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# AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: GEOPHYSICAL DATA

**Laurel E. Burns,** *Alaska Geological Survey*

## WHY STATE-FUNDED AIRBORNE GEOPHYSICS?

Alaska is in competition with the rest of the world for exploration dollars. Providing a "seed package" of airborne geophysical data for numerous mining districts encourages companies to begin more detailed exploration in more areas than they could have afforded on their own. When data are already available, the initial risk for people involved in exploration is decreased. Airborne magnetic and electromagnetic data are tremendous tools that aid in determining what rocks and structures are present under overburden and vegetation. These data form a fundamental package that exploration companies want prior to intensively exploring most regions.

Individual mining companies have conducted their own geophysical surveys during the past several decades, but these data are not available to other companies. The companies able to afford geophysical surveys have less money for ground exploration after purchasing expensive private geophysical data; therefore, they are not able to explore as many places as they might. Additionally, since data are not shared with other exploration companies, the proprietary surveys do not foster inter-company competition to move projects forward.

Individual prospectors and small companies can't afford their own geophysical surveys. "It is more often than not the grass-roots exploration efforts of the smaller operator that leads to significant discoveries," according to Klaus M. Zeitler, Senior Vice President for Development and Exploration at Teck Exploration Corporation.

Acquiring and releasing the geophysical data to the public produces several benefits. First, the increased exploration competition causes more money to be spent on the ground and leads to more mineral discoveries. Second, acquiring and releasing geophysical data demonstrates to mining companies that Alaska encourages responsible mining. And last, the geophysical data never goes out of date and investment gains value as geological data is accumulated.

**WE KNOW THAT OUR GEOPHYSICAL AND GEOLOGICAL SURVEYS HAVE…**

- changed exploration strategies in the Interior.
- helped locate mineralization in the areas of the surveys by focusing attention on areas showing unusual geophysical signatures.
- caused explorationists to modify exploration models, search methods, and prompted them to explore geologically similar regions.
- been the impetus for several drilling projects.

## HOW THIS PROGRAM DIFFERS FROM OUR PAST GEOPHYSICAL PROGRAMS

The primary objective of the airborne geophysical survey program is to catalyze mineral development investment in Alaska by providing a better understanding of the geologic framework in areas of high mineral potential. Thus, the current airborne geophysical program concentrates mostly on historical mining districts where there is good potential for undiscovered mineralization. The aeromagnetic program DGGS conducted in the 1970s was a generalized program to help understand regional geology. Now that we have at least a general understanding of the regional geology for most mining districts, we can concentrate on smaller areas. With the new program, we produce inch-to-the-mile geologic mapping of the survey tracts when funds and available personnel permit. These new geologic maps are significant improvements over earlier maps which were generally made without the benefit of geophysics.

An additional difference with the current program is that we are acquiring electromagnetic (EM) data in addition to aeromagnetic data. These data are complementary and provide far more detail on stratigraphy, petrology (rock type), and signatures that may be characteristic of mineralization than

*(continued)*

aeromagnetic data alone. The new surveys are flown with a closer line spacing than in the 1970s (¼ mile vs. 1 mile) and at lower elevation (200 ft vs. 1,000 ft). These differences yield much greater ability to distinguish rock units and structure.

An important reason for doing these surveys now is that technological advances within the last ten years allow both acquisition of more precise geophysical data and the ability to view interactive color images of the data. The technological advancements in the field of geophysics have been so large that the current time period has been referred to as "the Golden Age of Geophysics" by Misac Nabighian, Senior Consulting Geophysicist (retired) with Newmont Exploration Ltd. at the Vancouver Roundup in January 1998. Subtle details can now be seen easily with computer enhancements and can be of tremendous value from an exploration standpoint.

This airborne geophysical/geological program has continued for two main reasons. First, a variety of products are available within seven to eight months of the project funding. This is a fast turnaround for a wide range of products. The quick turnaround maintains the momentum of private-sector investment and technical participation. Second, the private sector, Native corporations, local, State, and even Federal agencies, have input into the direction and location of surveys. Therefore, they have supported the program.

In this program, our practice has been to have the community of Alaskans concerned with fostering mineral development guide the order in which candidate areas are surveyed. We have looked to organizations that represent a broad spectrum of Alaska's mineral industry for this kind of input, for example, the Alaska Miner's Association, the Alaska Minerals Commission, various economic development councils, chambers of commerce, and the Legislature. Their participation has served the objectives of the program well.

