

U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

**Alaska Digital Aeromagnetic
Database Description
(paper edition)**

by

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1. Northwest Geophysical Associates, Corvallis, OR
2. U.S. Geological Survey, Denver, CO

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INTRODUCTION

Northwest Geophysical Associates, Inc. (NGA) was contracted by the U.S. Geological Survey (USGS) to construct a database containing original aeromagnetic data (in digital form) from surveys, maps and grids for the State of Alaska from existing public-domain magnetic data. This database facilitates the detailed study and interpretation of aeromagnetic data along flightline profiles and allows construction of custom grids for selected regions of Alaska. The database is linked to and reflects the work from the statewide gridded compilation completed under a prior contract. The statewide gridded compilation is also described in Saltus and Simmons (1997) and in Saltus and others (1999).

The database area generally covers the on-shore portion of the State of Alaska and the northern Gulf of Alaska excluding the Aleutian Islands. The area extends from 54°N to 72°N latitude and 129°W to 169°W longitude. The database includes the 85 surveys that were included in the previous statewide gridded compilation. Figure (1) shows the extents of the 85 individual data sets included in the statewide grids.

NGA subcontracted a significant portion of the work described in this report to Paterson, Grant, and Watson Limited (PGW). Prior work by PGW (described in Meyer and Saltus, 1995 and Meyer and others, 1998) for the interior portion of Alaska (INTAK) is included in this present study. The previous PGW project compiled 25 of the 85 surveys included in the statewide grids. PGW also contributed 10 additional data sets that were not included in either of the prior contracts or the statewide grids. These additional data sets are included in the current project in the interest of making the database as complete as possible. Figure (2) shows the location of the additional data sets.

PERSONNEL

The NGA project team included the following individuals:

- Gerry Connard, M.S. was the project manager,
- Louis Carlson, B.A. was the staff geophysicist.

The PGW project team included the following individuals:

- Stephen Reford, B.A. Sc was the project manager,
- Biljana Milicevic, M.Sc was the staff geophysicist.

Rick Saltus was the technical contact person at the USGS. Saltus provided the initial database design, supplied the data and consulted with NGA about technical questions. Pat Hill compiled most of the archival information (metadata) for the individual surveys.

