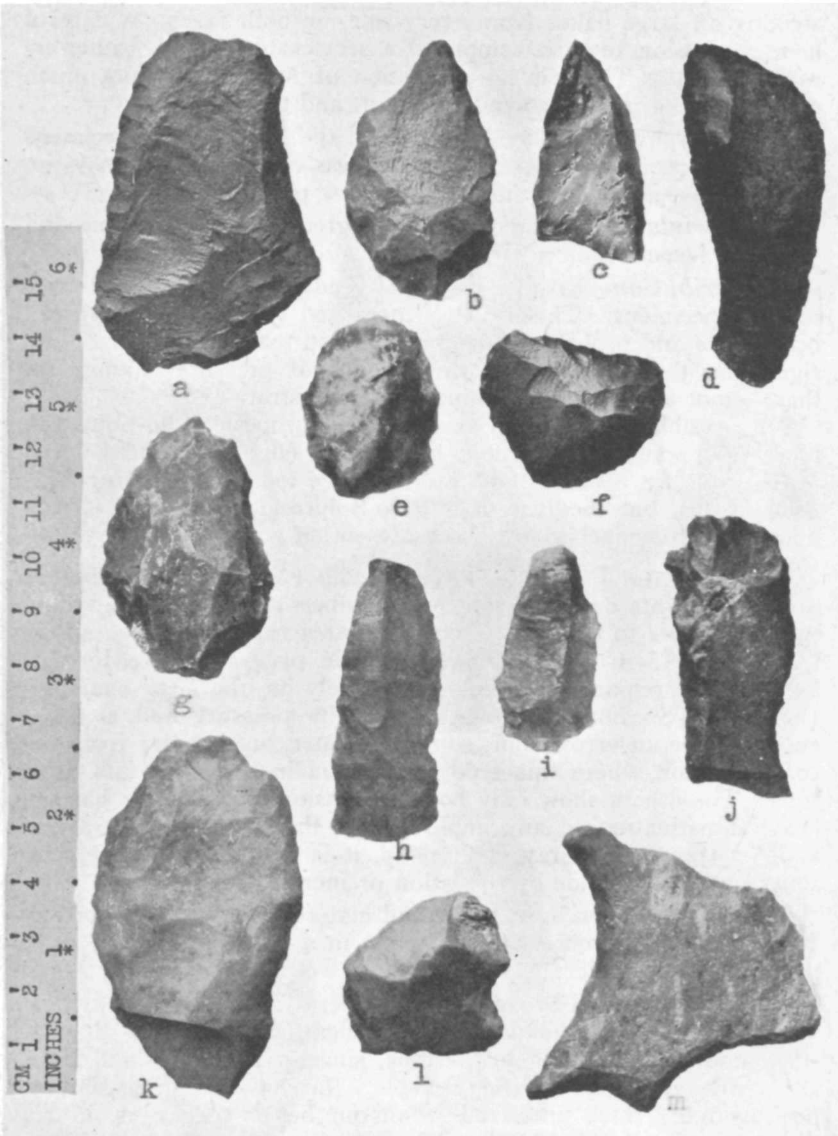
Specimens *l* and *m* in plate 10 are concave scrapers, "spokeshaves" in European terminology. Figure *m* has three such edges, all carefully trimmed. Such incurving edges sometimes result in primary chipping, and the implement may be the result of chance rather than deliberate plan. Only three were found in the whole group.

Size is well shown in plate 10, a typical group. Thicknesses vary from ¼ to ¾ in. (about 1 to 2 cm.).

Materials—As in the fluted keeled scrapers, stones suitable to long thin flaking — chalcedony, jasper, chert, obsidian — are the materials.

Distribution—Rogers, Ray, Kidder, and Andrews, all as cited, record similar types. The Audi blade of the Aurignacian culture (Burkitt, fig. 15; MacCurdy, I: fig. 82) seems to be a close Old World parallel. Better materials there have yielded a more blade-like flake, although the best of ours, shown in plate 10, are not far below the standard. Due allowance must be made for the fact that the flint of Europe, occurring in buried layers, is far superior to the impure nodular chalcedonies with which our desert dwellers worked. A long thin flake is the supreme test of material no less than of skill.

