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### Title

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Reports of the  
**UNIVERSITY OF CALIFORNIA**  
**ARCHAEOLOGICAL SURVEY**

*Reports.*



**No. 6**

THE STANFORD SKULL, A PROBABLE EARLY  
MAN FROM SANTA CLARA COUNTY, CALIFORNIA.

History and Circumstances of the Dis-  
covery of the Skull. By Robert F. Heizer

The Stanford Skull: the Physical Char-  
acteristics. By Theodore D. McCown.

Issued February 3, 1950

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**The University of California Archaeological Survey**  
**Department of Anthropology**  
**University of California**  
**Berkeley 4, California**

THE STANFORD SKULL, A PROBABLE EARLY MAN FROM  
SANTA CLARA COUNTY, CALIFORNIA.

1. HISTORY AND CIRCUMSTANCES OF THE DISCOVERY OF THE SKULL.

By Robert F. Heizer

Early in 1922, probably in April or May, a Stanford University student, Bruce Seymour, discovered a human skull protruding from the channel wall of San Francisquito Creek opposite the site of the Stanford residence. He removed the skull and took it to the late Professor Bailey Willis who showed great interest in it, visited the find spot, and made a study of the geology of the location. Willis advised Dr. Aleš Hrdlička, with whom he had collaborated in the study leading to the publication of Bulletin 52 of the Bureau of American Ethnology. Some correspondence between Hrdlička and Willis ensued, but interest in the whole matter seems shortly to have been abandoned by Hrdlička who never mentioned the find in print, and by Willis who became again involved in matters more geological than anthropological. Willis did print, in a college magazine, an account of the find which seems to have been overlooked or ignored.<sup>1</sup>

In February, 1949, Professor V. L. VanderHoof of the Department of Geology, Stanford University, sent me a file of letters and photographs which had recently been deposited in his Department by Dr. Willis. A perusal of these has led me to believe that the facts in the case are sufficiently interesting, as probably indicating really ancient skeletal remains, that they are worth presenting in more accessible form.<sup>2</sup>

There follows copies of: 1), Dr. Willis' letter to Hrdlička; 2), an extract from the little article published by Willis; 3), Hrdlička's reply to Willis; 4), a letter from L. L. Loud to Willis; and 5), an interesting letter to Willis from J. M. F. Dubois, son

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<sup>1</sup> Bailey Willis. "Out of the Long Past." The Stanford Cardinal, October, 1922, pp. 8-11.

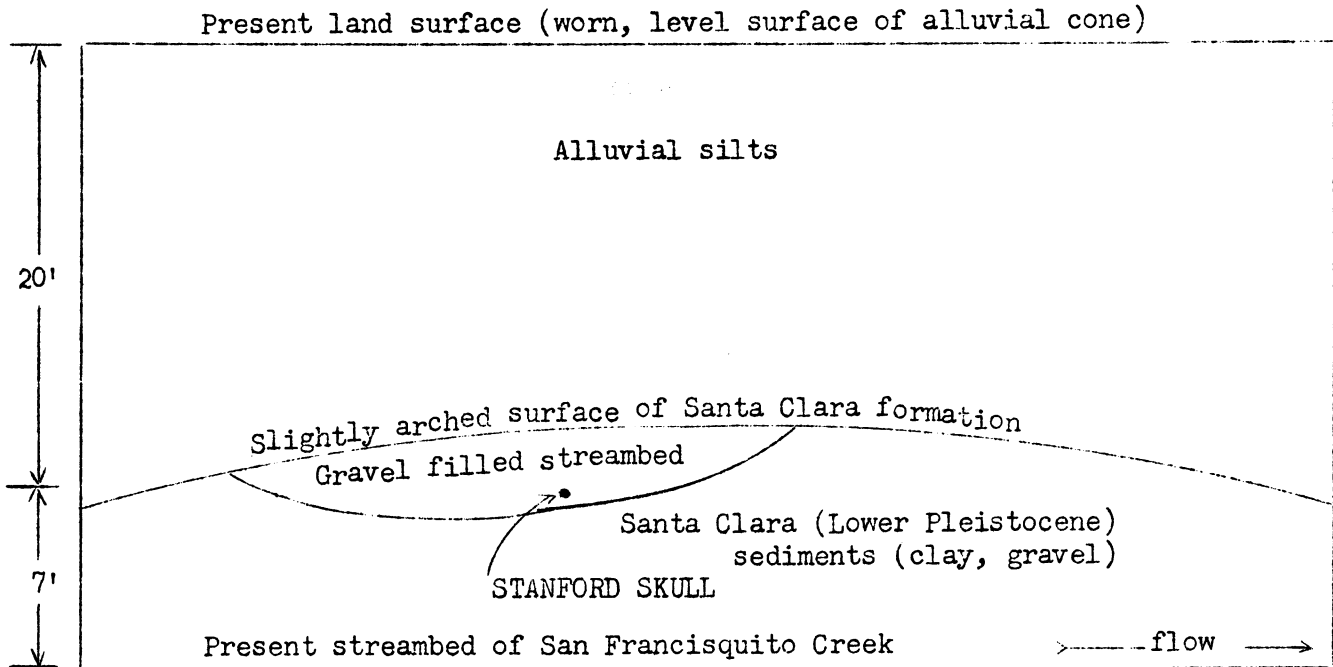
<sup>2</sup> The present authors express their appreciation to Dr. VanderHoof, Dept. of Geology, and Dr. F. V. Keesing, Dept. of Sociology and Anthropology of Stanford University for locating the skull, making available the file of data regarding the skull, and for permission to publish on the find.

