

for twenty rods or so more; then for a considerable distance I could get water by digging a few inches; then that indication failed, and beyond the stream-bed was entirely dry.

Not all such streams terminate thus in the middle of their bed: some terminate in a small shallow lake, some in a marsh; and either lake or marsh is pretty sure to be brackish, due to constant concentration by evaporation of the alkalis held in solution. Other lost streams fill up after a rainfall, and complete above the ground their course to the main stream. After a heavy rain in the mountains they are apt to change their 'lost' character with a suddenness and decision which may prove dangerous. The water occasionally pours down with an advancing wave or head, which is described as sometimes five or six feet high.

There is one remarkable case in New Mexico where the lost tributaries are plentiful, but the main stream does not exist. This is in a valley which lies between the Rio Grande and the Pecos River. The valley begins near the Sandia Mountains, and is shut out from the streams on each side by broken mountain-chains. It is a well-defined valley, not very broad, but having a length of perhaps three hundred miles. It is somewhat obscured by the small scale, and inaccuracies, of the smaller maps; but on a larger and correct map of the territory its valley-character is unmistakable. It lies much nearer the Rio Grande than the Pecos. Flowing into it, especially on the western side near the upper end, and on the eastern toward the lower, are numerous lost tributaries; but the primary stream has so completely disappeared that its bed can only be found at intervals.

In this valley lie the ruins of the Gran Quivira, the existence of which is not only attested by the ruins themselves, but also by the accounts of the earliest Spanish travellers. The records of the Spanish up to the latter part of the seventeenth century, when they were expelled by the Indians, are incomplete, as the Indians destroyed all that was left behind. That the Gran Quivira was well known to them, however, is shown by the fact that the most prominent ruin there is that of a church. There is now no water for many miles from the ruins. That there must have been once, can well be granted; for no large city would have been built by human beings at a distance of fifteen or twenty miles from a scanty water-supply. The valley may be named from this city, and would then be the Gran Quivira valley.

About half-way down the valley it is broken

by a long, narrow, thin layer of lava, now much broken up, and making a desolate region, locally known as the Mal-pais, or 'bad land.' The crater from which the lava was derived was near the northern end of the Mal-pais. Just above the Mal-pais an old river-bed is reached at the depth of about two hundred and fifty feet: below it, the river-bed, when found, is at a slight depth. South-west of the Apache reservation the old river-bed runs into a large salt-marsh.

A stream of no mean size seems to have once run down this valley. Not only has it now disappeared, but its bed is covered by lava and loose soil sometimes to great depths. As to the cause of the disappearance, it may have some connection with a tradition of the Indians which tells of a year of fire, when this valley was so filled with flames and poisonous gases as to be made uninhabitable. When this occurred, the chronology of the Indians is not perfect enough to tell us. That it was long ago, is attested by the depth to which the old bed is covered by detritus, probably washed down from the mountains, and by trees of considerable size which are found in some places in it. But that it was not so extremely long ago that it had become entirely uninhabitable, is made probable by the comparatively late desertion of the Gran Quivira. It is entirely possible that the Indian year of fire may have long preceded the drying-up of the part of the valley in which Gran Quivira was situated.

M. W. HARRINGTON.

#### *ZUÑIAN CONCEPTIONS OF ANIMAL FORMS AS SHOWN IN POTTERY.*

SEVERAL months ago I visited the Pueblo of the Zuñis, and while there enjoyed the opportunity of watching a group of five or six Zuñi women painting some of their pottery.

To show the degree of merit of the Zuñis in their copies of animal forms, one needs no better illustration than their attempts to reproduce the figure of the owl. It is probable that the species of this bird they have used as their model, from time immemorial, is *Bubo virginianus*, the great American horned owl. All the Zuñian clay effigies of owls have horns on their heads; and *Bubo virginianus* is not only the most common owl in the region, but the only one that is thus conspicuously tufted, being characterized by a prominent pair of feather-horns.

