by means of pressure tubing to the vacuum pump,[3] which should have a manometer connected with it. When the air pressure has been reduced to 20 or 30 mm of mercury the tube is sealed off at the constriction and appears as shown in Fig. 1, C. In this condition the tubes may be stored or shipped. To open the sealed tubes they are scratched with a file at a point a little above the center of the cotton plug as at c in Fig. 1, C. Touched at this point with a hot wire or bit of glass the tube breaks, leaving the cotton plug as a stopper in the lower half (Fig. 1, D). By means of flamed forceps the bits of filter paper are transferred to suitable media, it being our custom to transfer one to fluid medium and one to solid medium.

Although in these tubes most bacteria remain alive much longer if kept in the refrigerator rather than at room temperature, their ability to withstand shipment for long distances is illustrated by the following results. An assortment of cultures, including three streptococci, Pneumococcus Type I, Corynebacterium diphtheriae, Corynebacterium pyogenes, Pasteurella cuniculicida, Proteus, Bacterium sanguinarium and Hemophilus influenzae, was sent by mail to Peking Union Medical College, Peking, China, and a duplicate assortment to the Lister Institute of Preventive Medicine, London, England. Those sent to Peking were en route for more than a month, but all were reported viable, one strain (P. cuniculicida) being contaminated. Examination of our stock strain showed that the contamination came from that source. From London it was reported that all the strains were recovered except H. influenzae, which was contaminated. A culture of Meningococcus later sent to London did not survive. We are indebted to Dr. Carl TenBroeck, of Peking Union Medical College, and to Drs. J. C. G. Ledingham and C. J. Martin, of the Lister Institute, for reporting on the viability of these cultures. Numerous cultures sent to various parts of the United States have been received in viable condition.

The method of putting up cultures in individual vacuum tubes for shipment has the following advantages: Saving in bulk and weight for mailing. Less danger of breakage or, if broken, less danger of contaminating the packing. A large number of vacuum tube specimens can be prepared from a single tube of growing culture. Cultures received in vacuum tubes need not be transplanted immediately, but may be stored for some time. A longer period of viability for most bacteria.

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[3] A satisfactory pump for this purpose is the Hyvac Pump of the Central Scientific Company, of Chicago, Ill.

SPECIAL ARTICLES

UNDEFORMED PREHISTORIC SKULLS FROM THE SOUTHWEST[1]

INTRODUCTION

THE work of the archeologists in the American southwest is more and more becoming truly scientific and being conducted in a systematic manner, at least in a few districts. Hence we may look forward to satisfactory answers perhaps soon forthcoming in regard to culture characteristics, sequence, relations and origins.

But the task of the physical anthropologist is lagging far behind. The work has been sporadic, unsystematic and, as a result, we know little about the ethnic characters, relations and possible origins of the prehistoric populations of the southwest.

Archeology recognizes now two main cultures; the older is that of the so-called Basket Makers, the more recent belongs to the Pueblo Cliff Dwellers. The latter were brachycephalic people with heads artificially deformed posteriorly. The former had undeformed long skulls. But until now practically nothing has been published concerning them. In the past year I studied and measured all such crania as I could obtain. This is a very short résumé of my work in this line.

MATERIAL STUDIED

The following constitutes the basis of my study and conclusions:

(1) From Colorado: one female from Piedra (Archuleta Co.); one female skull from La Boca (La Plata Co); four female crania, more or less complete, and one fragment from La Plata Valley.

(2) From New Mexico: one female from near Rosa (Rio Arriba Co.) and fragments.

(3) From Arizona: three males and one female from Cañon del Muerto. Besides these, which I measured personally, I obtained, through the kindness of Dr. Hooton, of Harvard, pictures and measurements of four males and three females from the Marsh Pass district of Arizona. Also the principal measurements and indices of seventeen males and three females from Coahuila, Old Mexico; and finally 178 males and 137 females from Santa Barbara Islands, California, previously measured by Lucien Carr.

Dr. Hooton himself recognized the similarity existing between the Arizona skulls he studied and the Coahuila crania as well as the California skulls. I

[1] Address read before Section H—Anthropology—American Association for the Advancement of Science, Kansas City, December, 1925.

extended the resemblance to all those I measured. I have thus a sufficiently large series of diversified origin to be able to draw some conclusions as to general type and later, perhaps, to establish the local variations or diversities of the main type.

