

A RAPID METHOD OF DRAFTING AN ACCURATE MAP FROM VERTICAL AERIAL PHOTOGRAPHS

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Annotation of Photographs

ALL features to appear on the final map, unless obvious on the photographs, are to be first annotated in ink on any one of the photographs on which they occur. That is, all such annotations need be made on but one member of some stereo pair. Part of these annotations may appear on one member of a pair, and part on the other. For instance topographic contours may be drawn on alternate photographs from those containing cultural features or geology.

Radial-Line Plot of Principal Points

A radial-line plot by any standard method should be made of the principal points of all the photographs involved in the map. This must be to a scale enlarged over the average of the photographs in approximately the ratio of $b+s$ over b , b being the average distance on the photographs between centre and side principal points, and s being the separation of the photographs when mounted for stereo view (for ordinary lens-type stereoscope approx. $2\frac{1}{2}$ "). The exact scale of this radial-line plot should be determined, and for this purpose the radial intersections include the two ends of some base line of known horizontal distance. The scale of the plot will be $1:S_r$. S_r may be determined by either $S_r = (1_n/1_r)$ or $S_r = S_m(1_m/1_r)$, where 1 is the length of this base line: n , in nature, m , on a map of $1:S_m$ scale, and r , on the radial-line plot.

Preparation of Traceofilm Sheet for Map

A sheet of traceofilm or kodatrace is used on which to draft the map to the scale of the radial-line plot. First the sheet is laid over the radial-line plot, all principal points traced, together with lines joining these. Then two or more photographs at a time are mounted to drawing board or table top, and secured with scotch tape in the precise position called for by the traceofilm sheet, i.e. so that the latter can be laid over them to bring the principal points into coincidence, and side principal points exactly under the lines drawn connecting the principal points.

Preparation of Drafting Device

The drafting device consists of pins, fine black thread, small weights and ordinary pencils. The scheme is illustrated in Figs. 1 & 2. Slender pins or needles are pushed into the board through the principal points, and 2 pins at the right edge of the table as shown. The thread is passed around the several pins as shown. The weights hanging over the edge of the table will keep the thread stretched at all times. The thread is tied to the tip of an ordinary pencil (about 4 H) sharpened to a slender point. The free ends of the thread above the knot are fastened to the shaft of the pencil with a bit of scotch tape, to prevent the loop slipping off the tip of the pencil.

Stereoscope Used in Drafting

Drafting with this device must be done under a stereoscope. The best type to use is indicated in Fig. 1. The lenses should be 5 diopter corrected meniscus spectacle stock and made to ride at a height of $7\frac{3}{4}$ " above the top of the table.

Arrangement when drawing near side of principal points

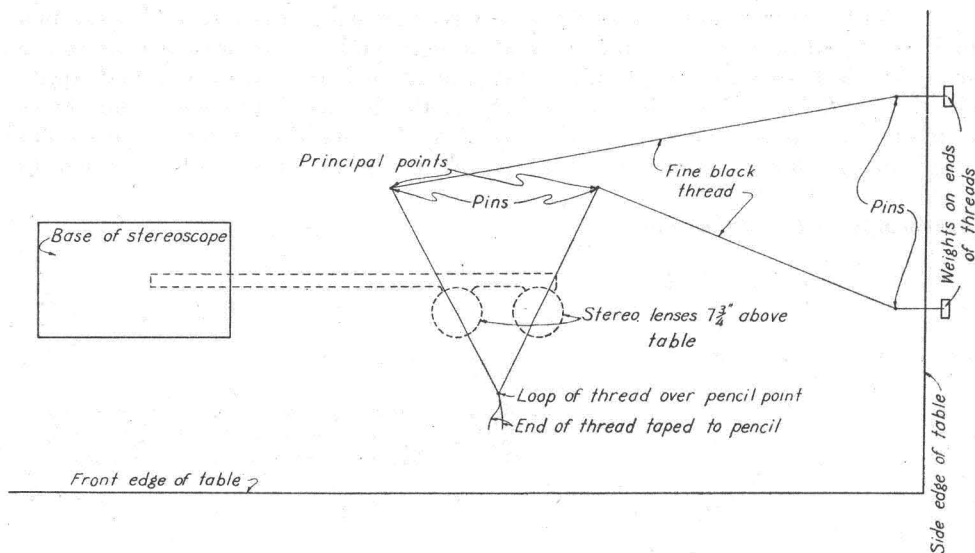


FIG. 1

This is high enough to allow ample room for the unobstructed use of the drawing pencil beneath. The frame holding the lenses should be carried on an arm extending out several inches from a weighted base resting on the table on the left side and clear of the area being drawn.

