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CROSS SECTIONS OF SOUTHERN ARIZONA AND ADJACENT PARTS OF CALIFORNIA AND NEW MEXICO

by

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Abstract

In an attempt to simplify the regional understanding of southern Arizona, I have prepared a series of 51 miniature cross sections which cover an area of almost 150,000 square miles. They cover roughly the area from the Mogollon Rim south to the Mexican border in Arizona, and they extend eastward into New Mexico across the Rio Grande and westward into California to the Salton Sea and well into the Mohave Desert.

The cross sections are drawn on the horizontal scale of four miles to one inch, and the vertical scale of 2,000 feet to one inch, making a vertical exaggeration of about ten to one. They are oriented N 60° E and parallel to one another at intervals of eight miles. Average lengths of six feet (300 miles) make them convenient for table size study.

The geology was compiled from published and available information with sources of information indicated beneath each feature. Portions of eight cross sections and an index map of the entire coverage are included with this report.

The set of 51 cross sections and 22 marked topographic base maps has been given to The University of Arizona for release through the Arizona Bureau of Mines by the open-file method.

It is hoped that the study of these cross sections will aid geologists as a time-saver in forming many preliminary ideas directed toward further study.

Geologists have always been and remain largely perplexed by the great variation of rock types and geometric arrangements exposed in the isolated mountain ranges of southern Arizona. Any reconstruction of the region's geologic history requires the reordering of many fragments. Precambrian and Paleozoic history has been scrambled by subsequent Mesozoic tectonism and all three of these were again rearranged by multiple Cenozoic events.

More than half of southern Arizona geology is concealed by flat-lying recent alluvium. The hard-rock exposures, surrounded by alluvium, are the only available pieces in the "jigsaw puzzle" with which to fit together the regional geology and its explanation. The study of publications on individual features and areas leaves one with a rather vague understanding of the regional relationships. The pieces often appear to be fragmental and unrelated.

In 1966 I started a series of miniature cross sections in an attempt to simplify the problem and to bring together in one regional study all of the published and available data. The attempt has been at least partially accomplished by showing each feature in its geographical relationships to the surrounding geology. In 1974 the 51 cross sections had reached a practical stopping point.

The set of sections together with the index maps has been given to The University of Arizona for release through the Arizona Bureau of Mines by the open-file method.

Portions of eight cross sections (cross sections 37, 40, 50, 52, 55, 61, 69, and 71, Plate 1, in pocket) are presented with this report together with a generalized index map (Fig. 1) showing the coverage of the entire project. The illustrations, which are reduced somewhat from the originals, show the manner of compilation and the references to source material.

Method of Construction

The orientation of N 60° E, essentially common to all the sections, was selected in order to cross the average structural grain at right angles. All are generally straight lines that are parallel to each other at intervals of about eight miles. The variations from straightness and in interval are quite significant because they allow the inclusion of many geographical place names, peaks, canyons, outcrops, and faults that would be missed by straight lines and precise intervals.

The base maps are the two-degree topographic maps of the U.S. Geological Survey on the scale of 1:250,000 commonly called the "Army Map Service" sheets. Thus the horizontal scale of four miles to one inch allows the average 300-mile length to be about six feet long which is a manageable table size. After experimentation, the vertical scale of 2,000 feet to one inch was selected with the resulting vertical exaggeration of about ten to one. Each section is marked by stars as guides for matching them geographically in series.

Planning of the section lines was not done hastily. It was done by comparing the topographic and geologic maps so as to present on each section a maximum of information on place names, geology, and topography. The many slight angles and interval variations should not interfere with practical understanding and use.

Once the lines were selected, they were inked on the base maps, usually in groups of 10 or more at a time. By handling each step in the construction in groups of sections, a great deal of time was saved. The tracing cloth was cut to the planned size with the sea-level line inked, as this line was the basic control for all later work. Topographic profiles were constructed by pencil on worksheets and later traced on the cloth strips. Even though the base maps show only 200-foot contour intervals, probably an accuracy within about 30 feet was attained by using peak elevations and benchmarks and by interpolation between contour lines. Horizontal control closely followed the base maps, and each section is a layover along the inked line on the base map.

Construction of the geology followed no set rule. The detailed mapping covered the most interesting areas, while the county and state maps furnished the background or the spaces between the detailed spots. I had best results by pencilling the geology on the tracings over areas of several thousand square miles at a time before inking. In this way, I felt that I had gained a certain "experience" in the interpretation of the

