UNITED STATES DEPARTMENT OF THE INTERIOR

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Digital Colored Magnetic-anomaly Map of the Basin and Range Province

By

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INTRODUCTION

Regional geologic investigations of major tectonic features are often aided by studies of their associated magnetic anomalies. The distribution of upper-crustal magnetized rock units interpreted from the anomalies may convey new information about known rock units or reveal subsurface information about unknown structures. The magnetic-anomaly map described here was compiled from digital data. It provides a synoptic view of major magnetic anomalies and contributes to information concerning the tectonic development of the Basin and Range. The availability of digital data also allows application of a variety of analytical techniques which can be used to enhance the anomalies and provide new interpretive information.

Although the surveys used to construct the map were conducted at different times, spacings, and elevations, attempts were made to compile a consistent data set by removal of an appropriate geomagnetic reference field and by analytical continuation to a common surface. Magnetic fields from several surveys had been referenced to an arbitrary datum level, but the residual field values over the entire map are expected to be generally within 100 gammas of their true values. Thus, the resulting map is regarded as being generated from a set of compatible data.

Reproduction of colored maps displaying these data may be obtained as standard 2" x 2" color slides from the U.S. Geological Survey Photo Library (Mail Stop 914, Box 25046, Denver Federal Center, Denver CO 80225, telephone 303/234-4004).

Data Reduction

The magnetic-anomaly map was compiled from digital data acquired from a diverse group of magnetic surveys (see index map). These surveys were flown at elevations ranging from about 1400 ft (0.43 km) to 15,000 ft (4.57 km) above sea level and with flight-line spacings ranging from 1 mi (1.61 km) to 5 mi (8.05 km). The residual magnetic field was obtained over most of the area by removing the International Geomagnetic Reference Field (1965 and 1975) after updating to the epoch in which the surveys were flown. An alternative reference field, GSFC1266 (Cain and others, 1967) was employed for the survey covering Arizona (Sauck and Sumner, 1970).

For each individual survey, an elevation of 12,500 ft (3.81 km) above sea level was selected as the datum level. Surveys flown in a draped mode (constant elevation above terrain) were undraped and continued upward to this datum level. For surveys flown at a constant barometric altitude, the data were continued upward or downward an amount equal to the difference between the flight height and the selected datum level. Before merging, magnetic field values of each survey were adjusted by a constant amount, so that they were compatible with those of adjacent surveys. The data sets were then merged utilizing one-dimensional splining techniques described by Bhattacharyya and others (1979). A two kilometer grid of values was created using a minimum curvature method (Webring, 1981) and then contoured utilizing Applicon Incorporated proprietary software.

The overall precision of the magnetic field values is unknown, mainly because of the diversity of surveys used to construct the map. For example, a

source of error occurs from surveys in which the magnetic field values were referenced to an arbitrary datum level. These errors have been substantially reduced in the datum reduction process which included adding a constant value to the magnetic field intensities of each survey so that they were compatible with those of adjacent surveys. The datum level of the previously compiled data set in Nevada (Sweeney and others, 1978) may be in error by only a small amount because this survey was selected as a base to which all other survey field values were adjusted and was therefore not adjusted itself. Errors become progressively larger outward from Nevada but have been determined to be generally less than 100 gammas in regions where residual field values from aeromagnetic surveys were referenced to a nonarbitrary datum level.