My drawing (fig. 1) represents a side view of an adult specimen of the owl in question, with its mandibles intentionally opened, in order to be as much like the Zuñi model (fig. 2) as possible.

This clay copy is the most faithful one I could obtain from a large stock of such material, and one of the best of their attempts in this direction that I have ever met with, or seen figured.

It will be seen that the modeller has represented the tufts upon the head of his subject by a pair of conical elevations. The clay used to make this figure is susceptible of being formed into much more natural-looking tufts than these, yet we never find them. In common with the beak, they are painted a brownish red, in sharp contrast with the white body of the rest of the model. An attempt is always made to represent the feather disk about the eye. Sometimes this is done by two plane concentric circles; other artists make it as shown in fig. 2; and still others have the radiating lines without the limiting-circle. The beak in my specimen is one of the best efforts of the kind that has come under my observation, an attempt evidently having been made to represent its raptorial type. This is not always the case, as may be seen from examining the admirable figures of these models, presented us in Powell's 'Second annual report,' and illustrating Mr. Stevenson's unrivalled collections of 1879.

The body and wings of one of these effigies of the owl come much nearer in form to the body and wings of a young specimen of *Bubo*, say two or three weeks old, than they resemble these parts in the adult owl; the former being short and rounded, and sometimes represented with a tail, and sometimes without. This may have been influenced, originally, from the fact that these young owls are often taken; but they do not acquire the feather-horns until later in life.

We find the talons represented by five characterless points, sometimes radiating as a star, and sometimes arranged with three in front, and one behind, which is better; though these

parts never suggest to us the raptorial foot of the owl.

In criticising one of these Zuñi effigies, we must bear in mind the fact of the great tendency, as in many of the Spanish-American folk, to imitate the work of their ancestors;



FIG. 1.—Right lateral view of head of adult specimen of *Bubo virginianus*; reduced about  $\frac{1}{2}$ .

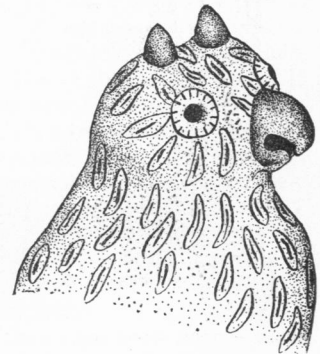


FIG. 2.—Three-quartering view from the right of a Zuñi model of the head of an owl; reduced about  $\frac{1}{3}$ .

and it would be hard to say for how many generations this clay model of the Zuñian owl has passed down without the slightest attempt at improvement in the direction of a more faithful portraiture of nature. Occasionally, however, an artist will make a lucky hit; and I have two ducks in my possession that illustrate this. The larger and adult one evidently intended to represent a widgeon (*Mareca Americana*); and its likeness, both in coloration and form, is at once quite striking. The other specimen is a young duck of some nondescript variety, the merit of which lies in the rather faithful imitation of the duckling as distinguished from an old bird. This is independent of its size, and, I expect, a difficult effect to successfully produce with the materials at their command, and rarely accomplished.

Their pottery illuminations of birds, as works of art, are no better than could be done by any of our children at eight or nine years of age. Occasionally we find one where the family can be guessed at, but more often the very order is obscure.

Mr. Cushing tells us, in one of his classical contributions to *Century magazine* (May, 1883), about Zuñi, the veneration these people have for the turtle, and how they seem to believe it harbors the soul of some one of their dead, or, as he expresses it, 'our lost others.'

We would naturally expect, therefore, to find

their models of turtles among the best of their clay sculptures. Nor are we disappointed in this, as may be judged from the two drawings (figs. 3 and 4) from a specimen of this kind in my possession.

