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GRAVITY AND MAGNETIC ANOMALIES IN THE SAN JUAN BASIN AREA

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Abstract—Regional gravity and magnetic maps that include the San Juan Basin area (e.g., Cordell, 1984; Keller and Cordell, 1984) demonstrate that there are many significant anomalies present. Here, we present a series of relatively detailed maps that enhance these anomalies and briefly comment on their geological significance. Our primary goal is to present these maps for the use of those interested in this region and to illustrate their utility.

GRAVITY AND AEROMAGNETIC ANOMALY MAPS

The geophysics group in the Department of Geological Sciences at The University of Texas at El Paso maintains an extensive database of gravity and magnetic measurements. These data were used to construct Bouguer gravity and total magnetic intensity anomaly maps of the San Juan Basin area. The San Juan Basin area contains more than 21,000 gravity and 17,000 magnetic data points. The data sets were processed to form a 2-km grid using a minimum curvature algorithm. A first-order polynomial surface was removed from both graips before they were filtered. The filtering algorithm employed was a generalized band-pass/strikepass filter based on the Hartley transform (Adams et al., 1991). The maps were filtered to pass wavelengths from 20 km to 800 km. In addition, a gravity map was filtered to reject strikes from 85° to 225° east of north. These strikes are perpendicular to the prominent east-northeast-trending gravity low that crosses the basin.

The filtered gravity maps (Figs. 1 and 2) are dominated by maxima associated with basement uplifts. The Nacimiento and Zuni uplifts are of primary interest here. The northwest-trending gravity high associated with the Zuni uplift indicates that this feature is much larger than the actual Precambrian outcrop area. As discussed by Woodward et al. (this volume), the Nacimiento uplift and its bounding faults have been of interest for many years. The gravity maxima associated with this uplift correlate very well with the outcrop area. The steep gravity gradient on the west side of the uplift attests to the steep dip and large throw on this fault.

There is a distinct regional east-northeast grain in the gravity map shown in Fig. 1. This trend correlates with the dominant anomaly in the aeromagnetic map discussed below, and gravity anomalies with this trend were enhanced to produce the map shown in Fig. 2. This map demonstrates the importance of Precambrian features, which reflect the evolution of the crust in this region.

The dominant feature on the aeromagnetic anomaly map (Fig. 3) is the northeast-trending low that extends across the San Juan Basin, passing just north of the Nacimiento uplift. Cordell and Keller (1984) showed that this anomaly passes through the Rio Grande rift onto the Great Plains. This anomaly is offset as it crosses the rift and the Sangre de Cristo Mountains, indicating the presence of a series of right lateral strike-slip faults (Cordell and Keller, 1984). It also follows the general structural grain of the Precambrian basement in the region (Grambling et al., 1988) and generally correlates with outcrops of the Ortega Group in the Sangre de Cristo Mountains. Such metasedimentary rocks would be expected to have a relatively low magnetic susceptibility, and thus this negative anomaly probably correlates with a thick metasedimentary sequence. Cordell and Grauch (1985) undertook a sophisticated analysis of this anomaly in the San Juan Basin area and mapped a northeast-trending zone of supracrustal rocks, which probably corresponds to

FIGURE 1. Residual gravity anomaly map, filtered to pass wavelengths from 20 to 800 km.

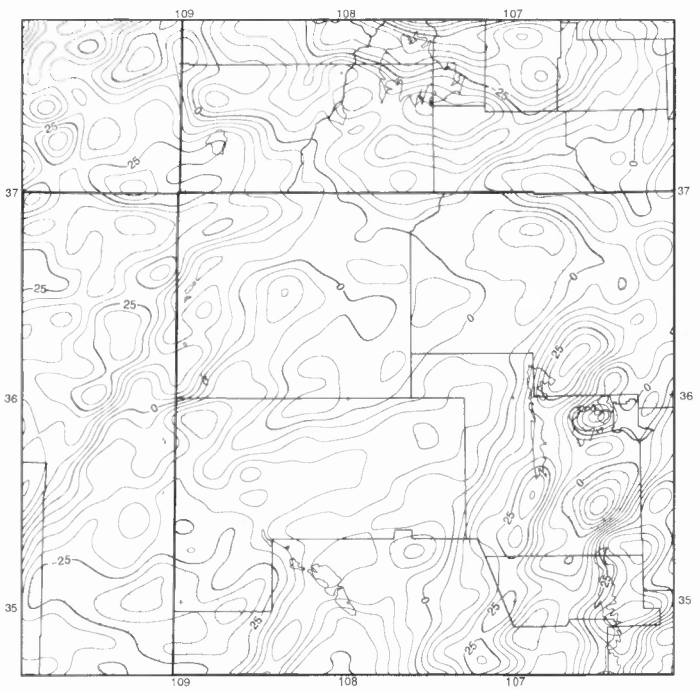

FIGURE 2. Residual gravity anomaly map filtered to pass wavelengths from 20 to 800 km, and strikepass filtered to pass strikes of 85°–225°E.