KNIVES—A fully fashioned knife — 27 specimens, mostly broken, as shown in plate 11—is one of the types represented. Of longish-oval form, it is thinned down from the original flake by



RETOUCHED FLAKES

These flakes illustrate the variety of forms and sizes found in this group. *l* and *m* have concave working edges that suggest the spokeshave of the Mousterian culture. Materials: lava (*a*), obsidian (*d*), chert (*b*, *m*), jasper (*j*), the rest chalcedony striking off large flakes from every side, on both faces. A careful bone-percussion retouch completed a serviceable though rather irregular blade. There is no suggestion of hafting, and not much differentiation of the two ends into butt and tip.

Size is shown in plate 11, wherein the four whole specimens of the collection are illustrated. Thickness varies from ¼ to ½ in. (½ to 1¼ cm.) in the center, the thickest part.

Materials are mainly banded gray-green chert, with some dull obsidian, jasper, chalcedony, quartzite.

Distribution—Rogers, Ray, and Andrews, as cited, illustrate similar specimens. This rather generalized type is of widespread occurrence and probably could be found in many horizons. More significant than the form is the absence of pressure flaking, but that cannot always be determined from illustrations.

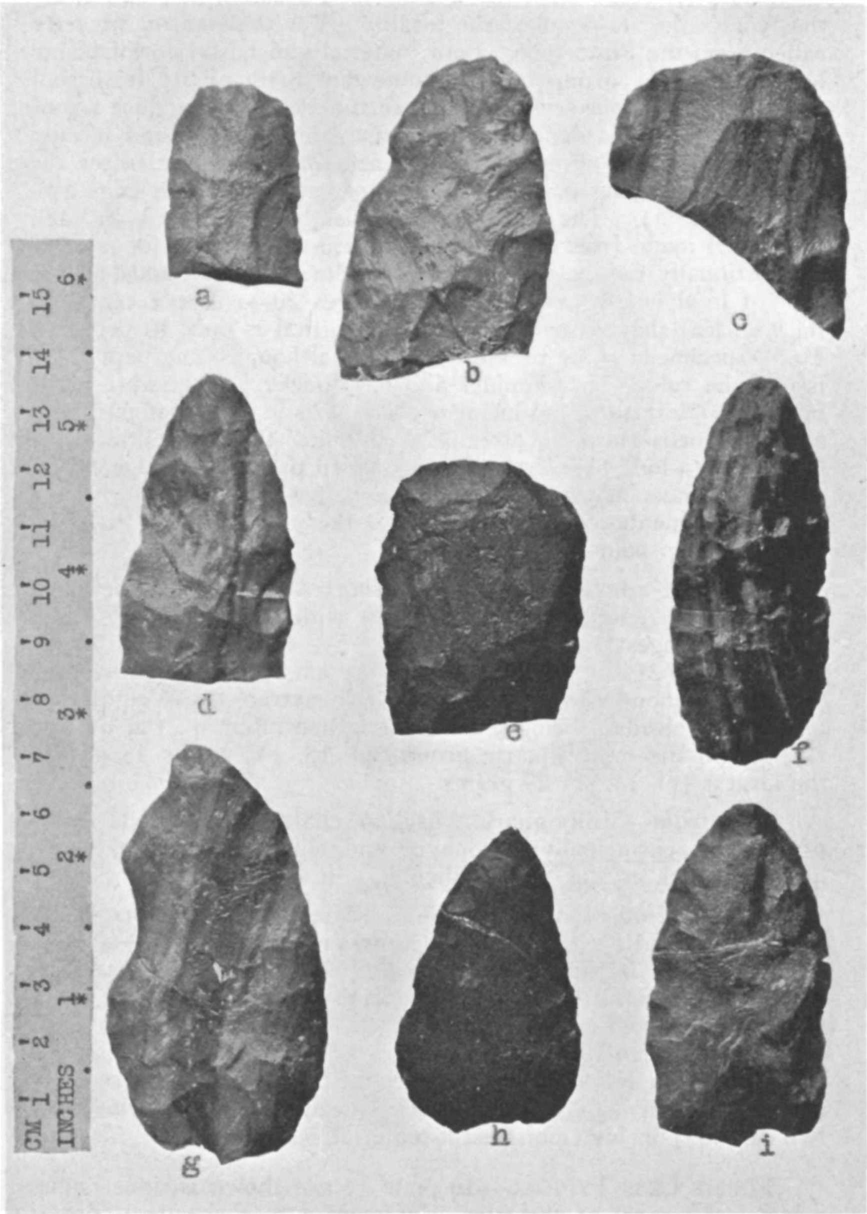
A possible valid parallel exists in the European proto-Solutrean laurel-leaf point as illustrated by Burkitt (fig. 7—6 and 8) and MacCurdy (fig. 89—5). One can easily go too far in making such comparisons, but the fact that proto-Solutrean follows so closely upon late Aurignacian justifies the mention.