of the discoverer of Pithecanthropus erectus. Reproductions of several photographs are also presented here in Plate 1, since these clearly illustrate some of the essential points detailed in Dr. Willis' letter of May 15, 1922. From the evidence presented in these documents, the following facts seem established:

1. The skull was found at a depth of 20 feet from the surface, cemented in the lower part of a gravel stratum exposed in the bank of San Francisquito Creek.
2. The skull, solidly embedded in gravels, was filled with small gravel as attested by Willis' published statement, by two photographs made at the time of discovery (and now on file in the UCAS office), and by the skull in its present condition (cf. Plate 2.)
3. There is thus ruled out the possibility that the skull was recently derived from a higher point, and it must be considered as laid down at the same time as the gravels in which it became cemented.
4. Some geologic antiquity, early Recent according to Dr. Willis, is to be accorded the skull on the basis of the time involved in the formation of the alluvial cone over the gravels in which the skull lay, and the cutting of the present creek trench into the cone and underlying deposits.
5. That the skull is not a recent intrusion into the gravels in which it lay is further demonstrated by the facts that it was solidly cemented in the gravels, was exposed in a vertical bank by the stream cutting, and its interior was filled with gravel of the same type in which it was firmly embedded.

The reconstruction offered by Loud in his letter (last 3 paragraphs) is not supported by the evidence of the deposition of the skull cited above, and because the present stream channel cuts across, at nearly a right angle, the gravel bed marking the course of the former stream which antedates the formation of the superincumbent alluvial cone.

The stratigraphic situation may be reconstructed about as follows:



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May 15, 1922

Dr. Ales Hrdlička,  
National Museum,  
Washington, D. C.

My dear Doctor Hrdlička;

Although it is some 12 years since you and I rejuvenated Ameghino's ancient man in South America, you are, I notice, still interested in our older inhabitants and I would, therefore, call your attention to a skull, which we have recently found in the alluvial gravels of this immediate vicinity.

Stanford is built on the alluvial cone of San Francisquito creek and the old Stanford residence stands on the bank of the creek about midway between the head of the cone and salt marshes. At this point the creek has cut a canyon in its own earlier deposits of silt over gravel and has gone down into the underlying

Santa Clara (Pliocene). The canyon is about 25 feet deep, some 20 feet in the alluvial deposits and some 5 feet in the Santa Clara.

The unconformity between the Pliocene and the more recent gravels is very sharply defined. The older formation, consisting of consolidated yellow clay and gravel, was eroded and presented a hard surface. The younger gravel was swept down upon it by the stream and was deposited in potholes and irregularities of its surface. The same process is going on today in the much more modern channel of the present course.

The gravels which rest upon the Santa Clara may, I think, be correctly classed as early Recent, to distinguish them from the deposits which have been laid down by the creek since it assumed its actual [i.e., present] course. I would not be understood, however, as attributing any considerable geologic antiquity to them. They seem to be old humanly speaking, but they are recent geologically. The early Recent gravels are strongly cemented. They stand in a vertical wall and even large pebbles are so firmly held that they cannot be dislodged, except with a pick. They fill an old channel, which can be traced in a curve, that is now cut across by the actual channel in a curve in the opposite direction. Hence I conclude that the old channel was filled, lay buried long enough to permit the cementing of the gravel by the solutions contained in the groundwater, and has been re-exposed by the erosion of the present canyon. How long that might take it seems impossible to conjecture, several thousand years, I would guess.

At the bottom of the early Recent gravels a skull was found by a Stanford student, Bruce Seymour, who dug it out and brought it to me. He said he had difficulty in freeing it from the gravel, which he had to pick away, and that even after he had cleared away all the gravel around it it still remained firmly attached by the mass of gravel which fills the base of the skull. I went down to the locality next day and found the cast of the skull clearly defined in the gravel, which immediately around the skull was somewhat finer than elsewhere. I replaced the skull in its original position, where it fitted perfectly, and took the photographs which I am sending you.

A week later the skull was again replaced in its old bed and the locality was examined by a number of geologists; members of the Le Conte club. Lawson, Buwalda, and Stock of the University of California were of the party. It was agreed, without question that the skull was an indigenous boulder in the formation. The idea of artificial burial was negatived by the continuity of the overlying strata, which were found to be undisturbed.

The skull itself is complete, except for the lower and upper jaw and nasal portion. It measures 181 mm. from front to back and 137 mm. above the ears, measured between verticals. If these

dimensions are rightly measured, the cephalic index would be 76.4. The super-orbital ridge is strongly developed and is continuous across the nose. The back of the head is prominent and the muscle scars of the neck are large. Examined by Professor Heath of the Zoology department and by Dr. Meyer, Head of the Department of Anatomy, the skull is regarded as very similar to Indian skulls, which have been collected from burying grounds in the Santa Clara valley. Dr. Meyer, however, commented on the somewhat primitive characteristics that I have mentioned and upon other anatomical details of a somewhat unusual character.

The evidence would seem to indicate that we have found a rather ancient Indian skull, perhaps older than any other known from this locality.

I feel sure that you will be interested to know the facts and to have the photographs.