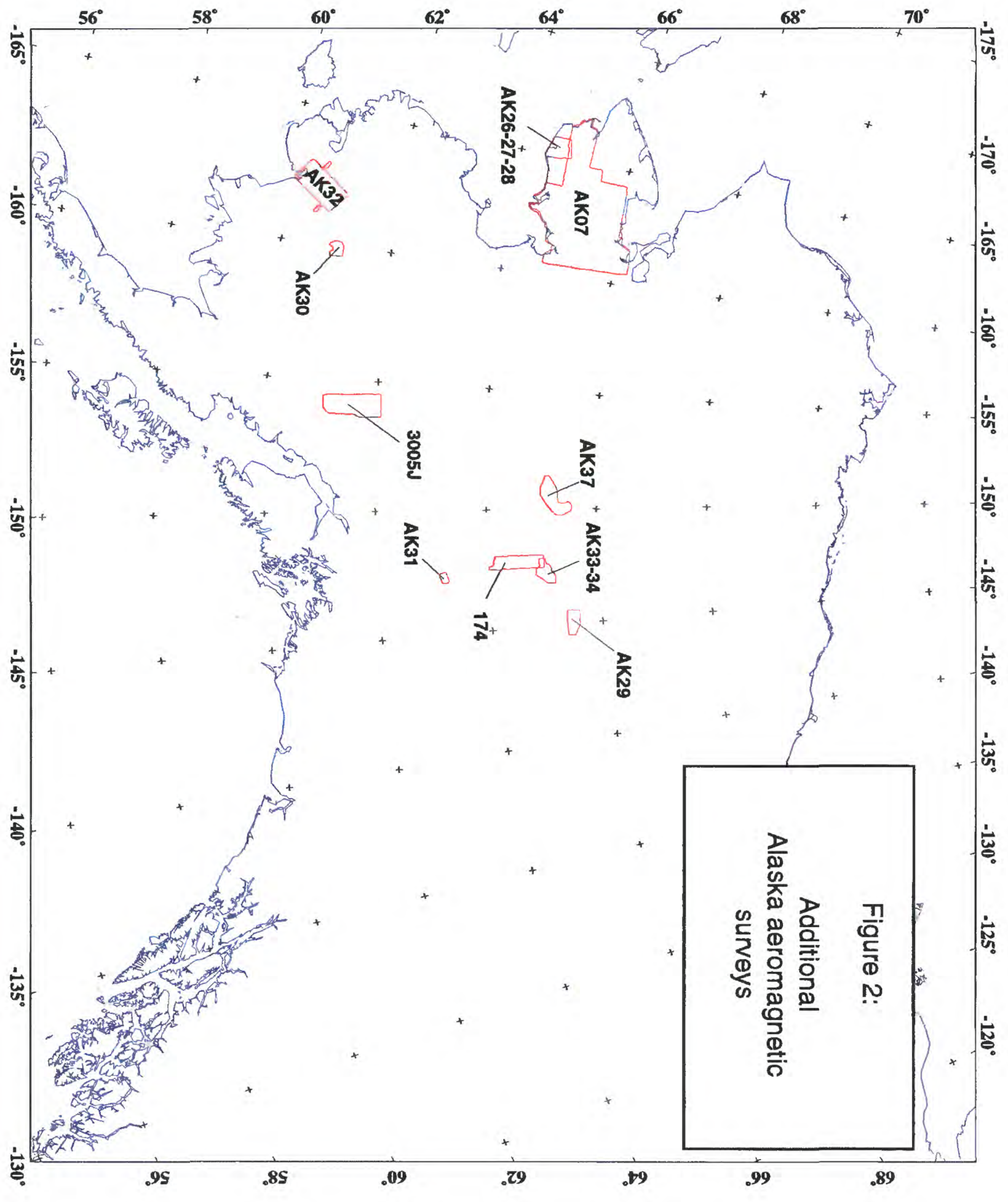


Figure 2:
Additional
Alaska aeromagnetic
surveys

TECHNICAL APPROACH

The goal of the project was to make available in an organized format, the original, detailed data used to construct the statewide gridded compilation reported in Saltus and Simmons (1997) and to include recently available surveys not included in the statewide gridded compilation. The database resulting from this project includes both unprocessed and processed data fields tied to the processed grids. The database provides consistent access to basic aeromagnetic data and other airborne survey information for any region of Alaska.

Processed data values were tied to the two statewide aeromagnetic grids reported in Saltus and Simmons (1997). The two grids are the Alaska Composite Grid (AKC) and the Alaska Merged Grid (AKM). The AKC is a one-kilometer grid consisting of all the individual surveys at original altitudes with datum shifts to minimize differences at the boundaries. For the AKM, all of the individual surveys were "draped" at a level of 1,000 feet above the terrain and fit together with seamless joins along the survey boundaries. Saltus, et. al. (1999) presented updated versions of the AKC and the AKM with additional long-wave components removed. For this project, we used the updated versions, which are shown in Figures (3) and (4).

In addition, a new Digital Elevation Model (DEM) for the State of Alaska with a 300-meter cell spacing (Riehle and others, 1997) was used to calculate terrain separation or construct a plausible flight surface when measured values for terrain separation or flight surface were not available in the original survey data.

In general, each survey is represented by a separate database file. However, in some cases, where survey parameters were consistent in adjacent surveys, we combined several surveys into one database file. Combined surveys include:

<u>Database File</u>	<u>Component Surveys</u>
173_193:	173, 193
204:	204A, 204B
6016:	Melozitna, Kateel River
6016abc:	6016a, 6016b, 6016c
6017:	6017a, 6017b, 6017c, 6017d, 6017e, 6017f, 6017g, 6017h, 6017i, 6017j, 6018
6020ab:	6020a, 6020b
6023de:	6023d, 6023e
6026fgh:	6026f, 6026g, 6026h
6121ac:	6121a, 6121c
ak08:	AK08, AK13
ak14-15:	AK14, AK15
ak21-22:	AK21, AK22
ak33-34:	AK33, AK34