PROJECTILE POINTS—LEAF-SHAPED POINTS—Two types of projectile points occur in sufficient numbers to warrant regarding them as native to the site. One is rather a rarity, all those surely identifiable, 13 in all, being illustrated in plate 12. The form is leaf-shaped, remarkably thin and shapely in the best examples (*e, i, n*). Specimen *i* shows retouch by pressure and is small enough to be an arrowpoint, so may be later, an intruder from the coastal region where this type is common in relatively late horizons. The others show only bone percussion work, and *e* has the heaviest patination of any implement in the whole group. Originally a translucent gray chalcedony, it is now a dull white, and roughened on one side by oxidation or incrustation.

Sizes are shown in plate 12, and materials listed in its caption. Thickness varies from ¼ in. (½ cm.) in *n* to ¾ in. (2 cm.) in *k*, which may be a reject.

Distribution—The form is too general to be of much critical value. Size and workmanship are the significant criteria. Rogers' small knives may belong to the type, since small knives and large dart-points are often indistinguishable. Ray has something similar, possibly more thick and crude than our better specimens, in his "Abilene points" (pl. 18, 84 to 87). Andrews (p. 309) illustrates points apparently comparable, from the Gobi. In Europe is the well-known Solutrean laurel leaf, of which this may be a form.

PINTO TYPE POINTS — These (pl. 13), of which 160 whole specimens and identifiable fragments were recovered, are decidedly



