CARTOGRAPHY

Making Mountains for Uncle Sam

Relief Workers From Many Fields Combine Talents To Reproduce National Parks in Perfect Relief Maps

By DR. ANSEL FRANKLIN HALL

Chief, Field Division of Education, National Park Service

WHEN you visit your favorite National Parks this summer you may see, in their museums, some fine new relief maps, that will give you the benefit of an airplane view—an advance summary, at a glance, of the wonders you will behold in detail as you drive along the roads between giant trees, or stand breathless on the brink of a tremendous canyon.

For these you may thank our too-well-known acquaintance, Old Man Depression. For by drafting a lot of highly skilled and enthusiastic workers into the Army of the Unemployed, he put a store of training and knowledge at the disposal of the U. S. National Park Service that we could never have got in any other way. These men got at least subsistence, plus a chance to keep their various skills from getting rusty; you got the maps.

It all happened because the government wanted to find jobs for a certain number of C.C.C. and C.W.A. workers. Could the Field Division of Education use them?

Frankly, I wasn't too enthusiastic. If the personnel of our staff had been larger, I wouldn't have been enthusiastic at all. But we needed help, and here was our chance to get it.

With resignation that rapidly changed to astonishment and thanksgiving, we went through the file of applications from the local jobless.

I don't know what we expected. Certainly not what we got. Engineers, draftsmen, molders, sculptors, architects, artists, trained librarians, photographers, historians, book reviewers, newspaper men, advertising men, radio technicians, school-teachers.

We had 52 people working under the C.W.A. Of these at least eight were Ph.D.'s and at least eight more were candidates for Ph.D.'s. Over 75 per cent. of the men were university graduates; several were graduates of schools of arts and crafts. Twelve or fifteen were women.

In addition to the 52 C.W.A. workers we had six enlisted men between the ages of 18 and 21, from the local C.C.C. camp.

How did these intelligent, specially trained professional men and women feel about working for a laborer's wage? That, too, was a surprise. They liked it.

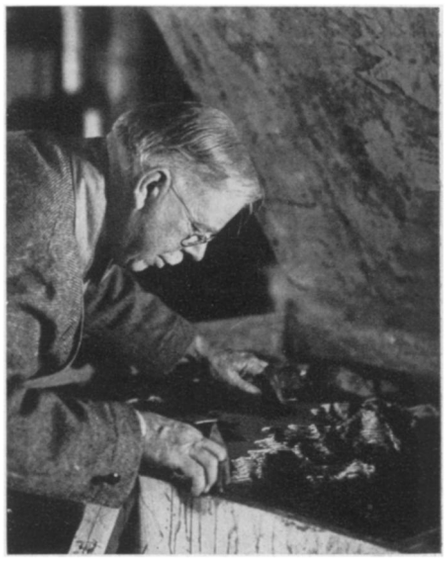
This is not by way of saying that they rejoiced at the change from $3,000 or $5,000, and in some instances more per year, to the C.W.A. scale ranging from 45 cents to $1.10 an hour. But many of these people had been out of work a long time. And many of them had never had the opportunity to do work they really liked.

In our shops, our laboratories and studios, each person did something he enjoyed. There was no commercialism, no rush, no competition. The job was the thing. Each one could take the time he needed to do his best work. Each one was encouraged to suggest new methods that made for better results.

The work was first carefully planned by our Museum Headquarters staff. Models of certain prehistoric animals, the 50,000,000 year-old bones of which are found at Petrified Forest, were needed for the museum there. Grand Canyon National Park wanted miniature models of pueblo and pit house dwellings found in the Grand Canyon region of Arizona. A series of pen-and-ink drawings to illustrate the history of the fur trade at Scotts Bluff. A relief model of Sequoia National Park . . .

The two buildings that house the shops devoted to map making were loaned by the University of California. There was no janitor. After the day's work was over everybody had to help clean up. This was usually complicated by certain enthusiastic ones unwilling to quit when the whistle blew. Believe it or not, it was harder to get them home when the work is supposed to be over at night, than back on the job in the morning. When I went down to the office on Sunday, I occasionally looked in at the studio and almost always found several —usually more than half—of the men at work. Why? Well, just because they liked it, and were accomplishing something.

The United States Geological Survey makes the so-called "contour" maps



PLACING THE CONTOURS

This phase of "mountain making" is being handled by an experienced civil engineer.

which furnish the data for our models. In these maps each 100-foot level is represented by a wandering brown line, following exactly the route that would be taken by a "side-hill gouger" on his course around a hill, if he could neither increase nor decrease his elevation.

Those squirming contours, all taken together, have a most confusing effect on the novice, but to the engineer, the Boy Scout, or anyone else trained in map reading, they present a key to the actual appearance of the country.

Where those brown contour lines occur far apart they indicate a gentle slope, when close, a steep declivity, and when they touch, as they sometimes do in the western mountains, that's the "jumping-off place."

The process of making the model is essentially the reverse of that by which the map was made.

Starting with the map, the model builder enlarges it to the desired scale—say four inches to the mile, as is the case in the one we are now making of Sequoia—an eight times enlargement.