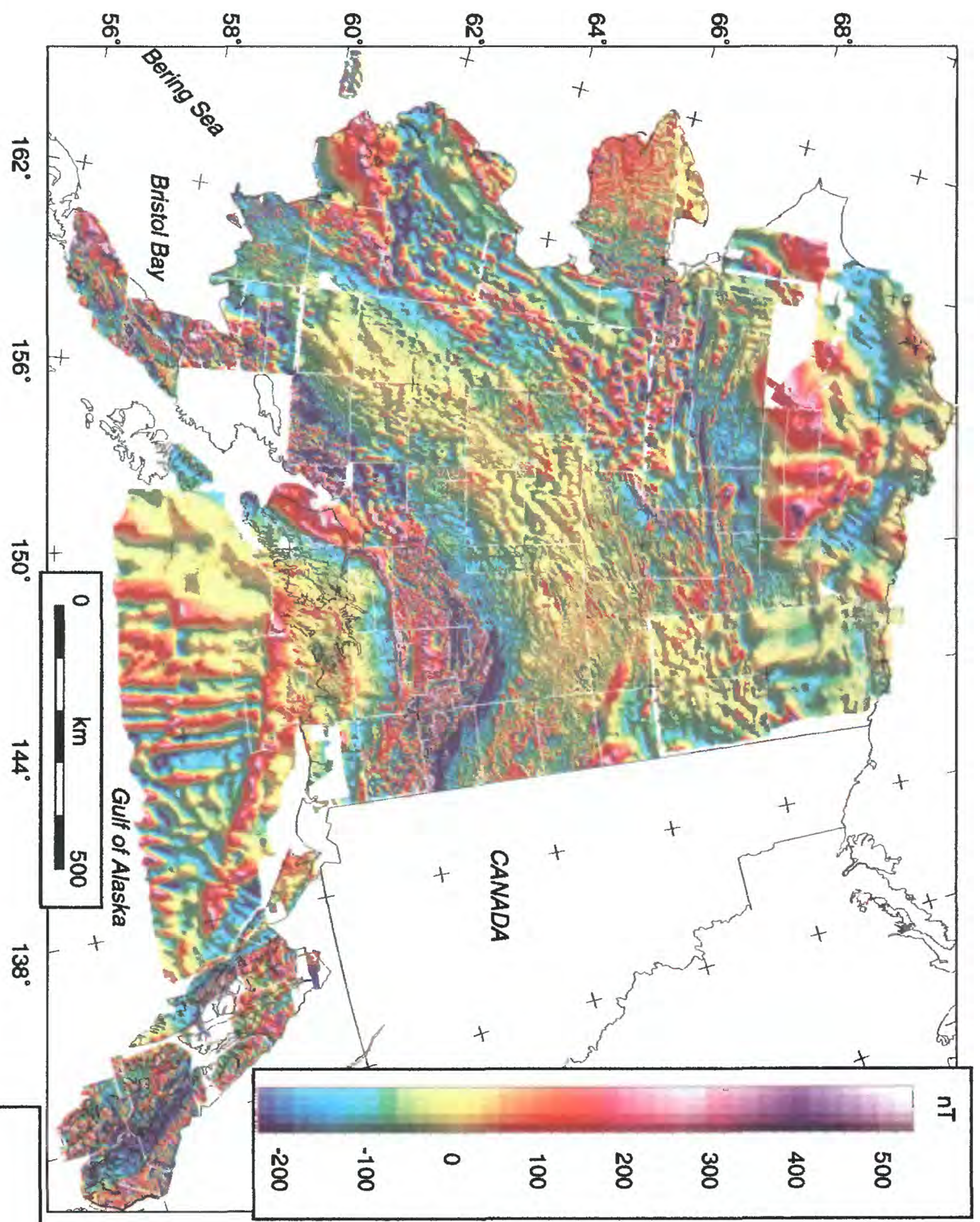