KNIVES

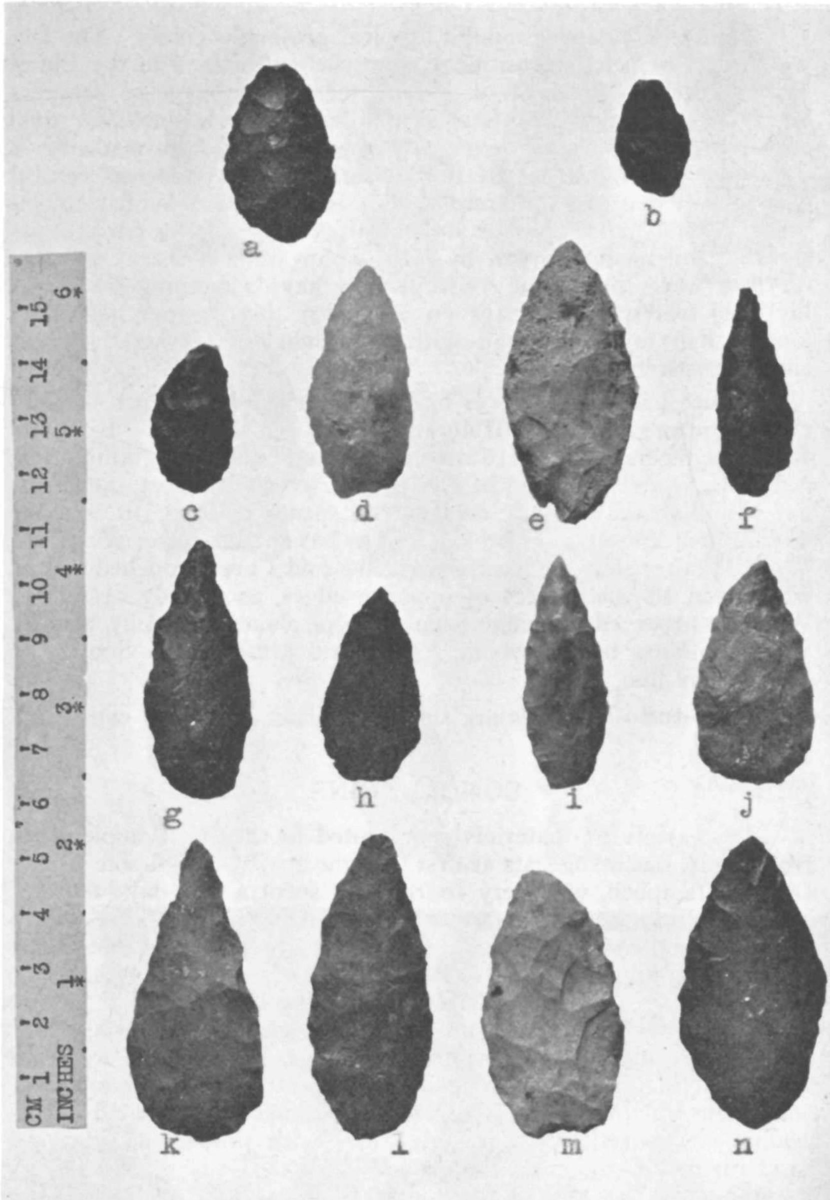
Only *f-i* are complete. Materials: quartzite (*i*), obsidian (*e*), slate (*h*), the rest of banded gray-green chert the type projectile point of the locality. For that reason we have called them the Pinto type. Poor material and hasty workmanship have caused the group to vary somewhat in detail of form, but through them all one sees the intent of the artisan to produce a projectile point with a definite although narrow shoulder and usually an incurving base. Frequently there are side nocks just below the shoulder, producing most often three serrations at each edge (pl. 13, *c, h, m, p*). The points are thickish, well rounded on each face, as if made from a thick flake by trimming down to its core. Proportionally expressed, maximum thickness often equals 30 per cent of total length and probably averages 20 to 25 per cent. In the best leaf-shaped specimens this proportion is only 10 per cent. Many specimens show pressure retouch, although bone percussion is still the rule. The shoulder and base nocks usually were made by a single deft blow, producing a characteristic curved effect. Several specimens show an attempt at thinning the fat central zone by striking a long flake from the base down the central ridge. Generally the flake has carried less than half-way to the tip. Some such experimentation probably led to the characteristic grooving of the Folsom point.

Size—Of whole specimens, the shortest (pl. 13, *f*) measures 1 in. (2½ cm.) long, ½ in. (1¼ cm.) wide, and ¼ in. (½ cm.) thick; the longest (pl. 13, *m*) 2¼ in. (5½ cm.) long, 1 in. maximum width (2½ cm.), and ½ in. (1¼ cm.) thick. An average would fall about midway between these extremes. Weights are misleading, obsidian being much lighter than milky quartz, but the smallest in the milky quartz group (pl. 13, *p*) weighs 13 grams, the largest (pl. 13, *m*) 29 grams.

Materials—Milky quartz, obsidian, chalcedony, various forms of rhyolite (principally vitrophyre and siliceous), jasper, chert, quartzite, rock crystal, slate (silicified), in about the order named.