GENERAL CHARACTERS OF THE SKULLS OF BASKET-MAKER TYPE

In norma verticalis the skull is generally ovoid and tending to a pentagonal shape with often a narrow, pointed and protuberant occipital. The most dolichocephalic are the females from La Plata, with 71.62 as horizontal index. The average for both sexes of the southwest is 75.72 and for Coahuila 75.11. The Santa Barbara skulls are slightly broader, with 76.73.

The most hypsicephalic crania are again the La Plata females, averaging 107.29, as height-breadth index. The others from Colorado are also above 100, the average for the whole southwest being 98.52 and for the Coahuila series 98.48. The Santa Barbara crania are lower, 94.59. Many of the southwest skulls are clearly scaphoid.

In norma occipitalis most of these skulls present a pentagonal shape with prominent parietal tuberosities, especially in females, and the parietals vertical or nearly so. The occipital crest and inion are often well developed.

In norma frontalis they display a forehead many times narrow, especially in females, somewhat low and slanting, with frontal bosses close together and not very visible. The nasal depression is seldom well marked. The superciliary arches are at times fairly prominent, at least on the first third from the glabella. The orbits are large and squarish as can be seen by the orbital index of Colorado females from 90.29 to 94.45 and for the Sta Barbara series averaging 92.39, truly megaseme, while the average for the Arizona index is 85 and 86.43 for Coahuila, thus showing a difference between the two groups. The nasal index is also interesting with the hyperplatyrrhine skulls from Piedra, 65.16, and a fragment from New Mexico, 65.21. The others from Colorado and New Mexico are also platyrrhine, 53.7 to 56; those from Arizona a little less so, 51.47 to 52.92; the Coahuila crania with 49.68 and Sta Barbara 48.39, being mesorrhine. The nasal aperture is broader and bridge lower in females. The lower borders are usually smooth and even indistinct.

The total facial index of only eight skulls from the southwest could be measured; it averages 85.79, near the lower limit of mesoprosopy. The upper facial index is known for a much larger number. It varies from 48.49 for females from Canon del Muerto and 48.51 from Piedra, Chamæprosope, to an average of 52.17 for the whole southwest, 52.45 for Sta Barbara and 55.02 for Coahuila; the females with shorter faces than the males in all series.

The palate is in all the specimens I have seen U-shaped, short and broad, the extreme cases being those from La Boca 128 and Rosa 128.84. The average maxillary index for the southwest is 120.48 and for Coahuila 119.69. The gnathic index, higher for the females of all series, is 97.36 as general average for the southwest and almost the same, 97.10, for Coahuila and slightly larger for California, 99. There is alveolar prognathism especially visible in Colorado skulls.

The largest skulls are the males from Canon del Muerto, averaging 1,503 ccm. For the whole southwest I found 1,410 for males and 1,255 for females, the Sta Barbara crania being smaller, respectively, 1,372 and 1,248, and the Coahuila showing less sexual difference, 1,393 and 1,338. The general average for 200 males is 1,374 and for 150 females 1,250, showing then a small capacity.

DISTRIBUTION OF TYPE

As already seen this cranial type has been found in southwest Colorado, northwest New Mexico and northern Arizona. I have no doubt that the skeletons discovered with archeological remains of Basket-Maker culture in Utah belong to this type, as their artifacts, according to Dr. A. V. Kidder, are of the same kind as and probably contemporary with the culture of the Arizona sites. Then this physical type would have occupied the whole San Juan basin and territory west of the Colorado River for some two thousand years B. C. The Coahuila remains constitute the Mexican district and the Californian district is represented by the large series from Santa Barbara Islands and opposite coast as well as the Pericue of Lower California reported by Ten Kate. A northeastern group would be constituted by many prehistoric skulls of the same type belonging to Algonkian, Iroquois and Erie Indians, and some mounds of the Ohio and Tennessee, according to Dr. R. Dixon. But I have no direct knowledge of these crania.

In South America, according to the anthropological literature in various languages, we see three groups. The western group in Ecuador, Paltacalo (Dr. Rivet), Punin calvarium (Sullivan and Hellman), and in Colombia (Dr. Verneau). The southern group, islands and southern coast of Chile, Tierra del Fuego, and Tehuelche of Patagonia (Dr. Verneau). The eastern group in Brazil, coast and highland, the Lagoa Santa race.