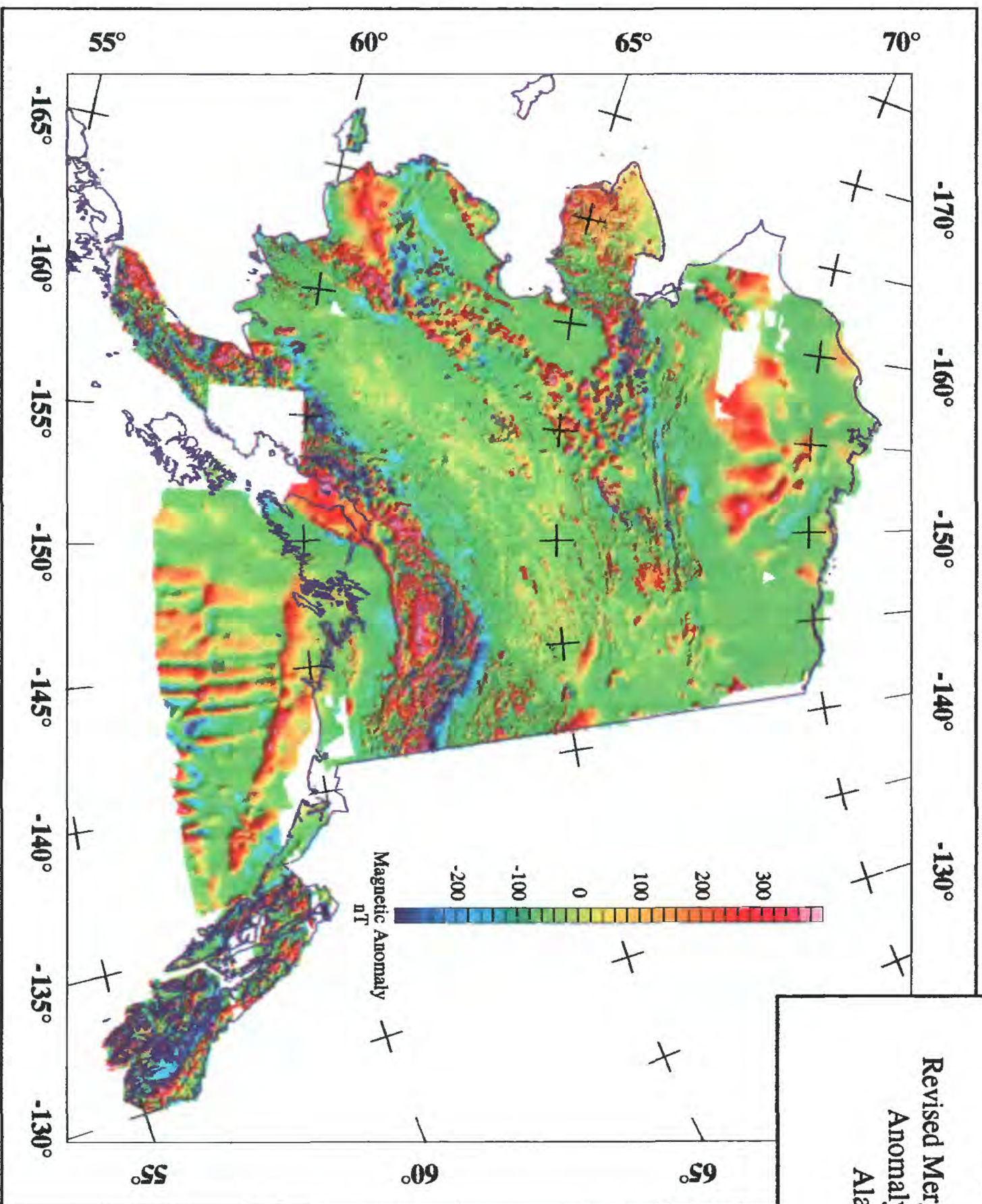