Distribution—Rogers' San Diego sites apparently yielded no Pinto points. Ray found them, however; his plate 18—69 is a perfect Pinto. Bryan illustrates several from central Texas in his plates 1 and 2; Bartlett one from northeastern Arizona (fig. 14); Kidder three from eastern New Mexico (fig. 8, *j* to *l*). Mr. M. R. Harrington found the type on terraces of ancient Lake Bonneville in northeastern Nevada, and one specimen has been found recently near the Moapa Valley, southeastern Nevada. Andrews illustrates two (p. 309) in his Gobi Desert material.

FORMS LESS TYPICAL—In plate 14 are shown various implements less typical of the site. Examples *a* to *d* are drill forms; *a* and *b* alone show pressure retouch; *a* is an elongate keeled scraper in general form, worked on the upper face only.



LEAF-SHAPED POINTS

Showing all found, and the great variation in size. Some probably are incomplete rejects. Materials: rock crystal (*d*), jasper (*c*), quartzite (*k*), chert (*j, l*), chalcedony (*e, i, m*), the rest of obsidian

Figures *e, f,* and *g* exhibit atypical projectile points. The last we suspect of being transitional from the leaf-shaped to the Pinto, having recently found it on a lake terrace with keeled scrapers and retouched flakes like those herein described. It