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Stereocombination of Landsat and aeromagnetic data, Claunch, New Mexico

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Memorandum for the Record (EC-72-Landsat)

By: EROS Coordinator, Topographic Division

Subject: Stereocombination of Landsat and aeromagnetic data, Claunch, New Mexico

In the digital domain, there is no limit to the types of spatial data that can be correlated, but graphic displays are basically two dimensional while the stereo mode permits the observer to interpret a third dimension. Many earth scientists use a stereopair of aerial photographs as well as a topographic map (if available) to study landforms since a topographic map is a sampled display (contour interval) rather than a continuous portrayal of relief.

The attached graphic illustrates a new concept whereby a parameter other than topography is displayed stereoscopically as the third dimension. In this case, the spatial variations in the magnetic field are shown continuously in place of natural terrain elevations. Such a stereo portrayal depends on the accurate correlation of the magnetic data to the Earth's surface which in this case, is represented by a Landsat image. This was made possible by the simultaneous acquisition of aerial strip vertical photography along with the aeromagnetic recordings. The strip photography was in turn correlated to the Landsat image, which has been registered to the figure of the Earth as indicated by geographic ticks. This same type of data could have been portrayed on a line or image map with the magnetic data shown as numbered contours similar to a topographic map.

This stereocombination of unlike data sets was first demonstrated by the USGS Center of Astrogeology, Flagstaff, Arizona during 1975 when they combined digital topographic data with Landsat. It was reported in EC-27-Landsat (October 10, 1975) by this office. This combination of Landsat and magnetic data results from a project conducted by William Fischer of the EROS program, USGS. The correlation for this product was performed by the Commonwealth Science and Industrial Research Organization (CSIRO) in Sydney, Australia which also produced the

original stereoimages. Stereopairs, in color transparency or print form, at about 1:800,000 scale can be ordered from the EROS Data Center, Sioux Falls, South Dakota 57198. Order numbers are E-773-99-CT and E-774-99-CT.

This example demonstrates the need for accurate location of any spatial data set which may be correlated with other spatial data. The accepted basis for locating spatial data is the figure of the Earth as geodetically defined by latitude and longitude. Precise maps project this figure of the Earth on a specific map projection which permits plane-coordinate referencing. Thus anyone who wishes to establish new data sets in a form compatible with other data sets must tie such data to precise maps, if not to geodetic control. The accuracy by which this is done should be commensurate with the resolution or sampling interval of the data being acquired If data is obtained at 10-m intervals, the positional accuracy of such data should be in error by no more than 10 m if its full value is to realized. In the attached example the aeromagnetic data was not controlled directly to maps but instead to the Landsat image. Fortunately, Landsat images have known internal geometry and can be correlated to the Earth figure through existing topographic maps. In this case, the positional accuracy is only about 500 m which is adequate since the magnetic data was recorded along flightlines of 1,600 m (1-mile) spacing.

With developments of digital data bases, there is no reason why similar stereocombined graphics cannot be produced based on a variety of data sets. Further research is needed to determine what types of data warrant display in stereocombined forms as opposed to conventional graphics. Undoubtedly, there are many data types that can be so displayed, and the technology to do so is now established.

Inquires for further information on this matter should be addressed

to:

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Reston, VA 22090

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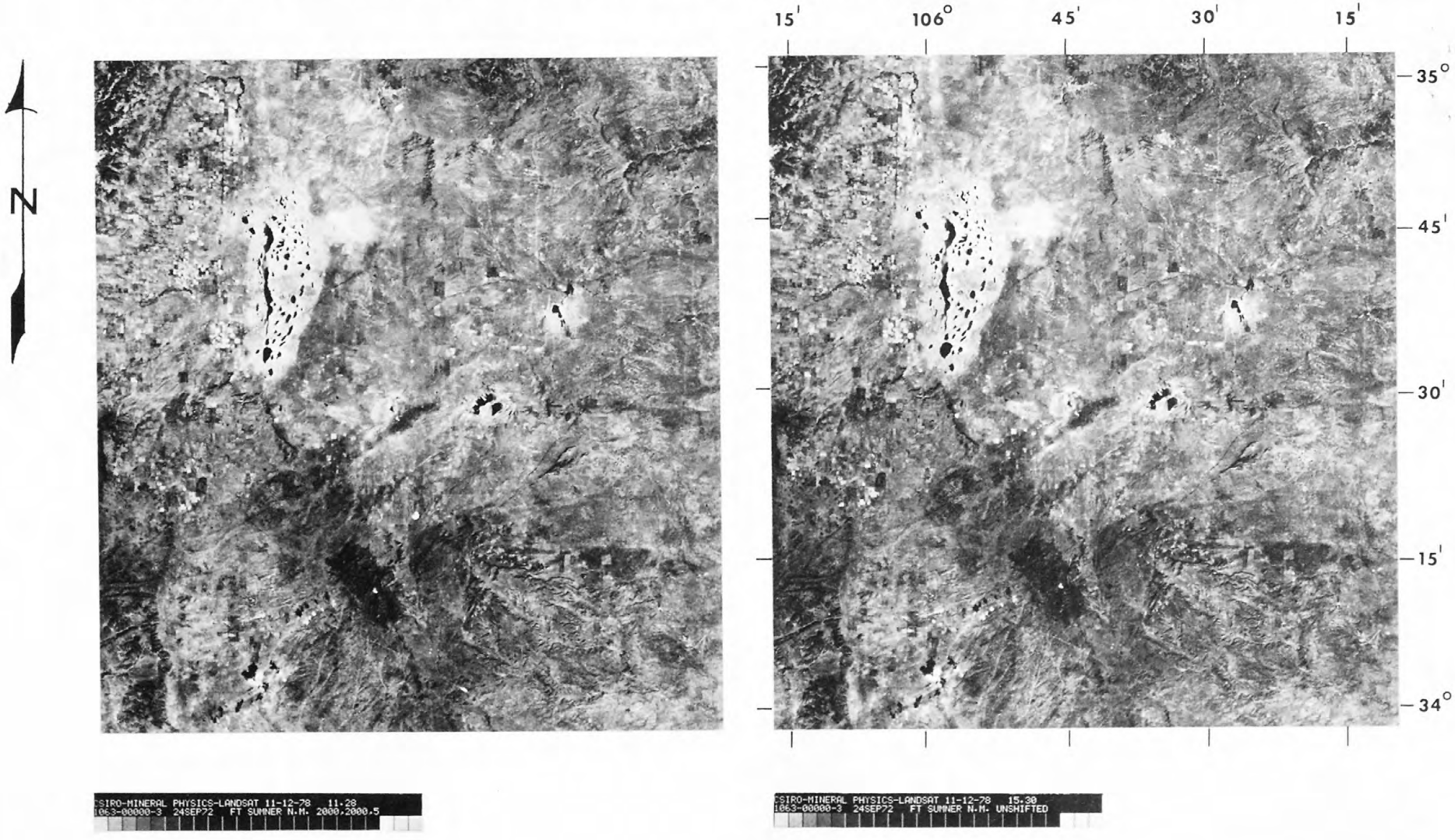
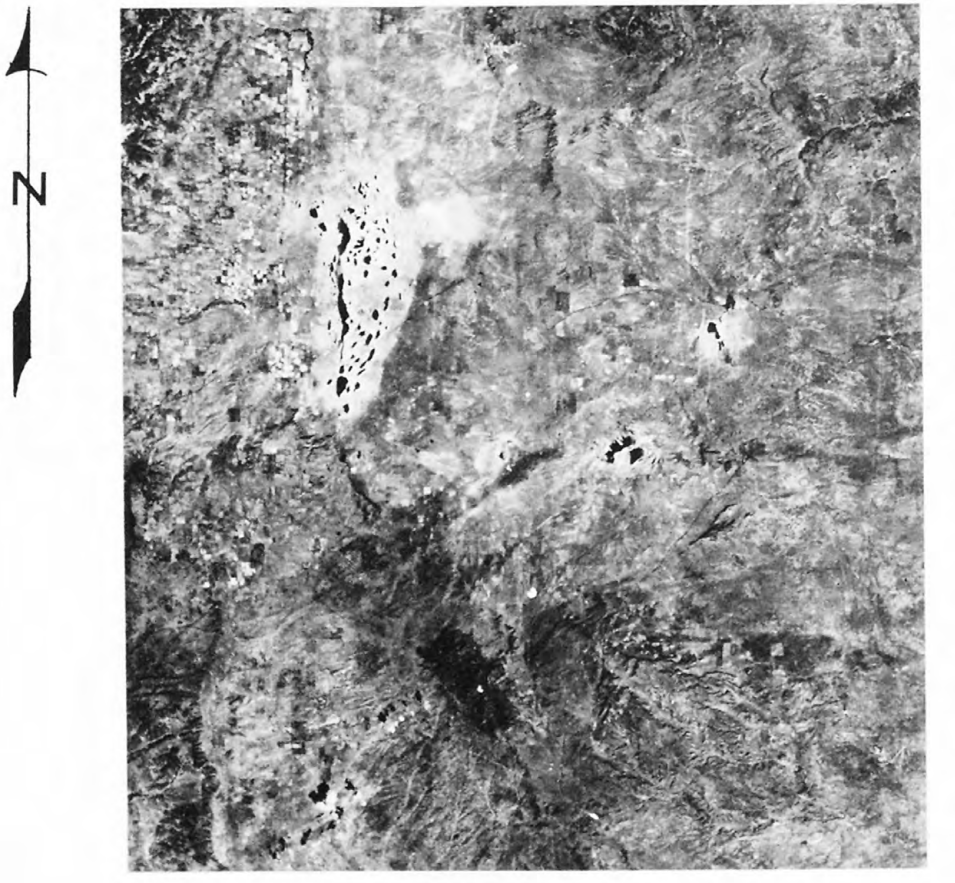
Attachment

