Digital Data From the Taos West Aeromagnetic Survey in Taos County, New Mexico.

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Digital Data From the Taos West Aeromagnetic Survey in Taos County, New Mexico.

By Viki Bankey[1], V.J.S. Grauch[1], B.J. Drenth[1], and EDCON-PRJ Inc.[2]

Abstract

This report contains digital data, image files, and text files describing data formats and survey procedures for aeromagnetic data collected during a survey covering the southwestern portion of Taos County west of the Town of Taos, New Mexico, in October, 2006.

Several derivative products from these data are also presented as grids and images, including reduced-to-pole data and data continued to a reference surface. Images are presented in various formats and are intended to be used as input to geographic information systems, standard graphics software, or map plotting packages.

Introduction

This report describes data collected from an aeromagnetic survey flown over the southwestern San Luis basin west of the Town of Taos, New Mexico, during October 2006 by EDCON-PRJ Inc., on contract to the U.S. Geological Survey (USGS) (fig. 1). The survey was designed to complete the coverage of surveys previously acquired in the southern San Luis basin (Bankey and others, 2004a and b; 2005; 2006). Our overall objective in conducting these surveys is to improve knowledge of the subsurface geologic framework in order to understand ground-water systems in populated alluvial basins along the Rio Grande.

Organization of Data

The "readme.txt" file provides summaries of the file contents. The folders are organized as follows. Files pertaining to this report are contained in the "report" folder; files pertaining to the gridded data are contained in the "grids" folder; files pertaining to the flight-line data are contained in the "linedata" folder; and files pertaining to the color shaded relief images are contained in the "images" folder. In the data folders, ASCII files with the extension ".txt" describe the format and contents of the data files. Please read the ".txt" files before using the data files.

Description of Data

Aeromagnetic data are collected using airborne geophysical sensors that measure subtle variations in the Earth's magnetic field. Aeromagnetic surveys are designed to map the variations caused by the irregular distribution of naturally occurring magnetic minerals associated with geologic

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features. High-resolution surveys such as this one are flown closer to the ground and with narrower line spacing than conventional aeromagnetic surveys to better detect weakly magnetic rocks and sediments, as well as anomalies of smaller aerial extent. Mapping the three-dimensional distribution of these features underground helps scientists understand the geologic controls on regional ground-water systems.

The aeromagnetic survey (fig. 1) employed a fixed-wing aircraft flying along traverse lines oriented east-west, spaced 200 m (about 650 ft) apart. Over most of the survey area, the pilot followed a pre-planned flight surface that was generally 150 m (500 ft) above ground and smoothly increased in height to equalize rates of climb and descent over high topography. In addition, the pilot maintained altitude rather than attempting to drape the steep descents west of the plateau escarpment along the west side of the survey area. Whereas this procedure degraded the resolution of magnetic sources down-slope of the escarpment, it ensured flight safety, provided a regularly shaped area for easier data processing, and allowed for better sampling of magnetic sources at the plateau edge. Orthogonal lines were flown north-south at a 1,500 m (4,920 ft) spacing. Total flight-line coverage was 327.7 km. The east-west orientation of traverse lines was chosen because it is oblique to the predominant northerly geologic strike of the area. The flight-line data from the contractor are included in this report. Contractor-provided details of the flight specifications, survey procedures, and data processing are included in Appendix A.

Topographic and radar-altimeter gridded data are also provided. The topographic grid was created from 1-arc-second (30-m) digital elevation data that were resampled to 50 m.

Data Processing

Initial data processing and data reduction were accomplished by the contractor (Appendix A). The additional data and grid processing described in this section was done to display maximum detail while removing unwanted noise and simulating a flight surface draped at a consistent level over terrain.

The magnetic and radar data were interpolated onto a grid at 50-m intervals. Map projection is Universal Transverse Mercator (UTM), zone 13 (central meridian of 105^{o} W longitude, a false easting of 500,000 m, a false northing of 0 m), and North American Datum of 1927 (NAD27).

To enhance details and provide better consistency for interpretation, the final magnetic grid was continued to a simulated flight surface of 100 m above the ground, using the draping method of Cordell (1985). A digital elevation grid is provided to represent the ground surface. In this continuation method, the continued data are extrapolated from a series of parallel continuation surfaces that have each been computed using standard FFT techniques. The grid of radar-altimeter values determined the distances to upward or downward continue the data to a common terrain clearance of 100 m. A low-pass filter was applied during downward continuation based on a cosine-squared roll-off function that increases the wavelength cutoff with greater continuation distance. As implemented by OASIS Montaj™, the wavelength cutoff is inversely proportional to the continuation distance (a high-cut factor of 1). Through trial-and-error, slightly longer wavelength cutoffs (a high-cut factor of 1.25) gave the best results for the Taos west data.

Supplementary filtering was required to minimize noise that was enhanced during continuation. The noise consisted of east-west linear "corrugations" in the grid, which commonly occurs due to subtle mismatches between flight lines. To remove this noise, decorrugation filtering was applied, following the method of Urquhart (1988), modified for use with a Blackman window (Oppenheim and Schafer, 1975; described in Sweeney and others, 2002). A Blackman window with a filter of 11 grid points was convolved with data along the grid rows (the direction of the traverse lines), resulting in both a high-pass grid and a low-pass grid. The same Blackman window was then convolved with the data along the columns of the low-pass grid (the direction orthogonal to the traverse line) to remove flight-line "corrugations". The high-pass grid was added to this filtered grid to retain the short-wavelength information in the direction of the flight lines.