## What the program accomplished during the past year

Between January and March of 1997, we released airborne geophysical data for Chulitna (330 square miles), Petersville (415 square miles), and Rampart (330 square miles). The new Rampart survey was adjacent to the survey released in 1996 that covered 660 square miles near Rampart. We released about 45 products in map, text, and digital form for these three areas.

We acquired survey data for 690 square miles in the Talkeetna Mountains and 590 square miles in the Ruby area in western Alaska during the summer and fall of 1997. The geophysical data for the Iron Creek area in the Talkeetna Mountains were released January 26, 1998. Ruby data were released February 27, 1998. We also intend to release a geologic map of the Ruby/Poorman area in the near future. The geologic map is a contribution from a local consultant and has not been generally available to the public.

As part of a cooperative project, we were able to acquire data in March and April and release data in September of 1997 for 1,100 square miles near Wrangell in southeastern Alaska. The project was funded by the U.S. Department of Interior Bureau of Land Management (BLM) and the City of Wrangell. We released 55 products in map, text, and digital form for the Wrangell area.

A similar project that is still ongoing was funded by BLM. With this project we were able to acquire data for 530 square miles near Wiseman in northcentral Alaska. Data will be released in spring, 1998.

## Future work

Of the proposed candidate areas shown in figure 1, 11 have been surveyed and data released to the public. Two more areas should be released this spring. Over 40 candidate areas remain unsurveyed at this time. If funding continues, we will acquire data for more mining districts in a systematic fashion.

We are changing our products to suit a changing industry and a growing technology—such as producing full-color magnetic and resistivity maps with topography for the data releases for the Iron Creek and Ruby areas. We are also trying to respond to our constituents' requests by putting the contacts and faults from geologic maps on top of the geophysical maps in a timely fashion. Down the road, we intend to form consolidated data sets—including geophysical data, revised geologic maps, geochemical data, prospects, etc.—that can easily be updated, merged, and can be used to produce custom maps.

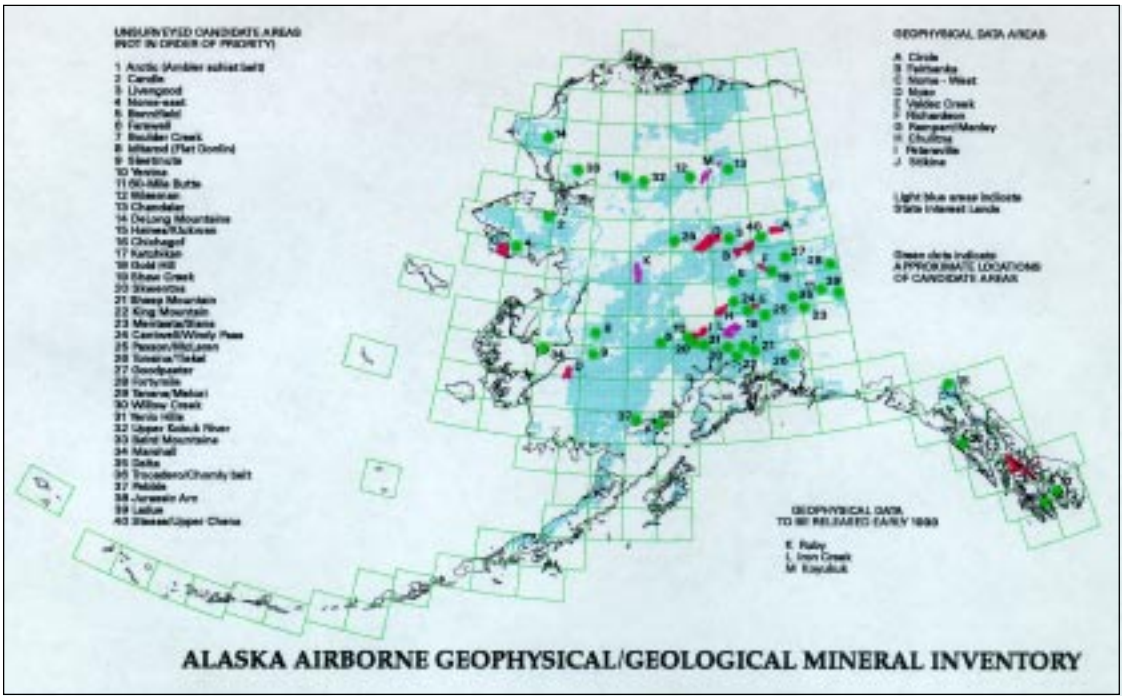
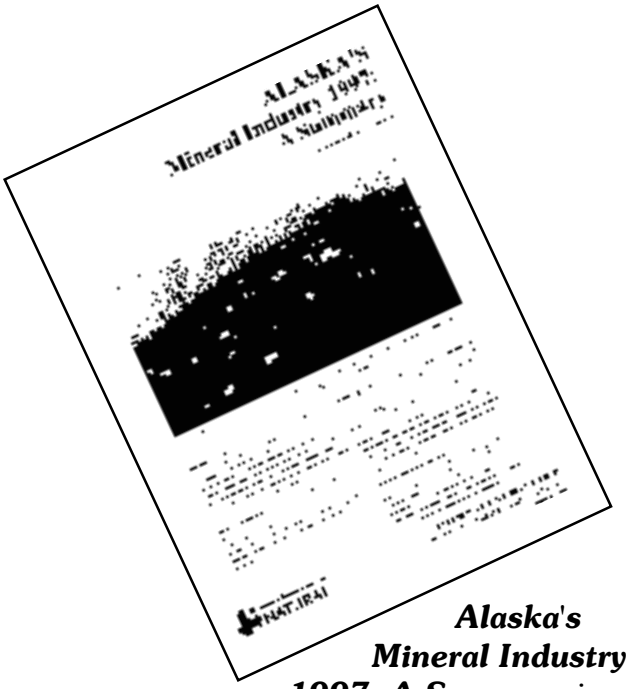