shows no pressure retouch; *f* does, however, a thin point excellently made. *e* is a base only, reminiscent of the Folsom type in its broad central groove and fine pressure retouch. *h* is a lozenge-like flat implement, possibly a scraper or finger-knife: 5/16 in. (1/2 cm.) at its thickest and nicely worked by pressure on both faces. Only two of these were found, but Andrews may have something similar in his Gobi material. He says (p. 77): "A tiny scraper not much longer than my thumb-nail with a rounded edge was the most characteristic tool."

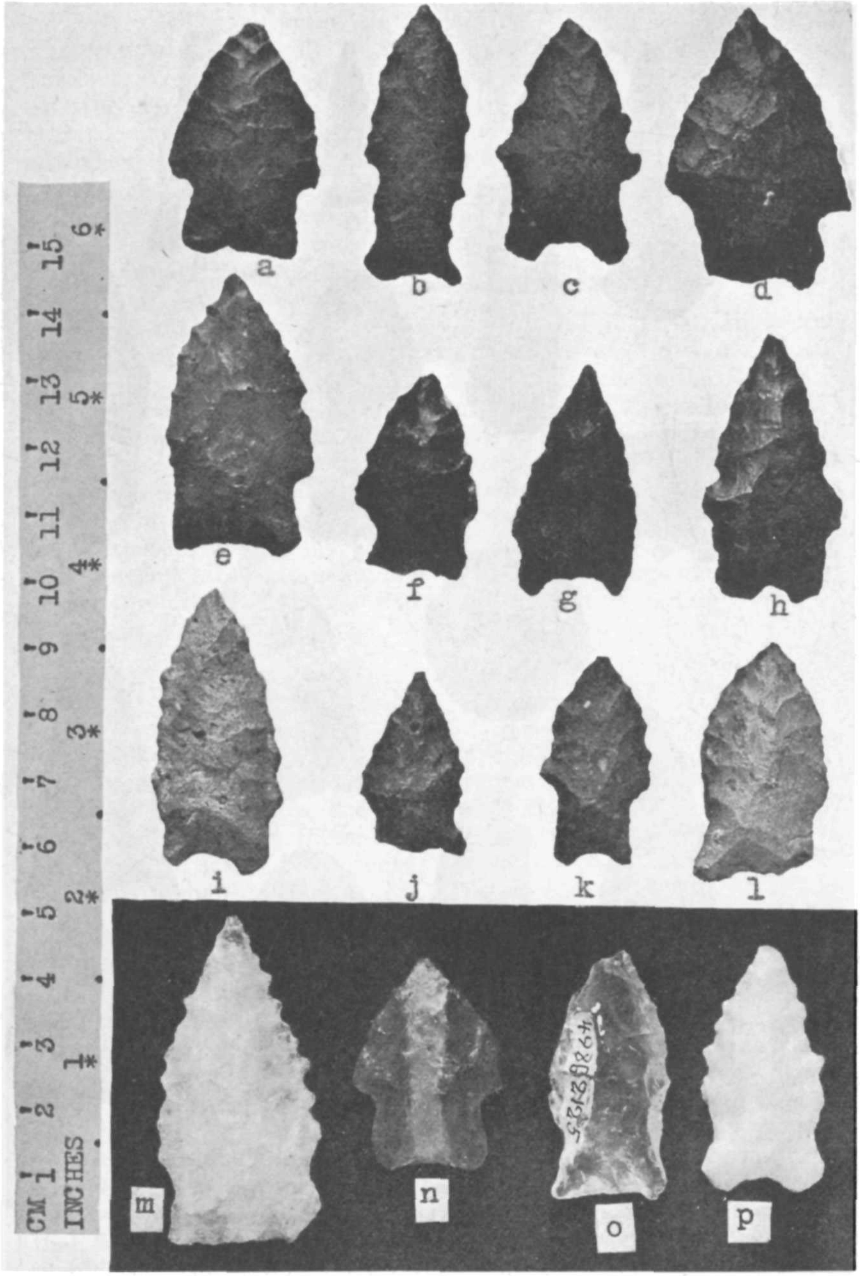
Figure *i* shows the lower half of a fine knife, 3/16 in. (1/2 cm.) at its thickest, and beautifully retouched by pressure. It is far above the technical standard of the group and almost certainly is an intruder. *j* and *m* would be called spear-heads by most collectors, but in the absence of any evidence of spears or lances it is safer to call them knives. *j* is broken, but *m* has the characteristic Pinto base. Neither shows pressure work. *k* and *l* are retouched flakes, worked on alternate faces of opposite edges, as already described. We have observed the same peculiarity on flakes found by Mr. H. W. Seton-Karr near Fayoom, Egypt, and presented to Southwest Museum by him.

