

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).¹ 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

¹ 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

	Peninsula ¹		San Fran- cisco Bay ²		Early		Middle		Late		
	M	σ	M	σ	M	σ	M	σ	M	σ	
Glab.-Occip. Length	185	183.9	6.02	182	5.84	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

¹ 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.

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

³ 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.² The techniques used by Newman and myself are identical and are those used by the majority of working physical anthropologists in the United States.³ The horizons represented are those now familiar from the work of my colleague Heizer⁴ 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

² 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.

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

⁴ 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"⁵ 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

⁵ 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

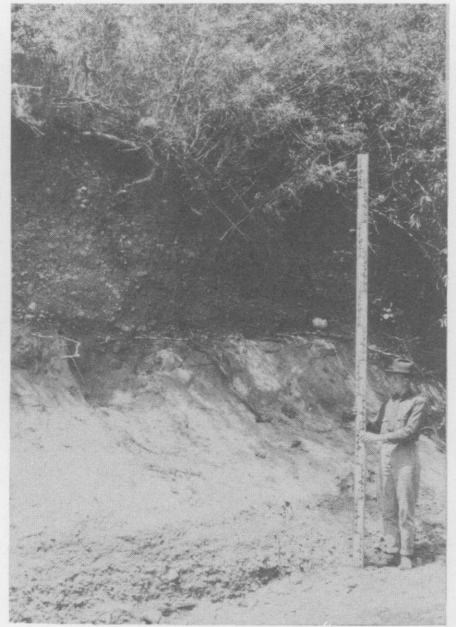
- A. The Stanford Calvarium (Stanford Geological Museum No. 2915). Right lateral aspect. This and figures B, C, D and E show the specimen posed in the eye-ear plane, determined by assigning 35 mm., as orbital height.
- B. Occipital aspect.
- C. Left lateral aspect.
- D. Facial aspect.
- E. Basal aspect.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



A



B



C



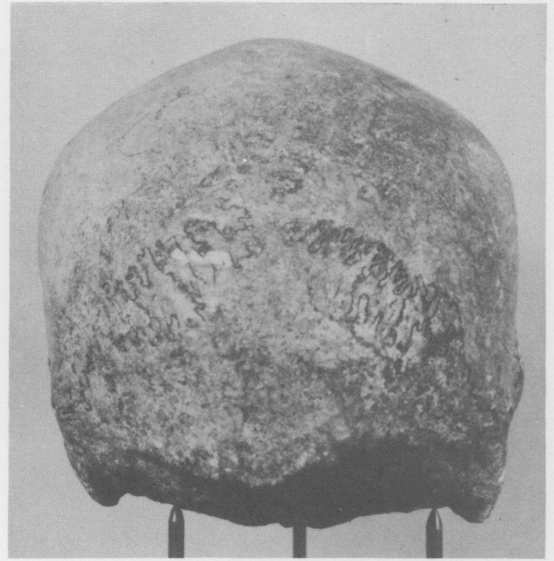
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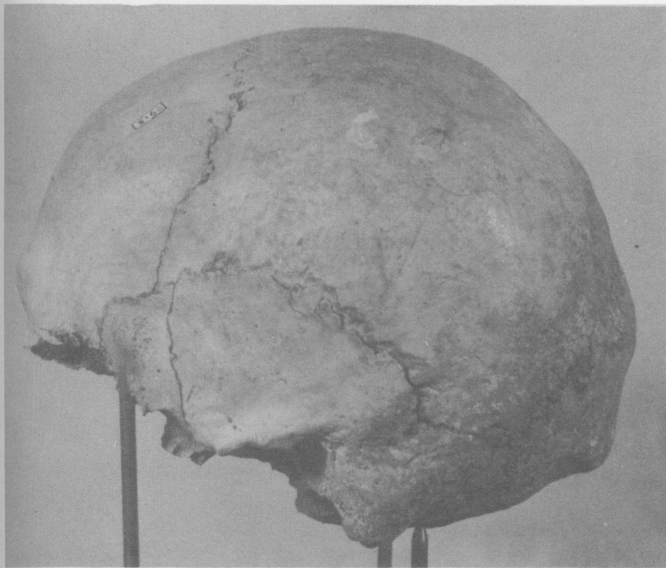
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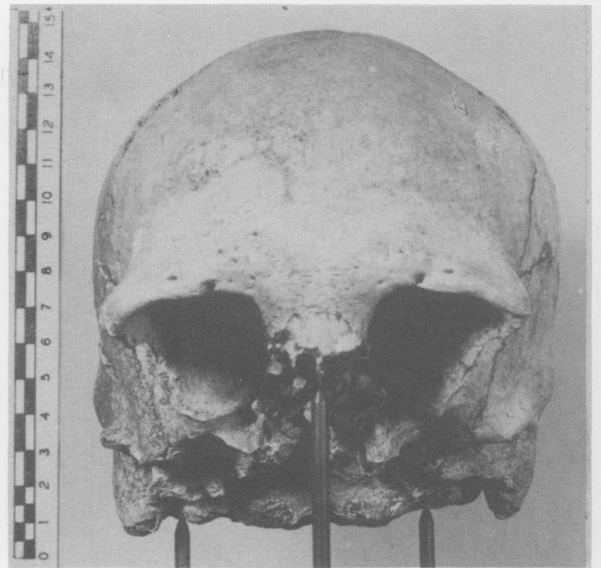
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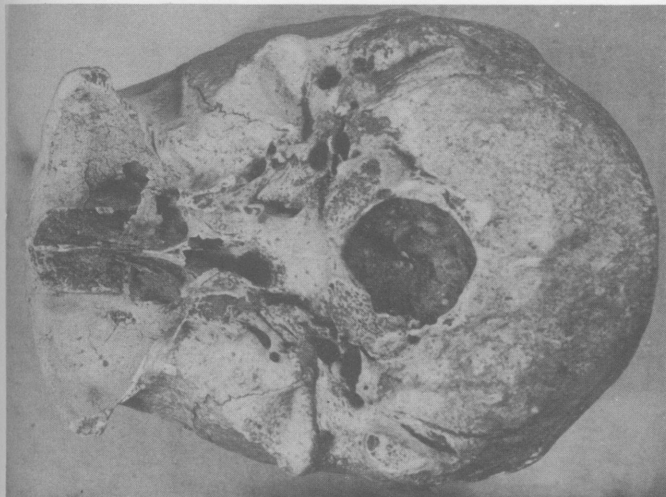
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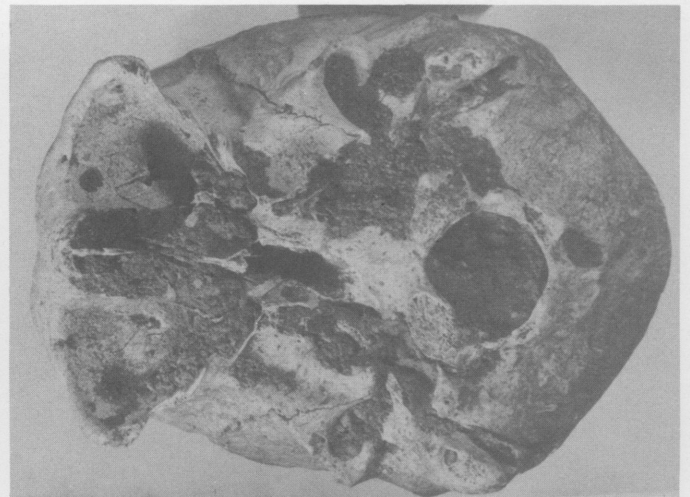
C



D



E



F