Arrangement when drawing far side of principal points

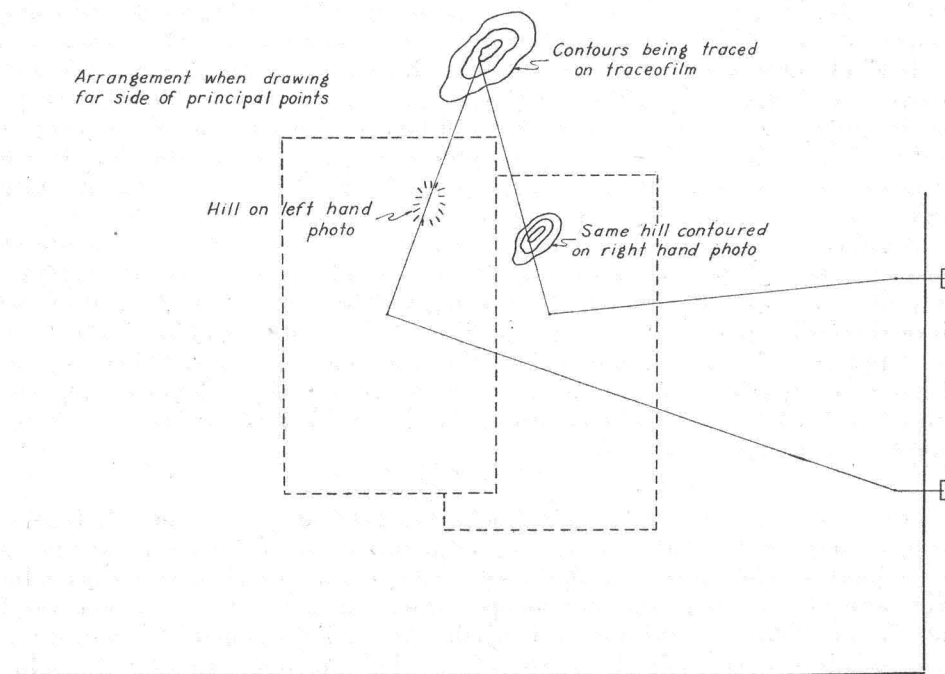


FIG. 2

Drafting Procedure

Under the stereoscope one sees the apparent crossing of two threads as shown in Figs. 2 and 3. The traceofilm or kodatrace is sufficiently transparent to see stereoscopic fusion of the photographs, and all features to be mapped, quite clearly. To draw a given contour, merely guide the pencil in such a manner as to make the apparent crossing of the two threads trace the contour seen stereoscopically. To locate any map feature, merely bring the crossing of the thread to

Appearance under stereoscope

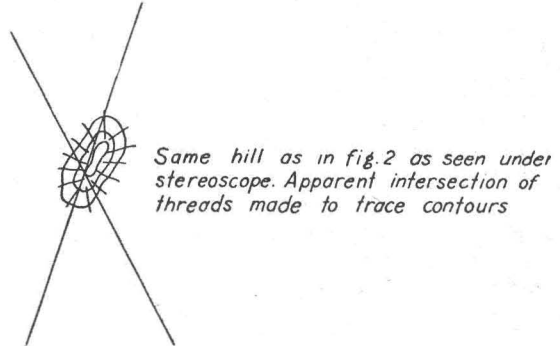


FIG. 3

that feature, on the photographs. The following of contours, streams, etc., will be found to proceed rapidly and accurately because the pencil always moves in the same direction as possessed by the lines followed by the eyes. One quickly gets the illusion that the muscular movement of guiding the pencil is directly applied to the *X* being seen, and the process is as simple as actual tracing.

It will be observed that the pencil-drawn lines will in large part unavoidably lie over the photographs, without corresponding as to position of details (except for the principal points). No confusion will be experienced from this as long as drafting is done in pencil, and photograph features are annotated in ink. If one wishes to see the pencil-drawn work separately, merely slip a sheet of white paper between the traceofilm and the photographs.

Another unavoidable condition of this method (as here described for use of lens-type stereoscope) is the overlapping of one photo over the other, which prevents the entire stereo model from being visible at one time. After drafting all of the visible part, one will have to lift the pins and traceofilm, reverse the overlapping of the prints, and replace the traceofilm and pins. (There are no theoretical objections to using a mirror stereoscope with the photographs entirely free of each other. The chief disadvantage of this is the enlarged scale required for the map.)

Blind Area

A narrow area along the principal point line is blind by this method. To plot the true map location of as many selected points on the principal point line as desired, proceed as follows: Mark the selected point accurately on the traceofilm over both photos under the stereoscope. Mark similarly any other point well outside the blind area. With a straight edge, rule a light pencil line connecting the two points so determined over the left-hand photo, and again over the right-hand photo. The two lines so ruled will appear under the stereoscope in fusion as a "floating line." Select any two points on this floating line outside the blind

area, preferably where the line appears to lie on the ground or not too high above it. Bring the apparent intersection of the threads to each of these points in turn, marking with the plotting pencil the corresponding map location on the traceofilm. (Note that the threads must intersect on the floating line, if this lies above the ground, not on the ground beneath.) The last two points so established on the traceofilm may be joined with a straight line, extended to the principal point line, to give the map location of the original selected point.

It will be found in practice that recourse to this method need very seldom be used. As drafting skill is gained, contours and other lines may be drawn into and through the blind area with more and more assurance. This is a matter of co-ordination between the muscles in the hand guiding the pencil and the eye following the crossing of the threads. Remember that the line actually drawn follows the same pattern, proportions, and orientation of that seen.

Final Map

After all pencil lines are drawn on the traceofilm, this should be photographed or photostated to the desired scale for the final map. This will then be drawn in ink on tracing cloth by direct tracing, at which time proper symbolic differentiation of drainage, topography, culture, etc., is made and all lettering is performed. During this inking process, the original photos may be consulted to clarify all lines and points whose meaning may have been forgotten.

Theoretical Basis

The theoretical basis underlying this map-plotting device should be apparent to all readers familiar with the elementary principles of radial-line control. What this device accomplishes is the placing of every map detail automatically in radial-line location. Thus the map is fully corrected for errors on the original photos from relief, tilt, and scale variation from one photo to the next.

The theory behind locating points along the principal point line depends upon the principle of all straight lines in nature photographing as straight lines. Hence any pair of straight lines on the photos which fuse stereoscopically define such a straight line in nature. The map position (orthographic projection) of this line can be drawn from determining it for any two points, and connecting by a straight line.