Figure 1. *Proposed candidate areas.*




***Alaska's Mineral Industry 1997: A Summary*** is now available. Order a copy from our office or visit our web page to view the report. http://wwwdggs.dnr.state.ak.us

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**Dear Readers,**

Somehow, the winter months seem to slip into spring before we know it. Time is becoming scarce for finishing reports from last summer's fieldwork. DGGS folks have not been idle, however, and new projects and initiatives are being launched as current projects are on their way to completion. By the time you receive this newsletter, the airborne geophysical maps and data for both the Iron Creek and Ruby mining districts will have been released. A geologic map of the Ruby area is scheduled for publication later this spring, as is the geologic map of the Rampart-Tofty area in the Tanana A-1 and A-2 quadrangles. There will soon be a new surficial geology map and cross-sections for east Anchorage and an interim map for the Upper Chulitna mining district. Preliminary mining activity statistics for the 1997 annual *Alaska's Mineral Industry* report has been released.

In January DGGS began a new project to evaluate the hydrocarbon potential of the Holitna Basin northeast of Bethel. A thorough evaluation of the Holitna Basin would require seismic surveys and test wells. Before such expensive methods can be justified, however, a more complete understanding of the basin's fundamental geology, geochemistry, and thermal uplift history is needed. The purpose of this project is to fill in major gaps in our knowledge of the basin's geometry, stratigraphy, structure, and thermal history so that a credible recommendation can be made on whether or not to proceed with an advanced exploration program. Pending availability of funds, our Energy Assessment section also will return to the western Arctic this summer to gather additional data relating to the oil potential of NPRA.

Other work scheduled for FY99 includes field investigations in the Petersville mining district, continued work on the division's coalbed methane project, including seismic surveys; expansion of the Alaska Volcano Observatory volcano monitoring network; the generation of a seismic soil-type map of Anchorage; and production of a tsunami-inundation map of Kodiak.

In November, DGGS was notified that substantial federal funding would be provided to upgrade and expand the storage capacity of the division's Geologic Materials Center (GMC) at Eagle River. Because of accelerated acquisitions, the Materials Center is presently near, or at, capacity. The federal funds will allow the GMC to double its present storage volume and make the facility's inventory database available on the Internet. This work will start in July.

Clearly the coming spring and summer will be busy times for the staff at DGGS.

Director & State Geologist

## *DGGS wins awards at Surveying & Mapping Conference*

*Two of the maps that DGGS entered in the Professional Competition at the Alaska Surveying & Mapping Conference in Anchorage February 2-5, 1998, won first place awards at the conference.*

*Report of Investigations 97-14a, "Geologic map of the eastern half of the McGrath Quadrangle," with cartography/design by Andrew McCarthy, map compilation by Ellen Harris, GIS consulting by Gina Graham, and cartographic consulting by Ann-Lillian Schell, took* ***first place in Digitally Created Cartographic Products****. The map was created under the U.S. Geological Survey's STATEMAP program, which has a strict one-year performance period from fieldwork to finished product. The 1:125,000-scale map, a compilation of previously-published and updated unpublished mapping, and its accompanying text describe the geology and resource potential of a highly mineralized region centered in the Farewell silver–lead–zinc district southeast of McGrath. Potentially important coal resources flanking the Alaska Range are also described in the map; structural and stratigraphic interpretations will assist in future basin evaluations.*