Sizes and materials are shown in plate 14 and its caption.

CONCLUSIONS

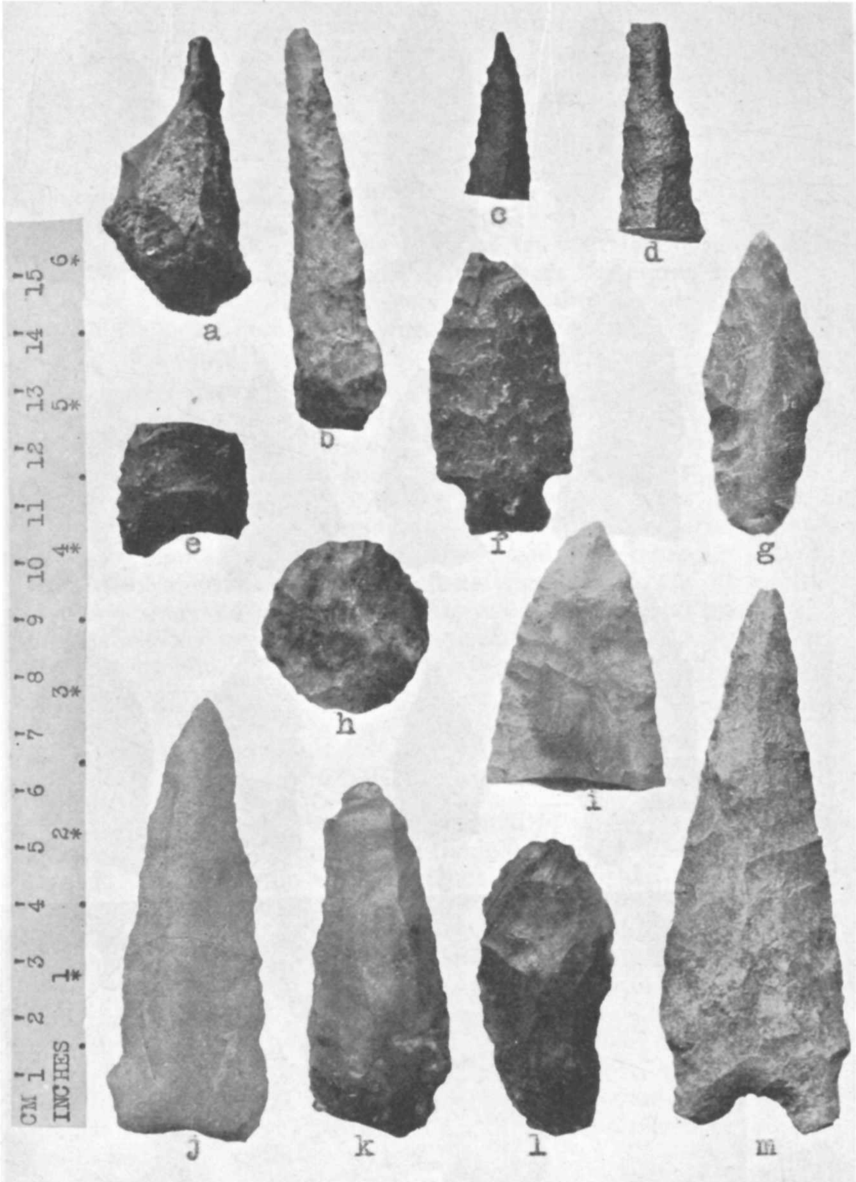
The variety of materials represented in the stone implements from Pinto Basin suggests at first thought a wide geographic range. Dr. Ian Campbell, who very courteously spent a half-day identifying them for me, says that this is not necessarily the case. One mountain range with a lava flow might easily yield them all, most of them being minor variants of three basic groups: silicates, granites, and lavas. Mr. Scharf reports that the two mountain ranges enclosing lower Pinto Basin are mainly of granite formation, while a lava flow lies between them in the basin proper. Hence it is likely that the smoothed stone implements are of local materials; both their weight and their extemporized fashioning would argue against transportation from a distance, with proper materials at hand for making them on the ground.

It seems less likely that the chalcedonies and obsidian were found in the Basin. None of the camps showed evidence of an abundance of raw material, nor were any occurrences of these materials noted by Mr. Scharf in his extensive survey of the



PINTO TYPE POINTS

A representative selection of sizes and materials, which are: *a-d*, obsidian; *e-h*, jasper; *i-l*, rhyolites; *m*, *p*, milky quartz; *n*, *o*, rock crystal



NON-TYPICAL FORMS

These are described in the text. Materials: obsidian (*c*), milky quartz (*j*), chert (*b*, *i*), jasper (*a*, *d*, *e*), the rest of chalcedony environs. All signs point to a gathering of these materials elsewhere, transporting only selected cores to the camping area for final working. The nearest important deposit of obsidian would probably be that near Little Lake, Inyo County. Much of the chalcedony proper resembles that found in large nodes in a locality where extensive preliminary working of this stone has been noted by us. Most of the jasper has a bright-brown color we associate with another known source of supply where this stone predominates; it lies some 40 miles north of Pinto Basin, while the chalcedony "quarry" mentioned is about 100 miles northwest of the Basin.

Thus of the three most likely sources of material, all lie to the north of the site. This suggests that the range of our culture is primarily northward, a suggestion strengthened by the fact that an extensive occurrence of red jasper 40 miles due south, where is much evidence of aboriginal gathering of material, is very sparsely represented in the stone materials recovered.

As to the local range of types herein described, Mrs. Campbell and I went through the collections of the Desert Branch of Southwest Museum, which she and Mr. Campbell have been gathering these seven years past, searching for similar implements. Among perhaps five thousand stone artifacts, representing certainly a hundred sites, the following type correspondences were found.