With best regards to both yourself and to Dr. Holmes, to whose attention I would be glad to have you bring this letter, I am cordially yours

/s/ Bailey Willis

\* \* \* \* \*

[Abstract of Willis' article in the Stanford Cardinal]

"...I must admit that I think the skull is more than 3000 years old, and for that I have this reason. I am by no means sure that 20 feet is all the silt there ever was above the skull. If any part of the plain were raised, say by earthquake or by warping under the pressures which cause earthquakes, the surface would be washed away or worn away by wind until it held even with the rest. The plain by the Stanford residence has thus been warped up and worn off. If you will go down into the deep channel of the creek, you will see that the present bottom lies seven feet below where its bottom was when the skull and the gravel were washed down... The newer, deeper part of the channel has been cut in a hard bed of clay and gravel, which slopes away both up and down stream. It is very slightly arched and the arching has taken place since the skull washed into place. Seven feet is the apparent height of the arch, and since the plain above is level, seven feet of silt must have been washed off. Considering how gradual are the changes, even where the growing mountains throw down our cities, I am inclined to think that the larger estimate is more likely to be the right than the smaller and that ... [the skull was deposited] more than 4000 years ago."<sup>3</sup>

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<sup>3</sup> Willis, op. cit., p. 11.

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SMITHSONIAN INSTITUTION  
UNITED STATES NATIONAL MUSEUM  
Washington, D. C.

May 23, 1922

Dr. Bailey Willis  
Department of Geology  
Stanford University

Dear Professor Willis:

I am delighted to have your letter of May 15, together with the clear photographs of the locality of the highly interesting specimen the finding of which is described.

Of course you know my position on this subject. While I have all reason to distrust the existence of man of any really great or geological antiquity on this continent, I would have no hesitation in accepting a man up to say, 6,000, 8,000 or even 10,000 years ago; though if man had been here as early as that he must have been very scarce.

I would like to have a few more details about the position of the skull:

- 1) How deep was it from the surface of the gravel at that particular spot?
- 2) How far was it from the outside wall or surface of the gravel (if there was such)?
- 3) Does the skull bear any marks due to contact with the gravel which would probably have been quite necessary had it been rolled with the same?

In addition I would be very thankful for a top view of the skull in such a position that the glabella-inion line would be about horizontal.

Of course I should be very glad to examine and report on the skull, perhaps in our new Journal, if it could be sent to me for information. I think it would be quite safe to send it by express.

The enclosed letter in one of the Argentine Journals will I am sure interest you; please send it back.

With best wishes, and hoping you will come to see me when in Washington, I am,



Sincerely yours,

/s/ A. Hrdlicka

P.S. I have of course called the attention of Professor Holmes to the skull.

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UNIVERSITY OF CALIFORNIA  
Museum of Anthropology

Second and Parnassus Avenues  
San Francisco, California  
May 24, 1922

Dr. Bailey Willis  
Stanford University  
Palo Alto, California

My dear Dr. Willis:

In regard to the skull which has had so much publicity in the newspapers recently you will recall that I said at the first glance that it was a typical Central California Indian skull of a male about 50 years of age at the time of death. Measurements confirm this decision as most of them do not vary hardly a hairs breadth from the average.

Measurements:-- Among the skulls from the San Francisco Bay shell-mounds which I recently measured are 40 which are undoubtedly from males. The average length of these is 184.4 mm., and the average width 139.1 mm. The corresponding measurements for your skull is 185 and 139 mm. The basion was broken in many of our skulls but the average height of 24 complete specimens is 135.8 mm. Your skull again is almost exactly the same, 136 mm. The average basion-nasion length is 98.5 mm. while your skull is 103 mm., but three of our skulls run higher than yours in this regard. The average minimum frontal width is 92 mm., while yours is 95 mm.

Indian Village Site: -- This is good evidence that the skull belonged to a typical shellmound Indian but I have also located an Indian village site a quarter of a mile or more upstream from the place where the skull was found. The village site is on the northwest side of San Francisquito Creek at the first bend below the old suspension bridge. This is on the ground that is being irrigated and planted to tomatoes and young fruit trees.

The ground is not a shellmound, neither is there blackened soil such as is usual at village sites in the interior of California far from salt water. There is much evidence of occupation by white men such as nails and broken glass and pottery yet the Indian signs are also unmistakable over a very wide area.

Shells: -- Broken bits of shell can be easily found of a character to strongly suggest Indian occupation. This statement would be true even though it might be shown that some of the shell was left on the ground by white men engaged in chicken business. The species found include, principally bentnosed clam (Macoma nasuta), but also California oyster (Ostrea lurida), and Cerithidea californica. The last species is rare in all San Francisco Bay mounds except at Castro where it is more abundant than any other species. Two fragments of shell were found which came from the ocean coast. One was abalone (Haliotis sp.). The other was the Washington clam (Schizothaerus nuttallii). Both of these are very rare in the San Francisco Bay mounds.

Implements: -- Other evidence of Indian occupation is fragments of animal bones, but more especially the abnormal quantities of stones of the size of an apple and smaller. Almost without exception these stones are burnt. They are what we know as cooking stones. There is one flake of chocolate colored chert. A kind of rock common on the Peninsula and used in making knives and arrow points. It is a typical piece of refuse such as is common in the Castro mound. Two flakes of obsidian were found. A very large Indian quarry six miles east of Santa Rosa has been worked for thousands of years to obtain this material. It is the nearest source of supply known to the writer.

Age of the skull: -- Although my belief is that the skull was washed down from the Indian village site a quarter of a mile or more up stream I am unable to determine the age of the skull. That is a problem for the geologist.