*Report of Investigations 96-6a, "Geologic Investigations of the Kandik Area, Alaska, and Adjacent Yukon Territory, Canada," with cartography/design by Katherine Queen, geologic consulting by James Clough and DeAnne Pinney, and GIS consulting by Gina Graham, took* ***first place in Project of the Year****. The publication is a five-map folio containing a diverse and integrated set of new geophysical, geochemical, and geological data from east-central Alaska and adjacent Yukon Territory, Canada. The data cover a portion of the Yukon-Charley River area, the Nation River basin adjacent to the Nation and Yukon Rivers, and extend across the Yukon Thrust tectonic system from east-central Alaska into Canada. This series of maps and data sheets provides critical new information on the geology, stratigraphy, and tectonics of this area of Alaska and Canada.*

*DGGS Geologist Katherine Queen accepts an award for her work on the Kandik Basin map project, which won Project of the Year at the Alaska Surveying & Mapping Conference.*

## *Other news from DGGS*

***Changes in staff include:***

***DeeDee Rager,*** *who started working with us in 1990 as the Director's secretary and recently moved into the Administrative Assistant position, has decided to pursue school full-time. DeeDee is attending the University of Alaska Fairbanks. We appreciate her good work and valuable contributions to our division over the past seven years. She will be missed.*

***Vickie Butherus:*** *In addition to her duties as secretary to the Director, Vickie will be resonsible for accounts payable, the in-house accounting system, travel, and many other duties. Vickie served for five years as the field office assistant for the Division of Mining, but most recently came from the Fairbanks Youth Facility, where she worked in the accounting section. We're glad to have you, Vickie!*

***David LePain:*** *A Geologist IV who will be working in the Energy section to help revitalize our basin analysis program. Dave comes to us from Shannon & Wilson, a private consulting firm based in Fairbanks and Anchorage. He received his Ph.D. from the University of Alaska Fairbanks. We are pleased to have Dave on board!*

***Andrew McCarthy:*** *A Geologist I who will be working directly for the Alaska Volcano Observatory, helping them redesign their web page, and producing GIS-based geologic maps. Andy worked with us previously as a UAF Research Assistant and proved his expertise using Arc/Info to digitize the McGrath map, which recently won an award for its outstanding cartography. Congratulations, Andy!*

***Eric Palm:*** *An Administrative Assistant who comes to us from Juneau, where he worked as an Accounting Technician for the Department of Administration and has firsthand experience with the legislative and budget processes. His outstanding experience should prove helpful in keeping the DGGS books. Welcome, Eric!*

***On another note:***

***Rocky Reifenstuhl*** *won the 1998 Iditabike! In 11 years of consistenty placing in the top four finishers in this grueling 100-mile race, this is the third first-place finish for Rocky. Competitors compete in either biking, skiing, running, or snowshoeing. Rocky's wife, Gail Koepf, came in 1st the snowshoe competition.*

*DGGS was saddened to hear of the tragic death of* ***Don Hodges****, who worked for us as a UAF Research Assistant. Don worked on the Kandik Basin map, trying to eliminate some problems with how it had been compiled digitally. Don brightened our office with his cheery personality and optimism, and he will be deeply missed by our staff.*

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**RI 98-1. Total field magnetics of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, 1998, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request. $26.

**RI 98-2. 900 Hz coplanar resistivity of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, 1998, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request. $26.

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**RI 98-4. Total field magnetics of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, 1998, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request. $26.

**RI 98-5. 900 Hz coplanar resistivity of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, 1998, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request. $26.

**RI 98-6. 7200 Hz coplanar resistivity of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, 1998, 2 sheets, scale 1:63,360. Topography included. Full color plot from electronic file, 400 dpi. Made on request. $26.

**RI 98-11. Bedrock geology of the Ruby/Poorman mining district, Alaska,** by Puchner, C.C., Smith, G.M., Flanders, R.W., Crowe, D.E., and McIntyre, S.C. Available soon.

**PDF 97-51. Water-quality data for Potter Marsh, Anchorage, Alaska,** by M.A. Maurer, October 1997, 12 p. $2.

**PDF 98-1. Flight lines of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 2 sheets, scale 1:63,360. Blueline. Topography included. $8.

**PDF 98-2. Total field magnetics and electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 2 sheets, scale 1:63,360. Clear diazo film. Magnetic contours and section lines included. Made on request. $54.

**PDF 98-3. Total field magnetics and electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 2 sheets, scale 1:63,360. Blueline. Magnetic contours and section lines included. $8.

**PDF 98-4. 900 Hz coplanar resistivity of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 2 sheets, scale 1:63,360. Blueline. Resistivity contours and section lines included. $8.