Type of Object	Number of Objects	Number of Localities
Small portable metate	1	1
Choppers and large keeled scrapers	11	4
Small (fluted type) keeled scrapers	12	8
Retouched flakes, one face only	22	7
Idem, opposite faces, alternate edges	2	2
Round scrapers ("lozenges" pl. 14, *h*)	5	3
Leaf-shaped points	9	3
Pinto type points	27	7

Of this total of 89 objects nearly half came from one site, where the culture is much like that of the Pinto Basin. It is apparent that those types which occur so abundantly at this latter site are in a decided minority in the collections thus far made from the desert area extending approximately northward from Pinto Basin to Nevada. The area south of the Basin has not been explored.

Whether the group represents a single complex or a mixture can be ascertained only by further work. Most of the types are so closely allied in form and so largely non-competitive in function that they probably are of a single group. Choppers grade downward into large scraper-planes, these into the finer keeled scrapers with fluting. The differences are essentially of size and fineness rather than of form or method. The retouched flakes reveal the same simple concept of making an implement by striking off a flake and trimming its most suitable edge or edges on one face only, usually the upper one. Fashioning and double edge trimming are alike foreign to this portion of the group.

The knives are both fashioned and double-trimmed, but remain kin to the others through an absence of pressure retouch. Only in the projectile points is there definite distinction of form in the same type of implement. The leaf-shaped are a small group, simpler in form and probably earlier in time than the Pinto type. All shouldered and stemmed points go through a leaf-shaped stage in process of making, so the latter could be postulated as the forerunner of them all even without the Old World evidence that it (the proto-Solutrean) is such in fact. The Pinto may be an outgrowth of the leaf-shaped, maintaining the unity of our complex.

Whether the metates and manos are contemporaries of the flaked implements is a nice question. They were widely scattered in the camping area determined by the ancient shore lines, and their eroded surfaces (as Dr. Ian Campbell confirmed) betoken the passage of many years. If they belong, then our hunters (for only hunters would need such abundance of implements for killing game and scraping skins) were also seed gatherers. The only doubt of their eligibility lies in the question—on which I can find no light in the treatises of European archeology—whether such smoothed stone implements belong in the essentially upper paleolithic group of chipped implements in which the other site types unite.

Paleolithic is used here in a typological sense. Certainly in all the range of Old and New World implement types of record no niche accommodates the group so neatly as the Aurignacian-Solutrean. Rogers drew a similar conclusion of his scraper-maker culture, and N. C. Nelson, who did Andrews' archeological work, labeled much of that material Mousterian. Very possibly our group is upper paleolithic in the full sense of the term, with all its time implications. European archeologists are looking more and more to Asia as the home of the principal cultural stages of this period. Burkitt (146) suggests an Asiatic origin for the Aurignacian, as do Peake and Fleure for the following stage, the Solutrean (p. 132); and both authorities take pains to specify northern Asia. On that basis western North America would be no more distant a periphery than western Europe. Space thus is no barrier to the possibility suggested, nor is time as measured by the glacial advances. These are generally regarded as world-wide phenomena, of approximately simultaneous occurrence in both hemispheres. Burkitt (134) and Peake and Fleure (chart, p. 90) agree that the upper Aurignacian and Solutrean industries made their appearance in Europe after the last glacial maximum, expressed in years by the last-cited as about 10000 B. C. This fits in nicely with Mr. Scharf's conclusion that Pinto river probably owed its water supply to the moist climate of earlier post-glacial times. The artifacts themselves cap the argument neatly, fitting typologically just where the geologic evidence tends to place them. If we knew that the Pleistocene animals of the ancient lake beds persisted down to the time of the river and were the quarry of its human associates, the evidence would be complete. Here is a good lead for further work in the area.[1]

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[1] Two sites of "Pinto" culture type have recently been found by Mr. and Mrs. Campbell. Already it is apparent that this is a definite culture stage in the area.