UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

in cooperation with the

SOCIETY OF EXPLORATION GEOPHYSICISTS

Composite Magnetic Anomaly Map of the United States

Part B - Alaska and Hawaii

Compiled under the direction of

Richard H. Godson

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INTRODUCTION

The accompanying magnetic anomaly maps of Alaska, the principal islands of Hawaii and adjacent offshore areas were compiled as part of a cooperative effort of the U.S. Geological Survey and the Society of Exploration Geophysicists (Hinze, 1976). The maps are published in two sheets on Albers equal-area projections at scales of 1:2,500,000, and with a contour interval of 200 gammas (nanoteslas).

ALASKA COMPILATION

The magnetic anomaly map of the State of Alaska was compiled at a scale of 1:1,000,000 from a variety of data sources. Aeromagnetic maps (Decker and Karl, 1977, Decker, 1979) of large areas of the state (see index map no. 2) have been released as U.S. Geological Survey Open-File Reports at a scale of 1:1,000,000, and although the individual surveys were not merged on these maps, the contours from them were used wherever possible. Larger scale maps, usually at a scale of 1:250,000, were the most commonly used maps in the compilation. Most of the maps were previously reduced to anomaly form by removing the International Geomagnetic Reference Field (IGRF) from the observed data. Available magnetic maps not previously reduced to anomaly form were digitized and the appropriate IGRF (Fabiano and Peddie, 1969; Barracough and Fabiano, 1978) was removed; machine-contoured anomaly maps were prepared and compiled into the Alaskan map.

The first step in the compilation was to join 200-gamma (anomaly) contours between adjacent maps and, where necessary, to reduce the maps to the compilation scale. The contours were then placed on a 1:1,000,000-scale master base map prepared using an Albers equal-area projection. The map was

photographically reduced to the 1:2,500,000 publication scale, and was subsequently edited to eliminate closely spaced contours.

In Alaska the secular change associated with both the 1965 IGRF and the 1975 IGRF is small--less than 10 gammas per year. In fact, the zero secular change contour line trends in a very nearly east-west direction through the southern part of the state. This small predicted change was confirmed by a study of the calculated IGRF and magnetic values measured at 12 stations that were occupied in 1965 and again in 1975. The small secular change of the magnetic field minimized the problem of merging maps produced from surveys flown several years apart. On some contour maps, it was necessary to adjust the base level to achieve compatibility with adjacent surveys because an arbitrary datum value was used in the original compilation process.

About 60 percent of the onshore area was covered by the U.S. Geological Survey and State of Alaska surveys and the remainder by Department of Energy National Uranium Resouce Evaluation (NURE) surveys. All of the NURE surveys were flown 122 m above ground at a 10-km spacing and in an east-west direction; north-south tie lines were flown at 40-km intervals. These low-level surveys over magnetic terrain resulted in high frequency-high amplitude anomalies on individual flight lines, producing data difficult to contour. To minimize this problem, a 4-km low pass filter was applied to the data before machine contouring (Tinnell and Hinze, 1981). The selection of four kilometers was empirical and was deemed to be sufficient to preserve anomalies that could be depicted at the publication scale. This procedure naturally suppressed the high frequency anomalies prevalent on individual flight lines and generally decreased the amplitude of all anomalies.

Comparisons of several quadrangles containing duplicate coverage of NURE surveys and more detailed surveys of the U.S. Geological Survey or the State of Alaska have shown that in general the high and low magnetic areas coincide but the shape and trend of the anomalies can vary significantly. Examination of the map in the southwestern part of onshore Alaska, where the NURE maps are the principal source of data shows that the overall pattern is one of longer wavelengths than in other parts of the map. This is a result of the survey specifications and the data processing procedures and should not necessarily be interpreted as having geologic implications. Similar differences in wavelengths can be observed in other parts of the map where the flight line spacings and/or the flight elevations vary. It is strongly recommended that the map be used only at the 1:2,500,000 publication scale or smaller scales of interest in broad regional investigations. For more detailed work at scales larger than the 1:2,500,000 publication scale, it is recommended that original data sources be used.

The marine areas of the map were contoured mostly from shipborne data; aeromagnetic data were used in the eastern and southern parts of the Gulf of Alaska. Data on one map (Bailey and others, 1976) was upward continued 1 km. The trackline spacings of the marine surveys vary considerably and in some cases exceed 50 km. Gaps between contours were left in that part of the contour map covering the Bering Sea where the spacings between track lines became greater than about 20 km. Boundaries where survey specifications, such as line spacings, directions or altitudes differ are shown as dotted lines on the composite magnetic anomaly maps. Limits of data are indicated by dashed lines.

A regional field was constructed from the recorded data by using the smooth field in areas of very little magnetic disturbance and interpolating across areas of magnetic anomalies. A planar field with a gradient of 3.8 gammas/km to the north resulted from this empirical approach. This regional field was then subtracted from the observed data to derive anomaly values used in producing the contour map.

ACKNOWLEDGMENTS

The cooperative arrangement between the U.S. Geological Survey and the Society of Exploration Geophysicists, effected in 1975, resulted in formation of the National Magnetic Anomaly Map (NMAM) committee which interacted with a group of U.S. Geological Survey personnel. Current members of the NMAM committee are:

William J. Hinze, Chairman (Purdue University)
Anthony R. Barringer (Barringer Research Inc.)
Sheldon Breiner (Geomatrics)
LeRoy Brow (Exxon Production Res. Co.)
James E. Case (U.S. Geological Survey)
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Richard J. Wold (Weston Geophysical Corp.)
Isidore Zietz (Phoenix Corp.)
W. Glen Zinn (MolyCorp Inc.)

Previous members of the committee and their affiliation during their period of participation are: Joseph W. Berg, Jr. (National Academy of Sciences); Bimal K. Bhattacharyya (Deceased) (U.S. Geological Survey); Ernest J. Iufer (National Aeronautic & Space Admin.); John F. Landau (Gulf Research and Development Co.); P. L. Lawrence (Mobil Oil Corporation); D. Beadle Moore (Exxon Production Corporation); Robert F. McMahon (Chevron Oil Co.); and Robert D. Regan (U.S. Geological Survey).

U.S. Geological Survey coordinators of the cooperative effort were Martin F. Kane, William F. Hanna, Gordon P. Eaton, and Charles J. Zablocki. James E. Case, David F. Barnes, and Andrew Griscom, all of the U.S. Geological Survey, assisted the Editorial Committee in reviewing the map.

Exxon Company U.S.A. supplied machine-contoured NURE magnetic anomaly maps of several Alaska quadrangles. The other NURE computer-generated maps were supplied by the Union Carbide Corporation of Oak Ridge National Laboratory under a contract from the Grand Junction Area Office of the U.S. Department of Energy.

Compilation of the Alaska map was performed by Frank A. Petrafeso, James R. Linton, Herbert A. Pierce and Joseph L. Plesha. The Hawaii compilation was accomplished by Patricia L. Hill and Jackie M. Williams.

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