**PDF 98-5. 7200 Hz coplanar resistivity of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 2 sheets, scale 1:63,360. Blueline. Resistivity contours and section lines included. $8.

**PDF 98-6. Portfolio of aeromagnetic and resistivity maps of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by L.E. Burns and S.A. Liss, January 1998, 16 p. Includes color and shadow maps. Maps fit 8½" x 11" sheet. $8.

**PDF 98-7. Project report of the 1997 geophysical survey data for Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska**. Price to be determined.

**PDF 98-8. Zip disk containing gridded files and section lines of 1997 geophysical survey data for Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998. $15.

**PDF 98-9. CD-ROM containing profile and gridded data and section lines of 1997 geophysical survey data for Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998. $150.

**PDF 98-10. Flight lines of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 2 sheets, scale 1:63,360. Blueline. Topography included. $6.

**PDF 98-11. Total field magnetics and electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 2 sheets, scale 1:63,360. Clear diazo film. Magnetic contours and section lines included. Made on request. $6.

**PDF 98-12. Total field magnetics and electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 2 sheets, scale 1:63,360. Blueline. Magnetic contours and section lines included. $6.

**PDF 98-13. 900 Hz coplanar resistivity of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 2 sheets, scale 1:63,360. Blueline. Resistivity contours and section lines included. $6.

**PDF 98-14. 7200 Hz coplanar resistivity of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 2 sheets, scale 1:63,360. Blueline. Resistivity contours and section lines included. $6.

*Public-Data Files (PDF) are unpublished documents that make project data immediately available to the public. PDFs usually comprise raw data and have not undergone peer review or been edited by DGGS staff. In many cases, PDFs are later released as DGGS Reports of Investigations (RI), Special Reports (SR), or Professional Reports (PR). Prices for PDFs are determined by their individual reproduction prices and are thus sold at copying costs. Information Circulars (IC) are normally free.*

# NEW PUBLICATIONS

# NEW PUBLICATIONS

**PDF 98-15. Portfolio of aeromagnetic and resistivity maps of the Ruby area, central Alaska,** by L.E. Burns and S.A. Liss, September 1998, Includes color and shadow maps. Maps fit 8½" x 11" sheet. $8.

**PDF 98-16. Project report of the 1997 geophysical survey data for Ruby area, central Alaska**. Price to be determined.

**PDF 98-17a. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby southeastern C-6 quadrangle). Blueline. $3.50.

**PDF 98-17b. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby southwestern C-5 quadrangle). Blueline. $3.50.

**PDF 98-17c. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby northeastern B-6 quadrangle). Blueline. $3.50.

**PDF 98-17d. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby northwestern B-5 quadrangle). Blueline. $3.50.

**PDF 98-17e. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby southeastern B-6 and northeastern A-6 quadrangles). Blueline. $3.50.

**PDF 98-17f. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby southwestern B-5 and northwestern A-5 quadrangles). Blueline. $3.50.

**PDF 98-17g. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby east-central A-6 quadrangle). Blueline. $3.50.

**PDF 98-17h. Total field magnetics and detailed electromagnetic anomalies of the Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 sheet, scale 1:31,680 (part of Ruby west-central A-5 quadrangle). Blueline. $3.50.

**PDF 98-18a. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 1 sheet, scale 1:31,680 (part of C-5 quadrangle). Blueline. $5.

**PDF 98-18b. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 1 sheet, scale 1:31,680 (part of C-4 quadrangle). Blueline. $4.

**PDF 98-18c. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 1 sheet, scale 1:31,680 (part of C-3 and C-4 quadrangle). Blueline. $4.

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**PDF 98-18g. Total field magnetics and detailed electromagnetic anomalies of the Iron Creek area, Talkeetna Mountains Quadrangle, southcentral Alaska,** by DGGS, Dighem, and WGM, January 1998, 1 sheet, scale 1:31,680 (part of B-3 and B-4 quadrangle). Blueline. $3.

**PDF 98-30. Zip disk containing gridded files and section lines of 1997 geophysical survey data for Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 disk. $15.

**PDF 98-31. CD-ROM containing profile and gridded data and section lines of 1997 geophysical survey data for Ruby area, central Alaska,** by DGGS, Dighem, and WGM, September 1998, 1 CD-ROM. $150.

**PDF 98-33. $^{40}Ar/^{39}Ar$ laser step-heating data and spectra from sandstone and volcanic rocks in the northern Brooks Range,** by Melanie B. Werdon, Paul W. Layer, and Rainer J. Newberry, February 1998, 25 p. $2.50.