Figure 3:
Revised
Composite Magnetic Anomaly
Map of Alaska



Two additional channels were included in the database files for a few of the INTAK surveys:

MAG_IGRF	IGRF-corrected magnetics where DGRF-corrected magnetic were not available
MAG_DRAPE	1,000 ft. draped version of MAG_DGRF or MAG_IGRF

To preserve as much of the short-wavelength information as possible in the digital flightline data, the following procedures were used to generate the MAG_COMP and the MAG_MERGE channels. Grid values were extracted from the AKC and the AKM grids and temporarily stored in the database as "COMP_GRID" and "MERGE_GRID". The MAG_DGRF channel was "leveled" against the COMP_GRID channel using a DC-shift, 1st-order trend, or 2nd-order polynomial to minimize the difference.

Variable-level continuation was applied to surveys where the data quality justified detailed adjustments and the original survey terrain separation deviated from 1,000 feet. (The AKM has a terrain clearance of 1,000 feet.) The continuation was applied by first gridding the MAG_DGRF channel at the finest grid spacing consistent with the survey specifications (typically to 1/5 of the flightline spacing). Where appropriate, micro-leveling or de-corrugation was applied to these grids. PGW's Compudrape technique was used to adjust the terrain clearance to 1,000 feet. The Compudrape algorithm described by Paterson et. al., (1990) is based on the chessboard technique described by Cordell (1985). Values from the continued grids were interpolated at every original data point into a temporary channel MAG_DRAPE.

Either the MAG_DGRF channel, a micro-leveled version of the MAG_DGRF channel, or the MAG_DRAPE channel was subtracted from the MERGE_GRID channel. A non-linear, low-pass filter was applied to the difference to compute the correction to compute the MAG_MERGE channel. The information files list the processing applied to each survey.

Digitized Map Data and Grids

Twenty-nine (29) surveys were only available in map form. These surveys were recovered by digitizing contours or digitizing points where contours crossed the flightline path. For these surveys, height above ground (HEIGHT) was derived by subtracting the DEM elevation from the listed flight surface (FLTSURF) if the survey was flown at a constant barometric elevation. If the survey was flown at a constant terrain separation, the flight surface (FLTSURF) was calculated by adding together the DEM elevations and the nominal terrain separation.

Six surveys were only available as digital grids. The original flightline data used to create the grids has been lost. HEIGHT and FLTSURF were constructed in the same manner as for the digitized map data.

The standard channels for digitized map data and grids are:

Standard Database Channels For Digitized Map Data and Grids	
Channel Name	Contents
Line (grids)	Line number (for grids but not digitized maps)
FID	Fiducial
LAT	Latitude
LON	Longitude
X	X-coordinate (meters) in the projection listed below
Y	Y-coordinate (meters) in the projection listed below
HEIGHT	Elevation above ground (meters) if available
FLTSURF	Flight surface (meters above sea level) consistent with AKC
FLTSURF_M	Flight surface (meters above sea level) consistent with AKM
MAG_RAW	Raw magnetics (if available)
MAG_COMP	Composite magnetic value (consistent with AKC)
MAG_MERGE	Merged magnetic value (consistent with AKM)
USE_FLAG	Used/not-used flag to signal use in AKC

Point locations in the database are digitized points along contours or flightlines. For digitized contour map data in the INTAK region, two versions of each survey are included in the deliverables. The second version (with the suffix "g" on the file name) is organized in lines oriented along grid rows. The grids were transposed, if necessary, so that the grid rows are in the original flightline direction.

All processing on these surveys was applied directly to the grids and interpolated back into the database. Where appropriate, grids were de-corrugated. If the processed grids were not more detailed than the AKC and AKM grids (e.g., grid spacing smaller than 1 km), the MAG_COMP and MAG_MERGE channels were interpolated directly from the AKC and AKM grids.

For the more detailed grids, the appropriate datum shift or tilt was applied to the grid to match the AKC grid and the MAG_COMP channel extracted from the shifted grid. A long-wavelength filtered version of the difference between the AKM grid and the MAG_COMP grid was added to MAG_COMP to compute MAG_MERGE.

Data Projection

All of the transformations between latitude, longitude and X,Y coordinates used an Albers conical equal-area projection with the following parameters:

Standard Parallels	55°N, 65°N
Base Parallel	55°N
Scale Factor	1
Central Meridian	151°W
False Easting	0 m
False Northing	0 m
Semi-major axis of ellipsoid	6378206.4000 m
(Eccentricity) ² of ellipsoid	0.0067686579973

PRODUCTS

Products of this project included a set of maps at a scale of 1:500,000 covering the project area and four CD-ROMs containing the Alaska Digital Aeromagnetic Database. The maps are color-coded data plots depicting the values and locations of the points in the database. The database contains 90 separate database files and 90 associated information files. Compressed versions of the digital data files are available at <ftp://greenwood.cr.usgs.gov/pub/open-file-reports/ofr-99-0503/data>. The CD-ROM version of the report is available from USGS Open-file services (order USGS Open-File Report 99-0502).