I find that the depth of San Francisquito Creek opposite the Indian village site is 30 feet. The skull was washed down in my opinion at a time when the channel was only 23 feet deep. Then 5 feet of gravel was deposited on top of the skull. This gravel appears to be of two different kinds with two different degrees of cementation. After the deposit of gravel the channel moved to one side and eroded a new channel 7 feet deeper than it had ever been before.

I am no judge of the time that this would require. If a geologist should judge the time to be four or five thousand years ago or even somewhat more it would, in my opinion, in no wise conflict with the findings of an archaeologist.

Yours sincerely,

/s/ Llewellyn L. Loud

P.S. You are at perfect liberty to quote from the above in any statements to the press that you desire to make.

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Ross, Cal. May 24, '22

Prof. Bailey Willis  
Stanford, Cal.

Dear Sir:

With very much interest I have followed the newspaper reports regarding the "Stanford Skull."

I take pleasure in informing you that I received today a cable from Holland from my father, Prof. D. Eugene Dubois (discoverer of the Pithecanthropus Erectus), requesting me to ascertain all possible data in regard to this new discovery. Would it be possible to obtain photographs, description of the location and soil in which it was found, measurements, color and general contour of this skull?

My father is still developing his theories and studies of the "Missing Link" and this information would help him greatly and would be very much appreciated.

Thanking you for anything you may be able to do in this matter, I am, dear Sir

Yours very truly,

/s/ J. M. F. Dubois

Address:  
J. M. F. Dubois  
Ross, Marin Co.  
Cal.

## 2. THE STANFORD SKULL: THE PHYSICAL CHARACTERISTICS.

By T. D. McCown

The skull which is the subject of this note consists of a brain case (calvarium), the vault sides and base being wholly or almost intact (Plate 2). The facial bones are missing except for small parts of the superior extremities of the ascending processes of the maxillae and of the nasal bones. There is no mandible. The interior of the skull is filled with a cemented sand and gravel and this has not been removed. Externally small amounts of the matrix were adherent to the base when I first examined the specimen and some of the fossae were completely filled (pl. 2F). This material has now been removed so that an unobstructed view of the entire base is now obtainable (pl. 2E). Post-mortem damage is minimal, the principal instance being a fracture and crushing of the right moiety of the anterior part of the basilar process. This perforation is of the size and has the form which would fit the pointed tip of a geologist's pick and probably is to be associated with the moment of discovery of the skull. A triangular piece of the right squamous temporal is missing. This appears to be an old break. There are small fresh breaks around the margins of the foramen magnum. The surfaces of the articular condyles are destroyed but here the exposed cells are filled with sand grains and the tips of the mastoid processes show an identical condition. The entire region below the cribiform plate is filled solidly, but without seriously disturbing the several laminae, and the lacrimo-ethmoidal air cells likewise appear to be filled. All these facts bespeak a slow and gentle filling of the skull by the fine sand and gravel, probably subsequent to the disappearance of the face. There is no evidence that the specimen has been abraded or rolled in more than a minor degree.

The position in which it was embedded is shown in Plate 1D and E and is further evidenced by the darker color of the surface of occipital and the posterior part of the right parietal. The skull rested on the right asterion as the inferior pole with what I believe is some resulting post mortem distortion, noticeable as a slightly flatter effect of the right hinder portion of the whole braincase. Plate 2A shows the darker coloration of the rear portion of the skull and also the facts that the squamous temporal and the great wing of the sphenoid are very slightly sprung from their normal articular relationships. The occipital view (pl. 2B) also shows this assymetry, the amount of which is insufficient in my experience to affect for comparative purposes the metrical values of the specimen.

The present condition of the skull and the nature of the filling of its cavities suggest certain inferences as to the manner of its deposition at the spot where Mr. Seymour originally found it. It is unlikely that it had been transported any great

distance before finally coming to rest. The quarter of a mile suggested by Loud (vide supra) is possible but not very likely. I should expect there to be much greater damage to all the exposed surfaces than are actually evident if the skull had been washed downstream such a distance. The nature of the filling ranges from clay particles through sand grains (abundant) to small stones, the largest of which found by me were the size of a small lima bean. My conclusion is that the filling took place at the location from which the skull was recovered, after the face had disappeared and that it was a process taking place in slow and gently flowing water.

The skull is moderately mineralized. This statement is based on the intuitive absolute standard I have developed over some years, and is not the result of a quantitative analysis. It suffers from the defect that the micro-environment of bone specimens plays an important and not easily estimated part in determining the appearance of such specimens, appearances upon which are based judgments like that just stated. Comparison with similar crania of known high antiquity leads me to the opinion that there is nothing obvious in the physico-chemical state of this specimen to warrant a guess that it is particularly ancient. It is equally evident, however, in comparing it with skulls known to have been buried within the last five centuries that the Stanford specimen has undergone changes not found in them.

Plate 2 shows six views of the Stanford specimen. Figures A to E are the standard normae in the eye-ear plane arrived at by assigning 35 mm. as orbital height. This value is equal to or only fractionally different from the mean value for numerous California Indian series. Figure F is the basal view of the specimen before cleaning, with the existing surface parallel to the plane of the film.

