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QUARTERLY PROGRESS REPORT  
LANDSAT-2 INVESTIGATION NO. 22840  
REMOTE SENSING IN MINERAL EXPLORATION

NASA-ER-149438

FROM ERTS IMAGERY (Contract No. NASA-5-20955)

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The following is a brief summary on progress to October 15, 1976 of the subject investigation. It is the primary purpose of this investigation to determine the value of Landsat imagery in mineral exploration in the Utah-Nevada mineralized belt. The techniques employed are standard geological and geomorphological methods based primarily on aerial photographic experience in the past and applied to Landsat imagery, U-2 imagery, and aerial photography.

Forty-six percent of the known ore deposits in the subject area occur within 2 kilometers of igneous intrusions, and seventy percent occur within 10 kilometers. Therefore the first investigation was aimed at the ability to detect igneous intrusions. The methods used were tonal analysis, drainage pattern analysis, and slope analysis. The results indicate that all three of the techniques, or any combination of them, failed to locate igneous intrusions with a statistically significant accuracy. Of the various data used, U-2 photography in stereoscopic viewing gave the most reliable results.

A second major effort was directed toward the study of lineaments in relation to ore deposits and igneous intrusions. By means of a moving grid it was determined that many of the intrusions are aligned and in directions other than that of the ranges themselves. However lineaments passing through these intrusions were not found by the study of Landsat imagery. Careful studies were made of the percent of area covered by lineaments and lineament intersections. In all except one case it was found that the distribution of ore deposits was not significantly related to either lineaments or lineament intersections. The same is true for igneous intrusions. In summary it is believed that the mapping of lineaments and lineament intersections will not significantly benefit the determination of location of igneous intrusions and/or ore deposits in the Utah-Nevada mineralized belt.

A further study was made of known mineralized trends and lineaments mapped on Landsat and U-2 imagery. Again no significant relationship was found between these two features. For example the well-known Battle Mountain-Eureka trend does not show as a lineament on any of the available imagery.

The one alignment which was found to be in apparent relationship to possible ore deposition were volcanic cones visible on Landsat and U-2 imagery. Alignment of these cones, usually made of basaltic material did parallel several known mineralized trends. Field investigation and low altitude overflights indicated that about half the cones could be seen on Landsat imagery once the trend was established.

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In summary, standard photogeologic techniques, with field check, do not appear to give significant results in the location of either igneous intrusion or ore deposits in the Utah-Nevada mineralized belt when applied to Landsat imagery. Drainage analysis, tonal analysis, slope analysis, and lineament mapping all failed to show significant relationships. The incomplete study of basaltic volcanic cones aligned on the Landsat imagery holds some promise and is being pursued.