The old style was to greatly exaggerate vertical height. We now keep as near the actual proportions as possible. Having decided on the scale, we find a thickness of cardboard that would represent 100 feet in height. Then we trace and cut the contours from the cardboard. These layers, piled one above the other, thus rebuild the country in miniature.

These large-scale maps of the national parks are invaluable in orienting the visitor. He sees the entire area as an aviator would see it, he finds his landmarks, traces his own progress in exploring its wonders.

To be of real value a model must usually be large. Not too large, of course, but big enough to show all the intricate details of the topography. Normally they may be as long as ten or twelve feet. But the Sequoia model is 18 feet square. Sounds impractical, but it isn't. It is built in 3-foot squares, sections that will fit slide-like drawers in a cabinet. Any four or six or eight can be fitted together on a long table, to give the section one wishes to examine closely.

There are eight steps in the making of such a map.

First lantern slides are made, in negative, from the original contour map. There are 36 of them for the Sequoia model. These were made by a C.C.C. boy who showed considerable aptitude in photography and who has been given special training so that he is now capable of doing any of our darkroom work.

Then the slide is projected onto cardboard of the thickness decided upon by careful calculation. The projection lantern must be moved back and forth until the image exactly covers a sheet of cardboard three feet square.

Then the map with its myriad little contour lines is carefully traced. This is a strange sight, for the lantern shines upon the tracer as well as the cardboard, decorating him with rivers, mountains, lakes. He has to stand always a little to one side of his work. Each contour line has to be traced on a fresh sheet of cardboard, full size.

Fascinating, but tedious, this work is now being handled by an electrical engineer and an architectural draftsman, both university graduates of several years technical experience.

Next comes the work of cutting out the traced contour lines. Two C.C.C. boys and a C.W.A. worker who was formerly a piano tuner and finisher did this. A little machine called a "cutawl" is used. It works on the same principle as a sewing machine, a minute chisel vibrating up and down with great rapidity. It is a vast improvement over the old, slower, dusty, motor-driven jigsaw method.

Much skill is necessary to keep the little needle accurately following a line, where a mistake of an eighth of an inch would make an error of 132 feet on the model represented. But our men don't make mistakes. They know that absolute accuracy is essential.

Perhaps the most tedious work of all is the pasting of these various cut-out contours, one upon the other. A professor of civil engineering and a consulting civil engineer have it in charge. Under their skillful hands plateaus and mountains rise as if by magic. They know the names of every tiny river, every little peak as these take form under their hands.

At one time we used very small nails to fasten these successive layers of cardboard together, but we had to improve on this method for we found that nails compressed the cardboard, and caused distortion. Now a waterproof glue made with silicate of soda is used, and the pieces are pressed into place.

Constant watch must be kept for error. If the cutter's hand has wavered, and one contour juts out over another as little as 1/32 of an inch, it must be patiently adjusted. Sometimes the glue slides ever so slightly in drying, carrying the cardboard contours out of place. Then they must be pried loose, carefully replaced in the proper spot.

When the work of assembling and pasting of one three-foot-square section is completed, it is fitted to the map as a whole. A flat section will be thinner than a mountainous section. Hence they are not all the same, and must be carefully built up with wood until all fit perfectly into place. Fortunately there was a professional cabinet maker available for this job.

Now comes the finer modeling and minute details of sculpture at the hands of one draftsman, one graduate architect, one National Park ranger, and two C.C.C. boys.

To remove the appearance of "steps" which is left when the pasting is finished, it is necessary to cover the cardboard with a thin, even layer of modeling clay. Then delicate details are finished by hand modeling, and when this is finished the entire surface is gone over with a dilute mixture of clay and water and finer tools, to give a forest finish. Mountain tops are left stark and bare.

And now it is the caster's turn. This plaster caster is the only man of the entire staff who is doing the work he is accustomed to. For years our caster has been making plaster casts. Speed was the watchword of his lifetime. If he weren't so good-natured he would have gone mad, waiting to snatch the model from someone's reluctant hands.

"That's finished, isn't it!—Here, I'll take it—"

"Mm . . . wait a minute. I want to look at this lake again. I want to ease it off, just a little—"

Our poor "Tony!"

But he's got used to it now. He, too, begins to enjoy sufficient time to make a perfect job.

The casting is done just outside the building. First the model is shellaced. When the shellac is dry the wet plaster is applied and the mold is made. This

ZION CANYON IN THE MAKING

The finished portion at the left represents the deep chasm known as "The Narrows"; the portion at the right shows the steps between the contours which will later be filled with prepared modeling clay.