No full description of the skull has been presented previously. Bailey Willis published in the Stanford Cardinal a few measurements supplied by Loud. Some measurements of the specimen are also to be found in Gifford's "Californian Anthropometry" (p. 375).<sup>1</sup> Sex is there stated to be male and age at time of death to have been 50 or more years. There is no serious question as to sex; it is a male although without the hypermasculine characteristics not infrequently found in California male crania. Loud was responsible for the age estimate and this is too great. The most reliable guide, the degree of synostosis of the endocranial aspect of the cranial sutures, is not available since the cranial cavity is still

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<sup>1</sup> E. W. Gifford. Californian Anthropometry. University of California Publications in American Archaeology and Ethnology, 22: 217-390. 1926. University of California Press, Berkeley and Los Angeles.

filled with matrix. The less reliable external closure has to be our guide as to age. All parts of the sagittal suture except the bregmatic part are obliterated while this last is very advanced (stage 3). The coronal suture is patent throughout but there is a suspicion of lapsed union. The lambdoid suture is at stage 2 in the pars lambdica, at stage 1 in the medial part and open towards the asterion. The occipito-mastoid suture shows closure of its anterior fourth. Other sutures show no external evidence of closure. A minimum age of thirty years is certain and on balance I believe the individual died during the decade 35-45 years, with the probabilities favoring the first rather than the latter half of this time span. As a single value, 38 years is suggested as the time of death. What is known with regard to the mortality rates and life expectancies of aboriginal populations suggests that the Stanford skull was that of a middle aged man when he died.

The metrical comparisons made in Table 1 are of two kinds. Gifford's published data are used in columns 2 to 5 while Newman's data for the Sacramento Valley populations are entered in columns 6 to 11. Columns 2-3 represent a recalculation of the means and standard deviations for 31 male crania from San Francisco, San Mateo and Santa Clara counties (Gifford's areas 19b and 19c), that is, material from the immediate geographic area including the Stanford campus and providing enough crania to make an intelligible comparison. Twenty one of these are from a single site, the Castro Mound (SCL-1). The limitation of the comparison to four measurements and four indices results from the impossibility of using Gifford's data for nose, face and orbits since the Stanford specimen lacks these. Hrdlička's measurements of crania from this area have not been used.

Columns 4-5 show the male means and their accompanying sigmas for the respective measurements but the indices are the means and sigmas for pooled males and females. This is Gifford's San Francisco Type, representing areas 18a, 19 a, b, c. Essentially this consists of the population, during an unknown time span, of the land area surrounding San Francisco Bay and includes the specimens treated separately in columns 2-3.

The comparisons are unfortunately limited but what they indicate is that the Stanford specimen is unlikely to represent an individual from a population different from that represented by either the known aboriginal population of the Peninsula or of the larger San Francisco Bay area. Where it deviates metrically from the samples representing these populations, the deviations are all less than one standard deviation except for the cranial module of the San Francisco Bay population. The smaller module of this sample has been undoubtedly influenced by including the smaller dimensioned females but even here the divergence of the Stanford skull is less than two sigmas. Statistically none of the differences even approach a level of significance.

TABLE 1  
The Stanford Skull Compared with Central Californian Cranial Series

|                      | Stanford | Peninsula <sup>1</sup> |      | San Francisco Bay <sup>2</sup> |      | Early |        | Middle |       | Late  |       |
|----------------------|----------|------------------------|------|--------------------------------|------|-------|--------|--------|-------|-------|-------|
|                      |          | M                      | σ    | M                              | σ    | M     | σ      | M      | σ     | M     | σ     |
| Glab.-Occip. Length  | 195      | 183.9                  | 6.02 | 182                            | 5.94 | 190.5 | 6.38   | 185.6  | 6.06  | 181.6 | 5.64  |
| Max. Breadth         | 140      | 136.6                  | 3.80 | 139                            | 4.96 | 144.1 | 5.23   | 142.2  | 4.82  | 146.3 | 4.88  |
| Basion-Bregma Height | 136      | 135.2                  | 4.20 | 135                            | 5.10 | 145.9 | 5.44   | 141.6  | 5.16  | 143.5 | 4.09  |
| Min. Frontal         | 95       | ..                     | ..   | ..                             | ..   | 97.0  | 4.02   | 96.6   | 4.00  | 98.4  | 4.21  |
| Endebasion-Nasion    | 103      | 100.8                  | 3.87 | 99                             | 4.18 | 106.8 | 3.68   | 103.7  | 3.86  | 103.6 | 3.36  |
| Interorb. Breadth    | 24?      | ..                     | ..   | ..                             | ..   | 25.8  | 2.19   | 25.1   | 1.95  | 24.7  | 2.52  |
| Up. Br. Nasalia      | 16       | ..                     | ..   | ..                             | ..   | 12.9  | 1.94   | 13.6   | 2.83  | 17.5  | 2.17  |
| For. Mag. Length     | 35       | ..                     | ..   | ..                             | ..   | 38.9  | 2.57   | 38.3   | 2.05  | 37.1  | 2.10  |
| For. Mag. Breadth    | 24?      | ..                     | ..   | ..                             | ..   | 21.7  | 2.43   | 21.3   | 2.03  | 21.0  | 2.14  |
| Arc Nas.-Opis.       | 377      | ..                     | ..   | ..                             | ..   | 385.4 | 14.38  | 378.2  | 14.15 | 375.7 | 11.18 |
| Max. Circumf.        | 520      | ..                     | ..   | ..                             | ..   | 526   | 13.96  | 519    | 14.96 | 516   | 14.45 |
| Capacity             | 1460     | ..                     | ..   | ..                             | ..   | 1538  | 102.90 | 1541   | 85.80 | 1576  | 86.7  |