Finally, a standard reduction-to-pole operator was applied. This operation, resulting in reduced-to-pole (RTP) data, corrects for shifts of the main anomaly from the center of the magnetic source that occur at most latitudes owing to the oblique orientation of the measured magnetic field with respect to the Earth's surface (the field is vertical only at the magnetic poles). Declination and inclination of the Earth's field were assumed to be 10^{o} and 64^{o}, respectively. To apply the reduced-to-pole transformation, one must assume that the total magnetizations of most rocks in the study area align parallel or anti-parallel to the Earth's main field. Based on considerations of rock type and age in the area, this assumption is generally valid (Grauch and others, 2004). To best characterize the long wavelength components during the application of the RTP operator, the total-field magnetic grid for the Taos west survey was first merged with surrounding data. Surrounding data were available from the Taos, central San Luis, and Questa-San Pedro surveys (Bankey and others, 2004a, 2005, 2006) and from more regional data compiled for the state (Kucks and others, 2002). RTP data were then extracted from the larger grid to match other grids for the Taos west survey area.

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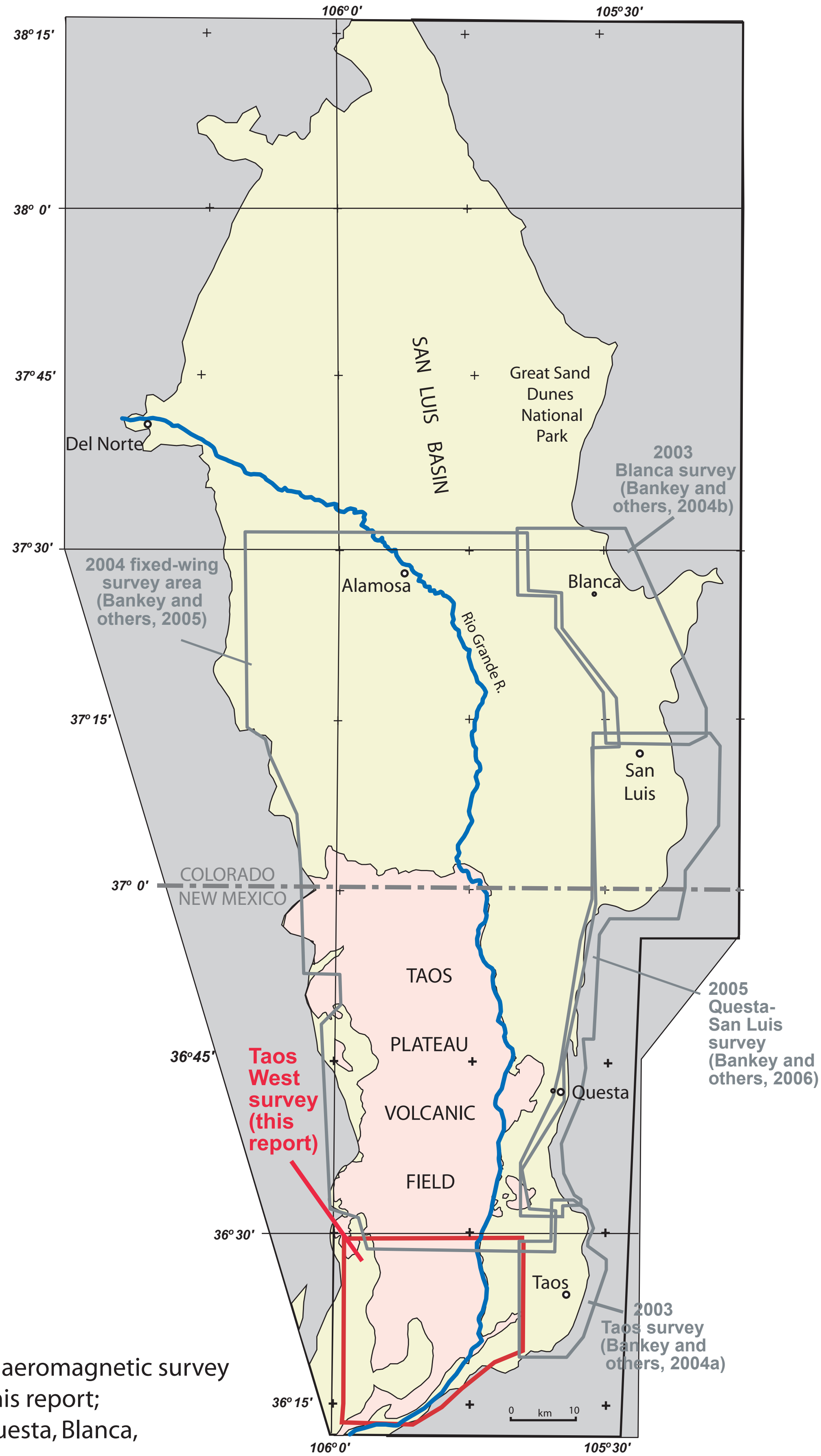

Figure 1. Location of aeromagnetic survey (Taos West = red, this report; Central San Luis, Questa, Blanca, and Taos = gray)