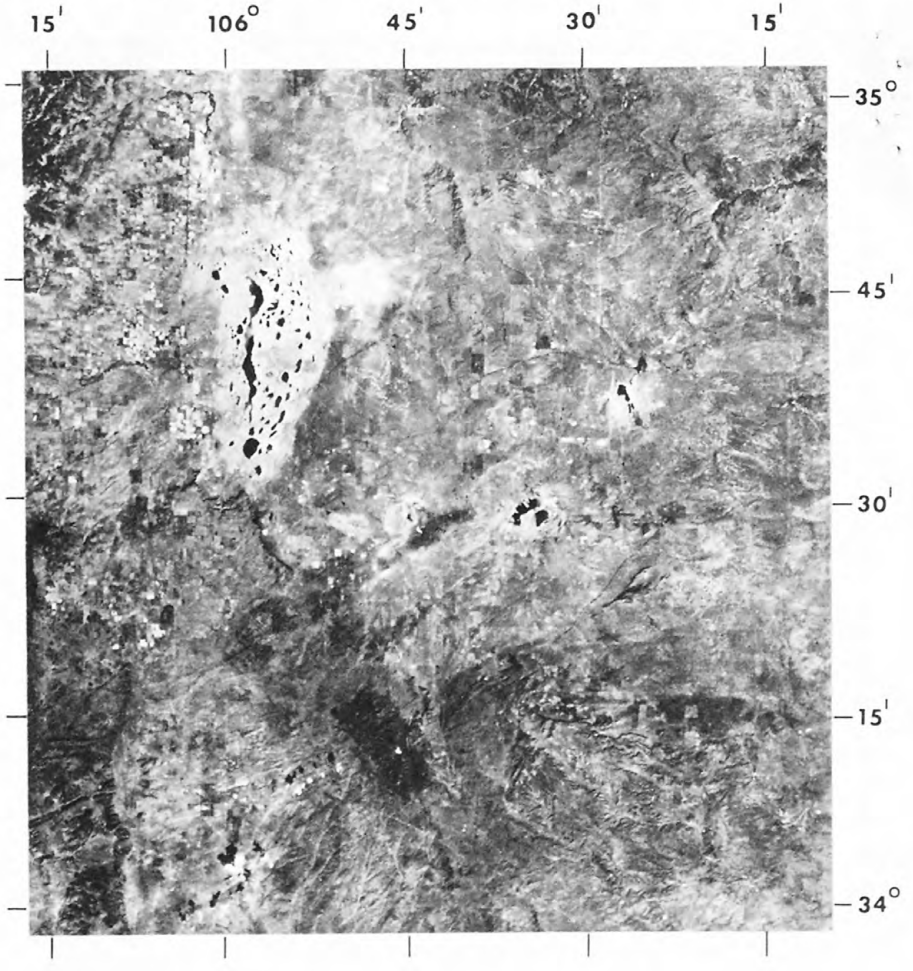
STEREO COMBINATION OF LANDSAT AND AEROMAGNETIC DATA, CLAUNCH, N.M.



Stereopair produced by digital correlation of Landsat and aeromagnetic data. The third-dimensional effect (stereo parallax) represents a shifting of the Landsat data on the left-hand image proportional to the local strength of the magnetic field. Areas of high magnetic flux appear as hills and areas of low flux as depressions. The high appearing plateau on the left side of the image pair is an area where no magnetic information was applied. The images should be cut apart and positioned for optimum stereo viewing.

STEREO COMBINATION OF LANDSAT AND AEROMAGNETIC DATA, CLAUNCH, N.M.





5 0 10 20 30 40 50 KILOMETER

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