Indices:

|                 |      |      |      |     |      |       |      |      |      |      |      |
|-----------------|------|------|------|-----|------|-------|------|------|------|------|------|
| Cranial         | 75.7 | 74.1 | 2.81 | 76  | 3.11 | 75.8  | 3.48 | 76.2 | 3.01 | 30.7 | 3.01 |
| Height-Length   | 73.5 | 73.6 | 2.90 | 74  | 3.18 | 76.8  | 2.88 | 76.0 | 2.92 | 78.9 | 2.71 |
| Height-Breadth  | 97.1 | 99.6 | 3.04 | 97  | 4.28 | 101.2 | 3.19 | 99.8 | 3.95 | 98.1 | 3.27 |
| Fronto-Parietal | 67.8 | ..   | ..   | ..  | ..   | 67.5  | 2.16 | 68.2 | 5.46 | 67.4 | 2.96 |
| Cran. Module    | 154  | 152  | 3.95 | 149 | 4.91 | 160   | 4.16 | 156  | 4.25 | 157  | 3.75 |

<sup>1</sup> Male crania from San Francisco, San Mateo, Santa Clara counties, Gifford's areas

19b-c; N's vary from 21 to 31 for individual measurements and indices.

<sup>2</sup> Data from Gifford's Tables 32 and 33. Measurements are male, indices pooled male and female.

<sup>3</sup> Data from Newman. N's vary from 20 to 50 for individual measurements.

Differences of technique of measuring do not affect the four measurements and the indices derived from them. Loud appears to have usually taken the basion-nasion diameter from what is now defined as endo-basion and his values are therefore comparable to mine.

The Sacramento Valley samples were measured and computed by Dr. Russell W. Newman and the data are taken from his thesis.<sup>2</sup> The techniques used by Newman and myself are identical and are those used by the majority of working physical anthropologists in the United States.<sup>3</sup> The horizons represented are those now familiar from the work of my colleague Heizer<sup>4</sup> and his associates. The material used by Newman was male and numbered between 40 and 55 for each individual series.

Comparison of the Stanford skull with this Valley population is instructive. There is no instance where its metrical or indicial values deviate from any Valley mean by as much as two standard deviations. In simple language this means that the probabilities are strongly against a conclusion that it represents a kind of man radically different from the Valley population. Its relationships, however, are not as close to any Valley group as they are to the Peninsula and San Francisco Bay region population. The clues to this are in the generally greater magnitude of the absolute differences between the corresponding 12 measurements and 5 indices and in the following relationships.

d/σ less than 1                      d/σ greater than 1 but less than 2

|                | measurements | indices | measurements | indices |
|----------------|--------------|---------|--------------|---------|
| Early Horizon  | 7            | 2       | 5            | 3       |
| Middle Horizon | 8            | 5       | 4            | 0       |
| Late Horizon   | 7            | 3       | 5            | 2       |

<sup>2</sup> Russell W. Newman. A Comparative Analysis of Prehistoric Skeletal Remains from the Lower Sacramento Valley. Ph.D. Thesis (unpublished). 1949. University of California Library, Berkeley.

<sup>3</sup> E. A. Hooton. Up From the Ape (especially Appendix, pp. 715-748). Revised Edition. 1946. Macmillan, New York.

<sup>4</sup> R. F. Heizer. The Archaeology of Central California, I: The Early Horizon. University of California Anthropological Records, 12: 1-56. 1949. University of California Press, Berkeley and Los Angeles.



The size of the sample affects such comparisons and so I do not press the following conclusions too vigorously. The differences, however, are least marked between the Stanford calvarium and the crania of the Middle Horizon population while they are about equally marked and somewhat greater between it and both the Early and Late Horizon people. The nature of the latter differences is not the same except for head height, all the Valley people being much higher headed than the Stanford skull or, for that matter, the San Francisco Bay population. The Early Horizon crania are larger, with greater cranial capacities, but they exhibit a cranial form which is not dissimilar to the Coast population. The Late Horizon population is slightly larger headed and is characterized by greater breadth and greater roundness of head than is the Stanford specimen.

Summarizing our information about the Stanford skull and the conclusions reached thus far, we can set down the following. The specimen is moderately long and narrow in absolute dimensions, of medium height, is barely mesocranial, is orthocranial, metriocranial and metriometopic. The capacity, estimated by using the Lee-Pearson interracial formula for males, reaches only a moderate amount. It is most like crania from the same district and cannot be clearly distinguished from the aboriginal population living in the region surrounding San Francisco Bay. Nor can it be convincingly distinguished from either the earliest known or the later peoples inhabiting the central part of the Great Valley of California. To be sure, it is somewhat less like them than it is like its closer geographical neighbors but this is a normal and expectable relationship.

Now let us turn to those characters which are difficult to measure and whose relationships are hard to express in arithmetic ratios. Looked at from above the outline is pentagonoid. Viewed from in front (pl. 2D) the browridges are large, of the common median form, while the glabella projects moderately. The forehead is low, sloping and there is a well developed post-orbital constriction. The root of the nose is low and broad. Seen from behind (pl. 2B) the inion is large, mound-like and the area of attachment of the neck muscles is flat and little curved. Evident also in this view is the partially obliterated transverse suture which cuts off what is commonly called an Inca Bone. This bone in the Stanford specimen has been segmented by short vertical sutures so that it is subdivided into more than half a dozen small to large Wormian bones. There is also a small interparietal bone in the pars lambdica of the sagittal suture and a similar condition bilaterally in the asteric region. The mastoid processes are large and so are the supramastoid crests. The mandibular fossa is deep because of the great elevation of the eminence but the postglenoid process is small

There are no evidences of traumatic or of infective injury sustained during life and clues are absent as to cause of death.