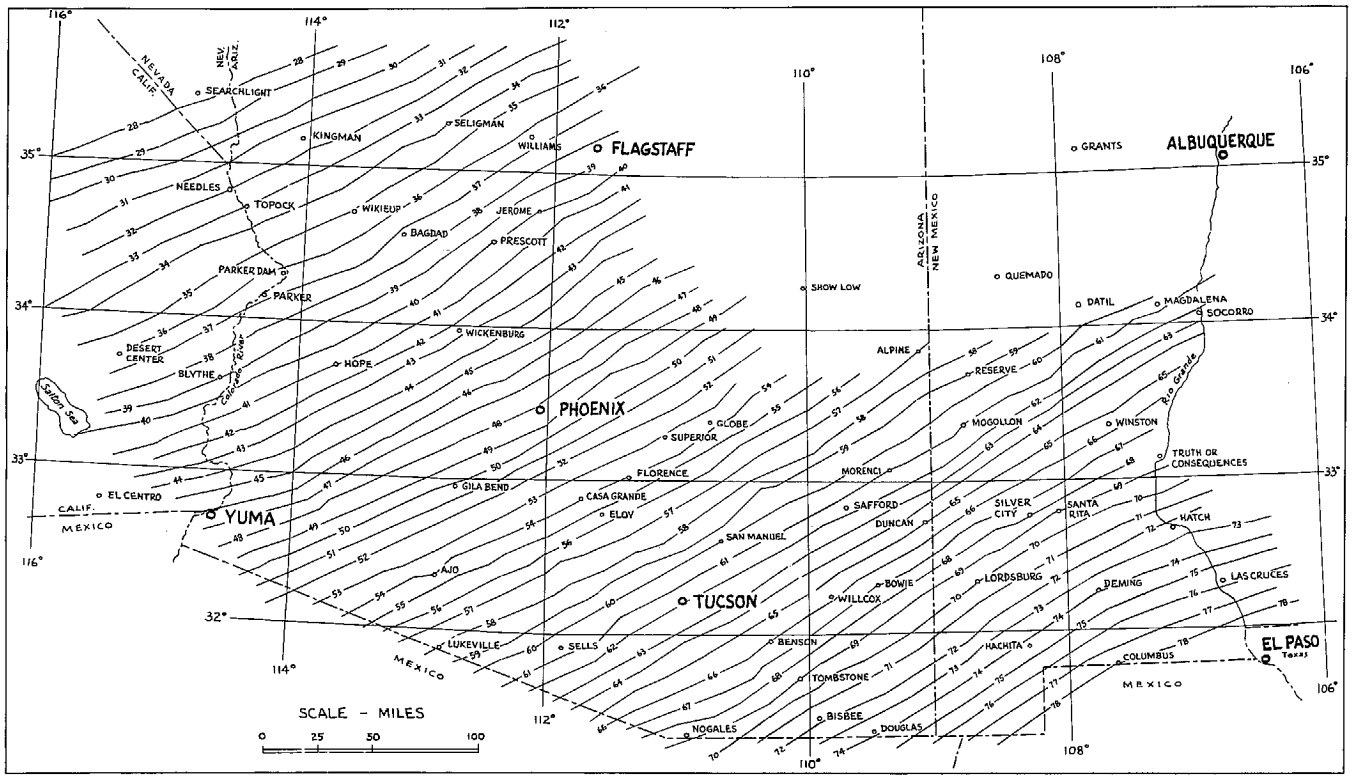

Figure 1. Cross section index map, southern Arizona and vicinity.

geology of that particular area. Wherever possible I adapted my interpretation to the detailed cross sections found in the literature and published maps. While assembling the geology, I examined aerial maps on both sides of the section line so that every isolated outcrop might be considered in the interpretation.

The sources of information are shown beneath the various geologic features as a sort of graphic bibliography.

Extent and Coverage

The 51 cross sections present a total of about 15,000 linear miles and cover an area of almost 150,000 square miles. The north limit is from Socorro, New Mexico, through Flagstaff, Arizona, and almost to Searchlight, Nevada. The east limit is from Socorro, New Mexico, south to White Sands and to near El Paso, Texas. The south limit is the Mexican border. The west limit is from the Salton Sea, California, north to near Searchlight, Nevada.

Purpose and Suggested Uses

The project is an attempt to simplify the understanding of the geology of southern Arizona. But the geology is not simple. It involves one of the most complex and least understood areas of the United States.

The cross sections may be particularly interesting to geologists who have not worked before in Arizona, but perhaps, also, many already familiar with Arizona will see new relationships.

I would like to be able to say that this is "geology at a glance." But this is not true. A geologist must first color the cross sections in some skeleton form to bring out the pictures that interest him most. This will take several days, but in that time he will have seen many interesting relationships, and a newcomer will have learned much about the geology. Such an introduction could lead to many preliminary or tentative conclusions to be tested by further work.

It is hoped that this will be a time-saver in that it presents a graphic assembly of much of what has already been done by hundreds of geologists. The coverage actually seems to magnify the known geology of the region by bringing together the work of so many people.

There are similarities to computer work in that the geology is "programmed" in miniature, thus relieving the geologist of the task of remembering great masses of detail.

Each section, drawn independently, naturally has a similarity to its neighbors, and each one shows relationships that might bear on interpretations elsewhere. Because of different interests and specializations, no two geologists are likely to see precisely the same things in these cross sections.

I claim no credit for any of the past geological work. My effort has been nothing more than office compilation. If the lines drawn on the sections suggest causes and relationships, they are not necessarily intentional. The idea was to draft the features in such a way that they will be helpful to others and to leave the conclusions to the viewers.

Acknowledgments

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