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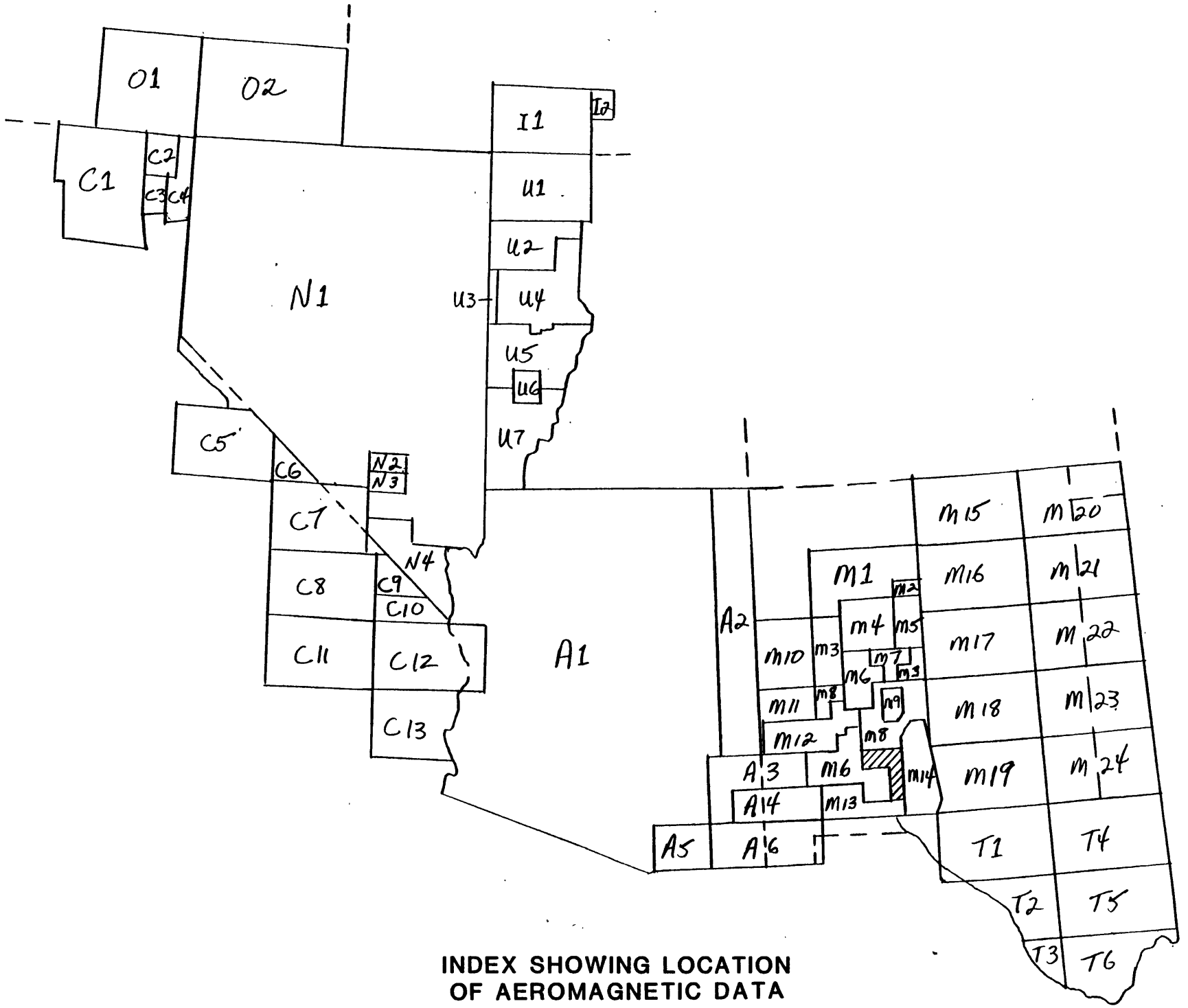

INDEX SHOWING LOCATION OF AEROMAGNETIC DATA

SPECIFICATIONS

ARIZONA

A1 North-South, 9,000 feet barometric, 3 mile (Sauck and Sumner, 1970)
A2 North-South, 11,000 feet barometric, 3 mile (Sauck and Sumner, 1970)
A3 East-West and North-South, 1,500 feet above ground, 0.6 and 1 mile (USGS, 1979)
A4 East-West, 500 feet above ground, 0.6 mile (U.S.G.S., 1980)
A5 North-South, 9,000 feet barometric, 1 mile (Andreason and others, 1965)
A6 East-West and North-South, 400 feet above ground, 3 mile (Texas Instruments, Inc., 1979)

CALIFORNIA

C1 East-West, 9,000 feet barometric, 1 mile (Couch, 1982)
C2 Unknown, 7,000 feet barometric, unknown (Calif. Div. of Mines and Geology, 1979)
C3 Unknown, 8,000 feet barometric, unknown (Calif. Div. of Mines and Geology, 1979)
C4 Unknown, 9,500 feet barometric, unknown (Calif. Div. of Mines and Geology, 1979)
C5 East-West, 400 feet above ground, 3 mile (High Life Helicopters, 1980b)
C6 East-West, 400 feet above ground, 3 mile (Geo-Life, 1979c)
C7 North-South, 400 feet above ground, 3 mile (Geo-Life, 1979a)
C8 East-West, 400 feet above ground, 3 mile (Geo-Life, 1979b)
C9 East-West, 400 feet above ground, 5 mile (Western Geophysical Co., 1979)
C10 East-West, 9,000 feet barometric, 3 mile (USGS, 1975)
C11 East-West, 400 feet above ground, 3 mile (High Life Helicopters, 1980a)
C12 East-West, 1,000 feet above ground, 0.5 mile (USGS, 1981)
C13 North-South, 400 feet above ground, 3 mile (LKB Resources, Inc., 1980)