All of the features described above are in the form and degree of development common in Indian crania from the Bay region and from the central parts of the Valley. No one nor any combination of these characteristics is in any way strange or unusual in the aboriginal people of central California. The over all morphology of the specimen is not primitive when it is regarded as an individual selected at random from our aboriginal California population. Relative lowness of vault height and of the forehead, greater general muscularity as evidenced by heavier, thicker or more protuberant bony ridges for muscle attachment, heavier and more massive browridges, are frequently considered marks of the primitive. It has to be kept firmly in mind that such judgments are relative to a scale which has some utility in comparisons involving humanity's ancient hominoid ancestors. But it is a scale whose gradations are and probably will always remain coarse ones. Because of this it is not applicable in a really useful way to the manifest and manifold small to moderate differences which distinguish the different kinds of modern humanity.

The conclusion I have reached with regard to the Stanford skull is that it is impossible to separate it physically by any one character or by any combination of these from the aboriginal people of coastal and interior California. Our knowledge of the aboriginal peoples of the State is admittedly imperfect but we know enough so that this conclusion rests on solid facts. The Stanford skull appears to be most like the people who occupied the district where it was found. Consequently Hrdlička's designation of it as a "Typical skull of a young male California Indian"<sup>5</sup> is substantially correct. We know that the Indian population of the whole of California is and was of more than one uniform type, despite popular belief and the widespread and indiscriminate use of the term "Digger". Hrdlička's experience with California Indian crania was based to a considerable extent on the examination and study of material derived mainly from the central coast and interior and he clearly recognized that the specimen put in his hands by Prof. Willis was conformable with that part of the State's native population. It is further, only moderately "young".

An additional consideration must be dealt with before ending this brief study. Does the specimen itself provide any evidence as to its possible high antiquity? The answer is No, with certain qualifications. The physical and chemical condition of the specimen make it most unlikely in my opinion that we are concerned with a recent Indian calvarium. Lacking, however, are strong positive indications that it is extremely ancient. But here it must be emphasized that the decisive evidence of its antiquity is to be sought from a correct interpretation of the geo-morphological

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<sup>5</sup> A 3 x 5 card accompanying the specimen when I studied it bears the notation "May, 1935", Hrdlička's signature, and the statement quoted above in his handwriting.

context in which it was discovered. This is especially pertinent when it is recalled that it differs little if at all from some modern Indians. It is, however, completely unwarranted to conclude from this latter fact that the Stanford skull cannot possibly be as old as five or ten millenia. Homo sapiens is changing now and has been undergoing changes for at least 150,000 generations but the nature and direction of these changes are such that they are unusable as time markers. Except for a few peoples in quite limited parts of the earth's surface these changes normally appear to be random ones within the larger unity of pattern which characterizes all Homo sapiens.

A brief example will make this clear. Newman's fine study of the Sacramento Valley population shows convincingly that the differences between Early and Middle, Middle and Late are small. The Early and the Late populations are more sharply differentiated but the amount of this difference does not, in my view, blur the real kinship of these populations. Each population, Early, Middle and Late, contains individuals who exhibit physical patterns that appear to have been present throughout the history of the valley's occupancy as we know it today. Consequently, to assign to one of the archaeological periods a single individual found in the region between Sacramento and Stockton but whose archaeological context is unknown is clearly a hazardous procedure and one that is also meaningless in final analysis. Study of such a specimen might indicate that it possessed a pattern of characteristics closest to the central tendencies of the Late people. Its lack of context then means that only a measure of probability can be suggested as to its having lived in Late times. One could not satisfactorily rule out this "unknown" as not having been a member of an Early or a Middle group. It is on such reasoning that I do not suggest that the somewhat greater resemblances of the Stanford skull to the Middle Horizon population of the Valley means a likelihood of its having lived on San Francisquito Creek in Middle Horizon times.

The observable physical pattern of the Stanford skull and its underlying and obscurely appreciated genetic pattern certainly would not rule out a geological determination of high antiquity, if such is ever forthcoming.

EXPLANATIONS OF ILLUSTRATIONS

Plate 1

- A. The gravel exposure with skull in situ at right center. Santa Clara formation below gravels. Man holding rod stands on present floor of San Francisquito Creek which has cut into arched Santa Clara formation.
- B. View down dry bed of San Francisquito Creek. Skull at left of man holding rod.
- C. Showing cutting of present stream into Santa Clara formation and skull in lower gravels.
- D. "Cast" of skull in cemented gravel. Skull rests on large root.
- E. Like D with skull inserted in its original position.