The data website and CD-ROM contain a copy of this report, the linked information files, and copies of the database files. The database format is a compressed (using gzip) ASCII, white-space-delimited, XYZ file with the file name extension ".gz". The first eight records of each database file begin with the "/" character and contain comments identifying the channels in the file. If the file is organized into flightlines, a record containing the identifier "Line" and the line number precede each flightline in the file. The identifier "Tie" precedes tie lines. Table (1) lists the 90 database filenames and a summary of the survey specifications. More complete survey specifications are given in the information files in the Appendix (available on the web and CDROM version of this report).

The 10 additional data sets provided by PGW are segregated in a separate directory on the CD-ROM (EXT-DATA).

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- Cordell, L., 1985, "Applications and problems of analytical continuation of New Mexico aeromagnetic data between arbitrary surfaces of very high relief," *in* Proceedings of the International Meeting on Potential Fields in Rugged Topography, Bulletin 7, 96-101, Institut de Geophysique de Universite de Lausanne, Lausanne, Switzerland.
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Saltus, R. W., and Simmons, G. C. 1997, Composite and merged aeromagnetic data for Alaska: A Web site for distribution of gridded data and plot files: U.S. Geological Survey Open-File Report 97-520, 15 p.
(<http://greenwood.cr.usgs.gov/pub/open-file-reports/ofr-97-0520/alaskamag.html>)

Saltus, R. W., Hudson, T. L., and Connard, G. G., 1999, A New Magnetic View of Alaska: *GSA Today*, v. 9 (3), p.1-6.

Table 1: Alaska Digital Aeromagnetic Database Files

File	Original Data	Name	Dates Flown	Spacing	Dir	Altitude (in feet)
165	digitized	Naval Pet. Reserve No. 4	07/45-08/46	2-4 mi.	NE-SW	1000 AG
173_19 3	digitized	Copper River '54 & '55	06/54 & 06/55	2 mi., 1 mi.	N-S	4000 B
174	digitized	Fairbanks	07/54	1 mi.	N-S	2000 B
177	digitized	Nushagak Basin	6/54	2 mi.	E-W	1500 B
204	digitized	Ugashik North & South	5/55	2 mi.	N-S, NW-SE	1000-1300 B
291	digitized	See "COOK" below				
550	digitized	Alaska Regional	7/65	10 mi.	N-S	5000 B
3005 h	digitized	Hogatza Trend	08/68-10/68	1 mi.	E-W	400 AG
3005 j	digitized	Lime Hills	08/68-10/68	1 mi.	E-W	7000-7500-10000 B
3019	digital flight lines	Northeast Alaska '72	07/72-08/72	1.2 mi.	N-S	1000 AG
3020	digitized	SE Alaska (Granite Fiords)	08/72-09/72	1 mi.	NE-SW	6000 B
3029	digital flight lines	Northeast Alaska '73	08/73-09/73	1 mi.	N-S	1000 AG
3030	digitized	Southeast Alaska '73	08/73-09/73	1 mi.	N63E	6000 B
3053	digital flight lines	McCarthy	01/75-03/75	1 mi.	N-S	1000 AG
3054	digital flight lines	Talkeetna	01/75-02/75	1 mi.	N-S	1000 AG
3055	digital flight lines	Ruby	01/75-03/75	1 mi.	N-S	1000 AG
3069	digital flight lines	Prince William Sound	06/75-09/77	1 mi.	N-S	1000 AG
3092	digitized	Ketchikan	05/76-07/76	1 mi.	NE-SW	6000 B
3093 m	digital flight lines	Glacier Bay	07/76-08/76	1 mi.	N35E	15,000 B?
3093 n	digital flight lines	Glacier Bay	07/76-08/76	1 mi.	N35E	8000 B?
3093 s	digital flight lines	Glacier Bay	07/76-08/76	1 mi.	N35E	5000 B?
3102	digital flight lines	Phillip Smith Mountains	10/76-11/76	1 mi.	N-S	1000 AG