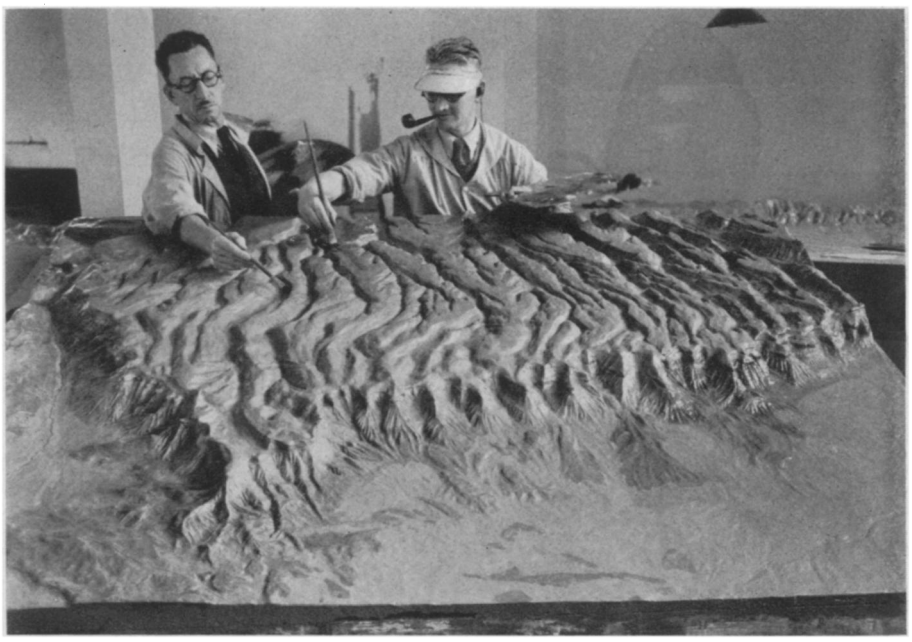
mold is the "negative"—just the opposite from the original model; ridges are valleys and valleys ridges. But when the casts are made from the mold, they, like the original, are "positive."

Each piece weighs between 25 and 150 pounds, depending upon whether the section is level or mountainous.

Then the cast is sent over to our studio department where the artists take it in hand and try to make an exact reproduction of nature as it would appear from an airplane flying at the height of several miles.

Work such as we have been doing in our laboratories has an actual money value of thousands and thousands of dollars—far more, in fact, than the Government put into the work. It has permanent value, for each model of this sort will be placed in one of the national park museums where it will interpret the story of the park to the many thousands of American citizens who will see it each year and whose vacations will be made the more enjoyable by a thorough understanding of what they see.

Science News Letter, May 18, 1935



FINISHING MESA VERDE

Mesa Verde National Park occupies the top of a plateau in southeastern Colorado.

PHYSIOLOGY

Nicotine Affects Nerve-Ends In Muscles, Not the Brain

A PERSON poisoned by nicotine stops breathing because the nerve endings in the muscles of his breathing apparatus are paralyzed. The drug does not paralyze the breathing center in the brain, as has been generally believed.

These discoveries, which suggest a new method of treating nicotine poisoning, were reported by Drs. Harry Gold and Frederick Brown of Cornell University Medical College, New York, at the meeting in Detroit of the American Society for Pharmacology and Experimental Therapeutics.

Artificial respiration, rather than drugs to stimulate the breathing center in the brain, is the method suggested by the Cornell investigators for treating cases of nicotine poisoning in which breathing has been dangerously slowed or stopped altogether. Stimulating drugs can only make matters worse in such cases, they pointed out, because the partially paralyzed nerve endings require rest, such as can be obtained by artificial respiration. A substance like barbital, which has a depressing rather than stimulating effect on the nerves, can abolish the convulsant action of nicotine, they found. An animal treated with this substance can survive an otherwise fatal dose of nicotine.

The new knowledge of how nicotine acts to stop breathing was obtained in several ways. First, direct application of the drug to the respiratory center in the brain caused marked stimulation of breathing, the Cornell investigators found, but even very large doses of nicotine applied to the brain center failed to cause paralysis of breathing.

Secondly, nicotine was found to be more poisonous when injected into a vein than when injected into the carotid artery, the principal artery of the neck. If the action of nicotine was directly on the respiratory center, the reverse should have occurred, for when the drug is injected into the carotid artery it goes directly to the brain without passing through the lungs. When injected into the veins it goes to the lungs first. This, therefore, indicates that the seat of the toxic action is not the brain respiratory center.

Thirdly, it was found that after nicotine the power of the nerve endings to carry impulses from the brain center to the muscles was markedly reduced or abolished. Significant evidence was also obtained by means of a special device by which the minute electrical potentials produced in the brain were enlarged through radio tube amplifiers and recorded with the string galvanometer. When all signs of breathing had ceased after nicotine, the cells of the breathing center in the brain were still continuing to send down volleys of electrical discharges in a normal manner, showing conclusively that the nicotine did not injure the breathing center.

Science News Letter, May 18, 1935

Clipping shrubbery to resemble animals, ships and other curious shapes was a garden custom popular with the ancient Romans.

●RADIO

Tuesday, May 21, 3:30 p. m., E.S.T.

THE MOSAIC OF NATURE, by Dr. George J. Peirce, Professor of Botany, Stanford University.

Tuesday, May 28, 3:30 p. m., E.S.T.

FOODS WE EAT AND WHY WE EAT THEM, by Prof. R. Adams Dutcher, Department of Agricultural and Biological Chemistry, Pennsylvania State College.

In the Science Service series of radio addresses given by eminent scientists over the Columbia Broadcasting System.