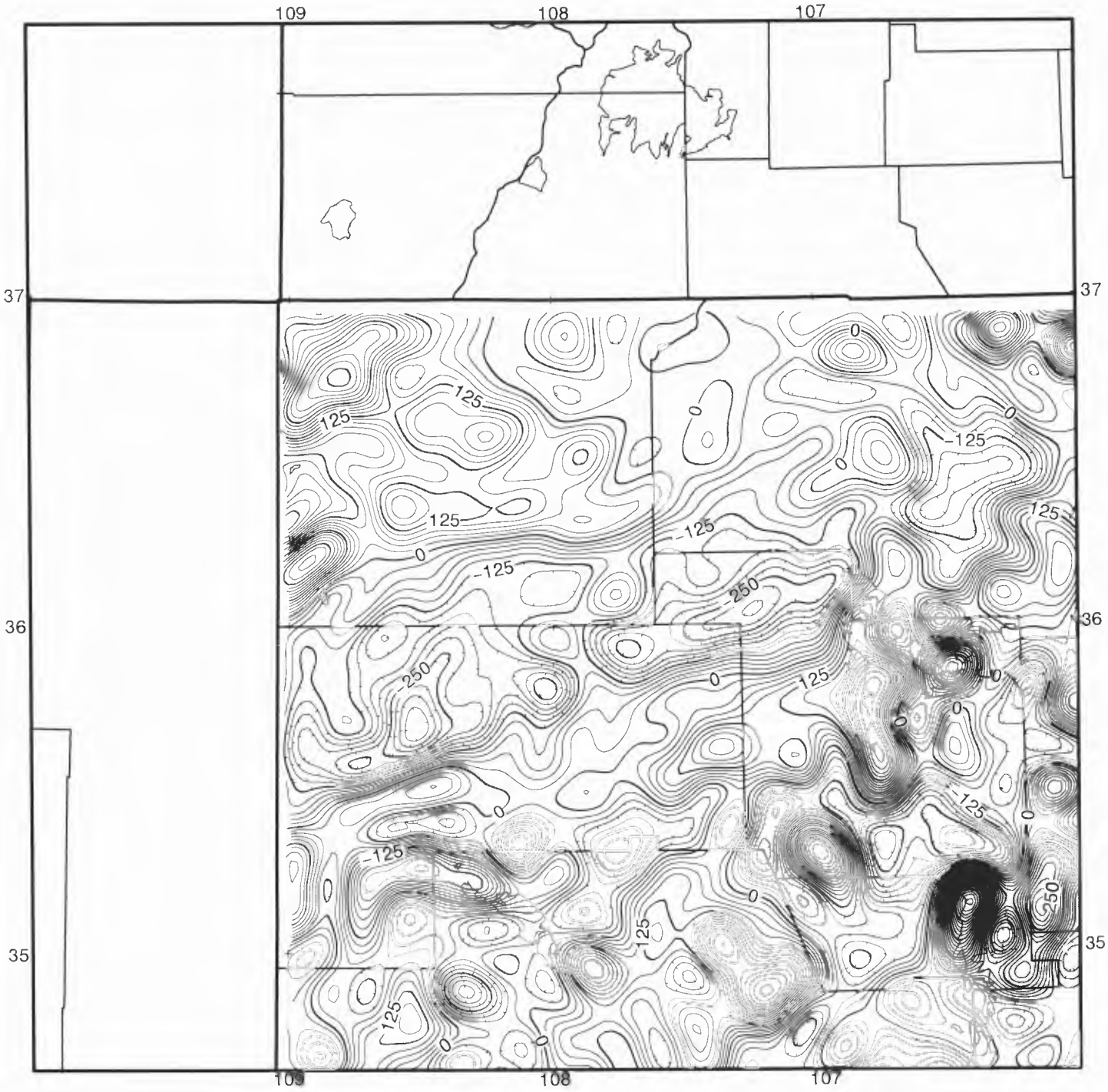

FIGURE 3. Residual magnetic anomaly map filtered to pass wavelengths from 20 to 800 km.

these metasediments. For more information, the reader is referred to their detailed analysis.

REFERENCES

Adams, D. C., Gridley, J. M. and Keller, G. R., 1991, Analysis of gravity data in the northern midcontinent region through filtering with Hartley Transforms: American Geophysical Union, EOS, v. 72, no. 44, p. 430.

Cordell, L., 1984, Composite residual total intensity aeromagnetic map of New Mexico: National Oceanographic and Atmospheric Administration, National Geophysical Data Center Map, scale 1:500,000.

Cordell, L. and Keller, G. R., 1984, Regional structural trends inferred from gravity and aeromagnetic data in the New Mexico–Colorado border region: New Mexico Geological Society, Guidebook 35, p. 21–23.

Cordell, L. and Grauch, V. J. S., 1985, Mapping basement magnetization zones from aeromagnetic data in the San Juan basin, New Mexico; *in* Hinze, W. J., ed., The utility of regional gravity and magnetic anomaly maps: Society of Exploration Geophysicists, Tulsa, Oklahoma, p. 181–197.

Keller, G. R. and Cordell, L., 1984, Bouguer gravity anomaly map of New Mexico: National Oceanographic and Atmospheric Administration, National Geophysical Data Center Map, scale 1:500,000.

Grambling, M. L., Williams, M. L. and Mawer, C. K., 1988, Proterozoic tectonic assembly of New Mexico: Geology, v. 16, p. 724–727.

Woodward, L. A., Hultgren, M. C., Crouse, D. L. and Merrick, M. A., 1992, Geometry of Nacimiento-Gallina fault system, northern New Mexico: New Mexico Geological Society, Guidebook 42.