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3103	digital flight lines	Chignik-Sutwik	05/77-07/77	1 mi.	NW-SE	1000 AG
3106	digital flight lines	Lake Clark	07/77-08/78	1 mi.	NW-SE	1000 AG
3121	digital flight lines	Medtra	06/78-07/78	1 mi.	N35W	1000 AG
3122	digital flight lines	Valdez	07/78-08/78	1 mi.	N-S	1000 AG
3123	digital flight lines	Sitka	8/78	0.5-1 mi.	N60E	1000 AG
3138	digital flight lines	Petersburg	08/78-09/78	1 mi.	N60E	1000 AG
3177	grid	Chugach	06/79-07/79	1 mi.	N50W	1000 AG
3178	digital flight lines	Afognak	06/79-07/79	1 mi.	N50W	1000 AG
4038	digital flight lines	Ugashik-Karluk	10/80	1 mi.	NW-SE	1000 AG
4092 n	digital flight lines	Kiilik River-Chandler L.	6/82	2 mi.	E-W	400 B
4092 s	digital flight lines	Kiilik River-Chandler L.	6/82	2 mi.	E-W	800 B
4093	grid	Healy	6/82	1 mi.	N-S	1000 AG
4094	digital flight lines	Anchorage	7/82	1 mi.	N30W	1000 AG
4095 a	digital flight lines	Craig	08/82-09/82	1 mi.	N-S	1000 AG
4095 b	digital flight lines	Northwest Craig	08/82-09/82	1 mi.	E-W	1000 AG
4095 c	digital flight lines	Southern Craig	08/82-09/82	1 mi.	N68E	1000 AG
4096 a	digital flight lines	Ugashik Northwest	7/82	1 mi.	NW-SE	1000 AG
4096 b	digital flight lines	Ugashik South	7/82	1 mi.	NW-SE	1000 AG
4096 c	digital flight lines	Ugashik Northeast	7/82	1 mi.	NW-SE	1000 AG
4097	digital flight lines	Juneau	07/82-08/82	1 mi.	N50E	7000 B
4123	digital flight lines	Wrangall Mountains	8/84	1 mi.	E-W	1000 AG
4150	digital flight lines	Middleton Island	10/87-11/87	1 mi.	N-S	500 AG
4160 ab	digital flight lines	Annette Island	07/86-08/86	.2 km, .4 km	NE-SW	200 AG
5006	digital flight lines	Four Corners	9/79	1 mi.	N-S	400 AG
6008	digital flight lines	Seward-Selawik	06/75-07/75	6 mi.	E-W	400 AG
6016	digital flight lines	Melozina and Kateel River	05/76-08/76	6 mi.	E-W	400 AG
6016 abc	digital flight lines	Yukon	07/76	6 mi.	E-W	400 AG