IDAHO

I1 East-West, 400 feet above ground, 3 and 6 mile (Texas Instruments, Inc., 1979)
I2 East-West, 9,000 feet barometric, 1 mile (Mitchell and others, 1965)

NEVADA

N1 Varied, 12,500 feet barometric, 1 to 5 mile (Sweeney and others, 1978)
N2 East-West, 8,400 feet barometric, 1 mile (in press)
N3 East-West, 7,500 feet barometric, 1 mile (in press)
N4 East-West, 1,000 feet above ground, 1 mile (USGS, 1979)

NEW MEXICO

M1 East-West, 400 feet above ground, 3 mile (EG&G GeoMetrics, 1979)
M2 East-West, 8,000 feet barometric, 1 mile (USGS, 1975d)
M3 East-West, 400 feet above ground, 3 mile (Geo-Life, 1979a)
M4 East-West, 8,000 feet barometric, 1 mile (USGS, 1975a)
M5 East-West, 10,000 feet barometric, 1 mile (USGS, 1975b)
M6 East-West, 10,000 feet barometric, 1 mile (USGS, 1974a)
M7 East-West, 8,000 feet barometric, 1 mile (USGS, 1975c)

M8 East-West, 400 feet above ground, 3 and 6 mile (Geo-Life, 1979b)
M9 North-South, 5,700 feet barometric, 1.25 mile (Unpublished data)
M10 East-West, 400 feet above ground, 3 mile (Texas Instruments, Inc., 1979a)
M11 East-West and North-South, 400 feet above ground, 3 mile (Texas Instruments, Inc., 1979b)
M12 East-West, 10,500 feet barometric, 1 mile (USGS, 1972)
M13 East-West, 400 feet above ground, 3 mile (Carson Helicopters, Inc., 1981)
M14 Northwest-Southeast, 5,700 feet barometric, 1.25 mile (Bath, 1977)
M15 East-West, 400 feet above ground, 6 mile (EG&G GeoMetrics, 1980)
M16 East-West, 400 feet above ground, 3 mile (EG&G GeoMetrics, 1980)
M17 East-West, 400 feet above ground, 6 mile (Carson Helicopters, Inc., 1981)
M18 East-West, 400 feet above ground, 3 mile (Carson Helicopters, Inc., 1981)
M19 East-West, 400 feet above ground, 6 mile (Carson Helicopters, Inc., 1981)
M20 East-West, 400 feet above ground, 3 mile (Texas Instruments, Inc., 1980)
M21 East-West, 400 feet above ground, 3 mile (Geodata International Inc., 1976c)
M22 East-West, 400 feet above ground, 3 mile (Geodata International Inc., 1976b)
M23 East-West, 400 feet above ground, 3 mile (Geodata International Inc., 1976a)
M24 East-West, 400 feet above ground, 3 mile (Geodata International Inc., 1980)

OREGON

O1 East-West, 9,000 feet barometric, 2 mile (USGS, 1972b)
O2 East-West, 9,000 feet barometric, 2 mile (USGS, 1972a)

TEXAS

T1 East-West, 400 feet above ground, 3 mile (EG&G GeoMetrics, 1978)
T2 East-West, 400 feet above ground, 3 mile (LKB Resources, 1979)
T3 East-West, 400 feet above ground, 3 mile (LKB Resources, 1979)
T4 East-West, 400 feet above ground, 3 mile (EG&G GeoMetrics, 1978)
T5 East-West, 400 feet above ground, 3 mile (LKB Resources, 1979)
T6 East-West, 400 feet above ground, 3 mile (LKB Resources, 1979)

UTAH

U1 East-West, 400 feet above ground, 3 and 6 mile (Geo-Life, 1979a)
U2 North-South, 12,000 feet barometric, 5 mile (Zietz and others, 1976)
U3 North-South, 12,000 feet barometric, 1 mile (USGS, 1971)
U4 North-South, 9,000 feet barometric, 1 mile (USGS, 1971)
U5 North-South, 9,000 feet barometric, 2 mile (USGS, 1972a)
U6 East-West, 400 feet above ground, 3 mile (Geo-Life, 1979b)
U7 North-South, 9,000 feet barometric, 2 mile (USGS, 1972b)

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GAMMAS
375
300
200
100
0
-100
-200
-300
-325
40°
36°
32°
118°
114°
110°
106°
0 100 200 KILOMETERS
AEROMAGNETIC MAP OF THE
BASIN AND RANGE PROVINCE