Plate 2

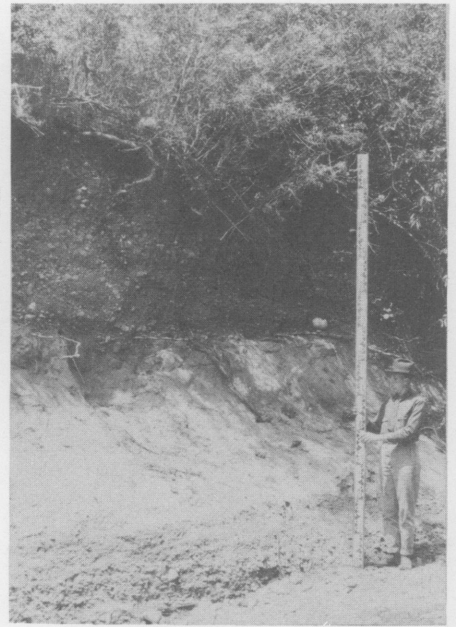
- A. The Stanford Calvarium (Stanford Geological Museum No. 2915). Right lateral aspect. This and figures B, C, D and E show the specimen posed in the eye-ear plane, determined by assigning 35 mm., as orbital height.
- B. Occipital aspect.
- C. Left lateral aspect.
- D. Facial aspect.
- E. Basal aspect.
- F. Inferior aspect before cleaning. The inferior surface is approximately parallel to the focal plane of the camera.



A



B



C



D



E

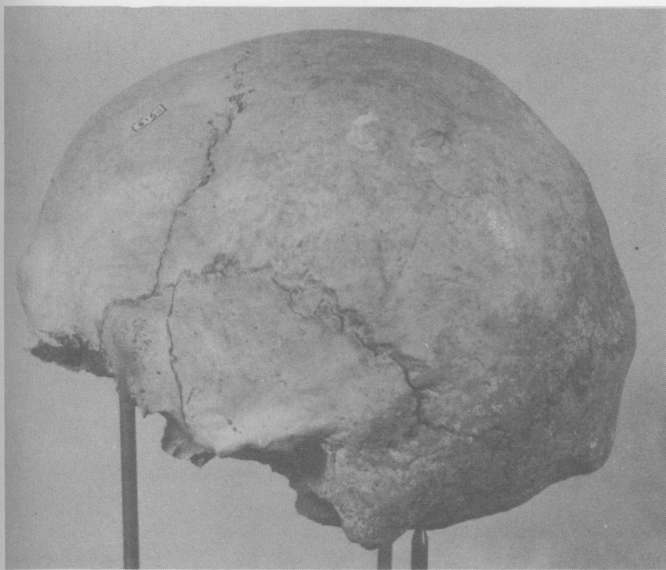




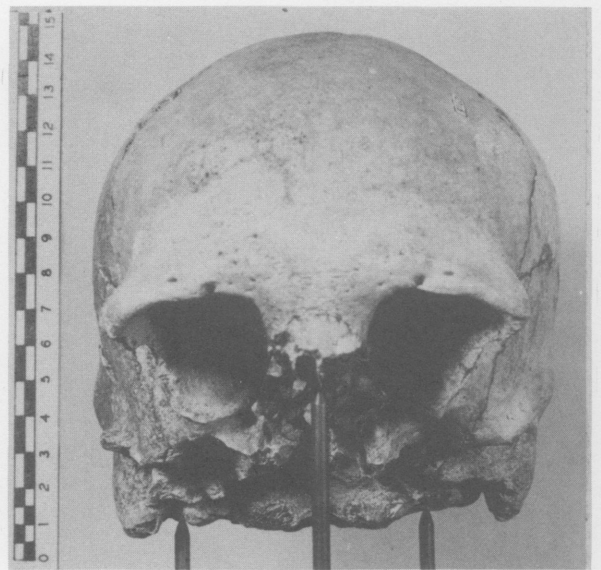
A



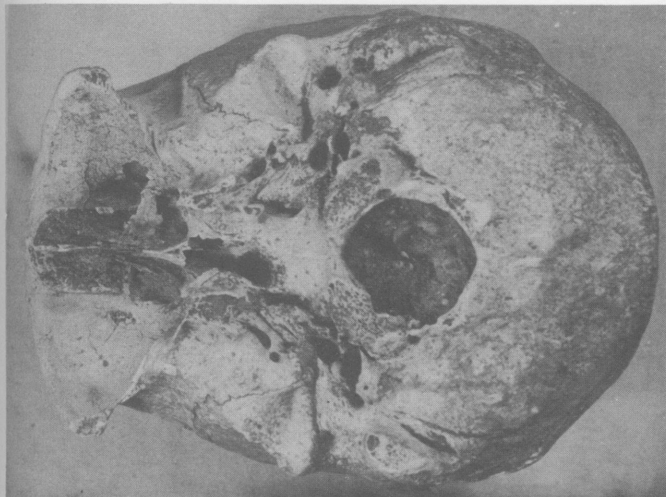
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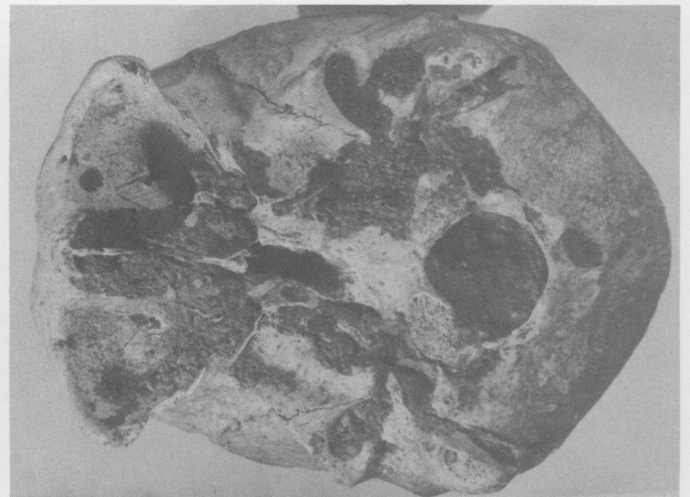
C



D



E



F