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6017	digital flight lines	Bethel & Nunivak Island	05/76-08/76	6 mi.	E-W	400 AG
6019	digital flight lines	Taylor Mountains	05/76-08/76	6 mi.	E-W	400 AG
6020 ab	digital flight lines	Nushagak Bay-Naknek	05/76-08/76	6 mi.	E-W	400 AG
6023	digital flight lines	Cook Inlet (Tyonek)	06/76-07/77	6 mi.	E-W	400 AG
6023 de	digital flight lines	Cook Inlet	06/76-07/77	6 mi.	E-W	400 AG
6025 a	digital flight lines	Chugach-Yakutat	08/76-08/77	6 mi.	E-W	400 AG
6025 c	digital flight lines	Chugach-Yakutat	08/76-08/77	6 mi.	E-W	400 AG
6026 a	digital flight lines	Southeastern Alaska	08/76-09/77	6 mi.	E-W	400 AG
6026 fgh	digital flight lines	Southeastern Alaska	08/76-09/77	6 mi.	E-W	400 AG
6035 j	digital flight lines	Eagle-Talkeetna	06/77-09/77	6 mi.	E-W	400 AG
6035	digital flight lines	Eagle-Talkeetna (Mount McKinley)	06/77-09/77	6 mi.	E-W	400 AG
6036	digital flight lines	Lime Hills-Lake Clark	06/77-09/77	6 mi.	E-W	400 AG
6037	digital flight lines	Dillingham	06/77-09/77	6 mi.	E-W	400 AG
6121 ac	digital flight lines	Norton Bay, Unalakleet	07/79-09/79	6 mi.	E-W	400 AG
6121	digital flight lines	West-Central Alaska	07/79-09/79	6 mi.	E-W	400 AG
6169	digital flight lines	Northern Alaska	07/80-08/80	6 mi.	E-W	400 AG
AK01	digitized - profiles	Western Brooks Range	58	6.5 mi.	N-S	5000 B
AK04	digitized - profiles	Western Baird Mountains	70	var.	var.	5000 B
AK05	digitized	Gulf of Alaska	04/70-05/70	0.5-4 mi.	var.	1000 AG
AK07	grid	Bendeleben Candle (Seward)	95	.25 km	E-W	1000 AG
AK08 a	digitized	E Alaska Range - Tanacross	71	0.75 mi.	N-S	1000 AG
AK08 b	digitized	E Alaska Range - Nabesna	71	0.75 mi.	N-S	1000 AG
AK08	digitized	E AK Rng. - Healy/Mt. Hayes	71	0.75 mi.	N-S	1000 AG
AK09	digitized	Goodnews Area	71	0.75 mi.	E-W	1000 AG
AK10	digitized	Eagle	71	0.75 mi.	N-S	1000 AG
AK11	digitized	Talkeetna-Anchorage	72	0.75 mi.	N-S	1000 AG
AK12	digitized	Big Delta-Fairbanks	73	0.75 mi.	N-S	1000 AG
AK14-	digitized	Baird Mtns.-Ambler River, Survey Pass Area	73-74, 75	1 mi., 0.75-	N-S	1000 AG

15						1 mi.		
AK16	digital flight lines	South NPR '77	77	6-10 mi.	N-S	800 AG		
AK17	digital flight lines	Wiseman-Bettles (DNR)	78	0.75 mi.	N-S	1000 AG		
AK21-22	digital flight lines	Prudhoe Bay Region, Arctic Nat. Wildlife R.	81	1-3 mi.	N-S, E-W	300 AG		
AK23	digitized	Eastern Copper River	71	0.5 mi.	N-S	500 AG		
AK24-25	grid	Phillips comp. 1/2 km grid	1992 merge	0.5 km	grid	1000 AG		
AK26-27-28	digital flight lines	Norne Mining District (Dighem Survey)	08/93	.25 mi.	N-S	130 AG		
AK29	digital flight lines	Circle (Dighem Survey)	08/93	.25 mi.	N-S	130 AG		
AK30	digital flight lines	Nyac Mining District (Dighem Survey)	08/93	.25 mi.	NW-SE	130 AG		
AK31	digital flight lines	Valdez Creek (Dighem Survey)	08/93	.25 mi.	N20W	130 AG		
AK32	grid	SE Bethel Basin	08/94	.5 mi.	NW(125)-SE(305)	500 AG		
AK33-34	digital flight lines	Fairbanks East and West (Dighem Surveys)	94	.25 mi.	N-S	130 AG		
AK37	digital flight lines	Rampart-Manley (Dighem Survey)	10/95	.25 mi.	N-S	130 AG		
CADY	grid	Seward Peninsula comp.	1995 merge	0.25 km	grid	1000 AG		
COOK	digitized	Cook Inlet	57, 58	2 mi.?	E-W?	2500 B		

AG = Above ground, B = Barometric elevation.

APPENDIX: Linked Information Files

Each ASCII database file has an associated "information" file. Each file begins with the following standard information:

Project No:
Name:
Date Flown:
Altitude:
Spacing:
Merge Priority:
References:

"Merge Priority" was assigned to help decide which survey to use in areas of overlap. 1 is the best quality and 99 the worst.

Processing notes follow these standard fields. The documentation received with the original data set is listed at the end of the file under the heading *Original "Info" file*:

The information files are included on the web version of this report located at:

<http://greenwood.cr.usgs.gov/pub/open-file-reports/ofr-99-0503/>.

They are also contained in the CD-ROM report, USGS Open-File 99-0502.