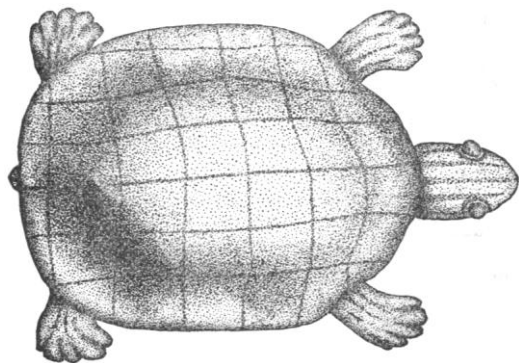


FIG. 3.—Dorsal view of turtle modelled in white clay by Zuñi Indian.

The carapace of this figure is painted a deep brown; while the epidermal plates are simply indicated by six transverse lines, crossed by the same number of longitudinal ones, both in a flesh-red color. This latter tint has also been used to paint the plastron and longitudinal lines on the deep-brown head and feet. This coloration gives it a not distant resemblance to some form of *Chrysemys*. Two such specimens are in my collection; and in both the designer has represented the toes by simply slitting the clay a little ways, in one instance correctly, as seen in the figure; and in the other by three slits, giving each foot only four toes.

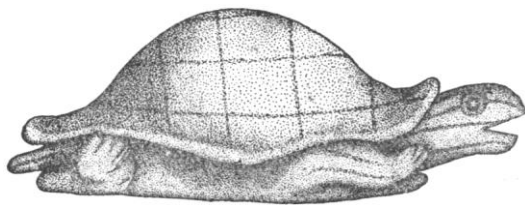


FIG. 4.—The same, lateral aspect. Both less than half the size of original.

I have never seen the turtle depicted upon any of their pottery, and I believe it must be one of their rarer forms to model in clay. So far as I can remember, Mr. Barber does not mention it, or figure the turtle in his article in the *American naturalist*, published some four years ago; nor does Mr. Stevenson allude to it, by word or figure, in the catalogue of his enormous collection of 1879 already quoted.

Mr. Stevenson's figures support another curious fact which I have observed, and will allude to before concluding. It is this: they seem to reserve their amblystomas, their axolotls, their tadpoles, and their bugaboos of human form, to illuminate the quaint clay baskets they manufacture, which usually have handles, and are ornamented with fancy serrated edges, and are of odd shapes. Almost invariably they represent the tadpoles upon side view, and take especial pains to draw the suctorial lips and the eye. The tail, however, is drawn simply by a wriggling line, and is not the broad tail of the tadpole, seen upon lateral aspect of this creature. R. W. SHUFELDT.

#### TYPES AND THEIR INHERITANCE.

THE object of the anthropologist is plain. He seeks to learn what mankind really are in body and mind, how they came to be what they are, and whither their races are tending; but the methods by which this definite inquiry has to be pursued are extremely diverse. Those of the geologist, the antiquarian, the jurist, the historian, the philologist, the traveller, the artist, and the statistician, are all employed; and the science of man progresses through the help of specialists. Under these circumstances, I think it best to follow an example occasionally set by presidents of sections, by giving a lecture rather than an address, selecting for my subject one that has long been my favorite pursuit, on which I have been working with fresh data during many recent months, and about which I have something new to say.

My data were the family records intrusted to me by persons living in all parts of the country; and I am now glad to think that the publication of some first-fruits of their analysis will show to many careful and intelligent correspondents that their painstaking has not been thrown away. I shall refer to only a part of the work already completed, which in due time will be published; and must be satisfied if, when I have finished this address, some few ideas that lie at the root of heredity shall have been clearly apprehended, and their wide bearings more or less distinctly perceived. I am the more desirous of speaking on heredity, because, judging from private conversations and inquiries that are often put to me, the popular views of what may be expected from inheritance seem neither clear nor just.

The subject of my remarks will be 'Types and their inheritance.' I shall discuss the conditions of the stability and instability of types, and hope, in doing so, to place beyond doubt the existence of a simple and far-reaching law that governs hereditary transmission, and to which I once before ventured to draw

Opening address before the section of anthropology of the British association for the advancement of science, by FRANCIS GALTON, F.R.S., etc., president of the section. From advance sheets of *Nature*.