All have many common characteristics. Their variations may be due to local adaptation or crossing with neighboring tribes.

INTERPRETATION OF DISTRIBUTION

All these prehistoric remains have been found either along marginal zones (coasts or islands) or in places of refuge (islands, rocky coast, deserts or very cold climate). This seems an evidence of antiquity and of having been pushed aside and away as by a central drive from newer and stronger tribes splitting an early population into small groups, isolating them, reducing them to live in less favorable districts and at the periphery of the country.

POSSIBLE KINSHIP WITH POPULATIONS OUTSIDE OF AMERICA

After a comparison of cranial measurements, proportions and characteristics of skulls, it seems more and more acceptable to believe that this type of prehistoric Indians is resembling, and even is possibly related to, populations scattered in Oceania between Australia and New Caledonia in the southwest, New Guinea and New Britain in the northwest and as far east as Hawaii and Easter Island. Ten Kate, Rivet, Sullivan and other anthropologists speak of Polynesians and Melanesians; Verneau and a few others favor the Papuans.

Recent investigations by Dr. Rivet, of Paris, seem to establish a relation between Australian and Polynesian languages on the one hand and on the other the Tson dialect of the Tehuelche of Patagonia and the Hoka of California. Linguistic and anthropological considerations appear then to point out in the same direction.

The center of origin and dispersion of these people, their respective routes of migration, the time of their arrival in America and other highly interesting problems must remain unanswered questions, at least for the present.

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THE LOSSES IN TROUT FRY AFTER DISTRIBUTION

THE losses in trout fry which were found by the Biological Board of Canada for three months of each of the summers of 1923, 1924 and 1925 have ranged from 73 per cent. to 100 per cent.

Probably all fish culturists will agree that the two most effective means of reducing losses are (1) to protect the fry from enemies and (2) to provide them with an adequate supply of food. These are fundamental conditions for avoiding loss, whether in the hatcheries, in the retaining ponds or after distribution.

It does not seem to be a wise policy to protect and feed fry in hatcheries and in rearing ponds and then distribute them in wild ponds and streams where they have no protection from enemies and in many cases an inadequate food supply.

If seining or other forms of netting wild lakes and streams are carefully carried out, then both protection and food will be assured and losses will be greatly reduced. This was well shown by the Biological Board of Canada in the summer of 1923. One brook was partially seined of enemy fish and five thousand fry distributed in it. A second stream similar to the first was left unseined and five thousand deposited in it. At the end of three months both streams were seined and the survivors counted, with the result that fifteen hundred or 30 per cent. were alive in the former and only 175 or 2 per cent. in the latter.

Another example has been communicated to me by Mr. Albert French, vice-president of the Mastigouche Fish and Game Club, of New York City. The fishing areas of this club are about one hundred miles northeast of Montreal. Mr. French sent me the following letter after reading my article in SCIENCE of December 25, 1925.

> The failure of our trout to breed satisfactorily has been due, we are told by the authorities in Washington, to the fact that our lakes were out of "balance," that is to say, the suckers were in the ascendant, and we therefore started a warfare upon them in aggressive manner. At the mouth of the various brooks leading into our lakes we placed fyke nets in the early spring, as the suckers have a habit of going up stream (practically as soon as the ice is out) for spawning purposes. They went into these nets and were destroyed by men employed for this purpose.
>
> In addition to these fyke nets, I had built a large number of wire traps (which were made out of one half inch mesh galvanized wire) the size of a flour barrel, with one end flat, the other conical shaped, allowing convenient ingress for a sucker weighing two pounds. These traps were baited with stale bread and were placed at various points in our lakes, with a rope and float attached, and every second day were emptied by the man in charge. Carefully kept records show that up to the present time we have destroyed 767,000 suckers, and in the instance of at least one of our lakes, we feel that we have now gotten it in "balance."

The Mastigouche Club runs its own hatchery and Mr. French tells me that all the food which is required to feed both fry and fingerlings while in the hatchery or retaining ponds is obtained from the enemy fish. For a change of diet they are occasionally fed on liver and heart.

The expense of this investigation was borne by the Biological Board of Canada, and the work was done under the supervision of the chairman, Dr. A. P. Knight.

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