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Geologic Ground-Truth Inventory of Liberty Bell, Western Bonnifield Mining District Geophysical Survey Tract

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INTRODUCTION

The Liberty Bell project is part of DGGS's Airborne Geophysical/Geological Mineral Inventory (AGGMI) program, a special multi-year investment by the State of Alaska to expand Alaska's geologic and mineral resources knowledge base, catalyze future private-sector mineral exploration and development, and guide state planning. The program seeks to delineate mineral zones on Alaska state lands that: (1) have major economic value; (2) can be developed in the short term to provide high-quality jobs for Alaska; and (3) will provide diversification of the State's economic base. The AGGMI program, which received initial funding in FY93, was originally designed to systematically acquire geophysical and, where necessary, geological data for about 40 million acres of state-owned lands having high perceived mineral potential. Funding limitations in the past have led to decreasing the annual scope of the project, but the purpose and goals have not changed. To date more than 6.1 million acres of state-owned lands have been surveyed. As a result of this program, millions of dollars of venture capital have been spent in the local economies of the surveyed mining districts and adjacent areas in direct response to the new geologic knowledge provided by the surveys.

The Airborne Geophysical/Geological Mineral Inventory program is designed to coordinate the generation of airborne geophysical data with ground-based geological surveys. Geophysical data are of limited effectiveness unless good geologic maps are available to permit analysis and interpretation of the geophysics. The geophysical data and follow-up ground-truth geologic mapping stimulates increased mineral exploration investment within survey areas and the surrounding region. After release of the geophysical data, DGGS's Minerals Section geologic mapping team produces 1:63,360-scale or 1:50,000-scale geologic maps of the geophysical tracts; typically a bedrock-geologic map and also frequently surficial-, comprehensive- (merged bedrock- and surficial-geologic map), and engineering-geologic maps are produced for a given area. The principal objective is to catalyze industry exploration for mineral deposits. Should mineral development occur, surficial- and engineering-geologic data generated by this project will be useful for mine site and access planning.

Funding for the geophysical data is provided by the Alaska State Legislature. Funding for the geologic ground-truthing of each geophysical area comes from the Alaska Airborne Geophysical/Geological Mineral Inventory program, the State's General Fund, and the Federal STATEMAP program. Geologic mapping in the Liberty Bell area is the most recent ground-truth mapping project associated with the AGGMI program.

PROJECT FOCUS

DGGS released airborne magnetic and electromagnetic geophysical maps for 276 square miles near Liberty Bell, western Bonnifield mining district, in March 2002. During the summer of 2005, DGGS conducted fieldwork for 21 days, covering 131 square miles of the Liberty Bell geophysical survey tract coinciding with the southern half of the Fairbanks A-4 Quadrangle. The objective of the Liberty Bell project is to produce a 1:50,000-scale geologic map to foster a better understanding of the geology and mineral potential of the area. Although the Liberty Bell project team is concentrating on characterizing plutonic-related gold and associated mineralization, the team is also studying Tertiary sedimentary deposits, which contain coal resources. In addition to field traverses, the geologic map incorporates interpretations of airborne geophysical data (Burns and others, 2002) and is supplemented by ore-element geochemical analyses, coal energy and trace-element analyses, major- and minor-element analyses, $^{40}Ar/^{39}Ar$ and possible pollen age determinations, thin section and grain mount petrography, Tertiary clay compositions determined by X-ray diffraction, and historical and mineral industry data. Data from ore-element geochemical analyses and major-, minor-, and trace-element analyses were published in October 2005 (see "New Publications" section in this newsletter).

The Bonnifield district is located about 80 miles south of Fairbanks and extends across the north flank of the Alaska Range for approximately 40 miles. The western part of the district is highly accessible, with extensive infrastructure for mineral development (fig. 1). Alaska's main ground transportation corridor between Anchorage and Fairbanks, containing

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(continued on page 2)

the Parks Highway and Alaska Railroad, runs 5 miles from the border of the study area. A well maintained, 10-mile-long dirt road (informally known as the Ferry Road) and numerous spur trails exist between the Liberty Bell Mine near the center of the map area and Ferry, Alaska, a small community situated adjacent to the railroad. Beside the same transportation corridor, two high-voltage interties connect the Healy Power Plant (located 12 miles south of the map area) to the power grid that provides electricity to Fairbanks, Anchorage, and numerous railbelt communities.

Approximately 85,000 ounces of placer gold have been mined from the region since 1903 (Szumigala and Hughes, 2005), with most production between the Totatlanika River and Ferry. Eleven placer gold mines (three active) and eight metallic lode occurrences are located in the map area (Freeman and Schaefer, 2001) (fig. 2). The Liberty Bell gold mine is the major lode occurrence known in the mining district. The Liberty Bell property has an announced potential of 250,000 ounces of gold, with inferred resources of 1,240,000 tons at an average grade of 0.1 ounces of gold per ton at the Mine Zone (Freeman and Schaefer, 2001).

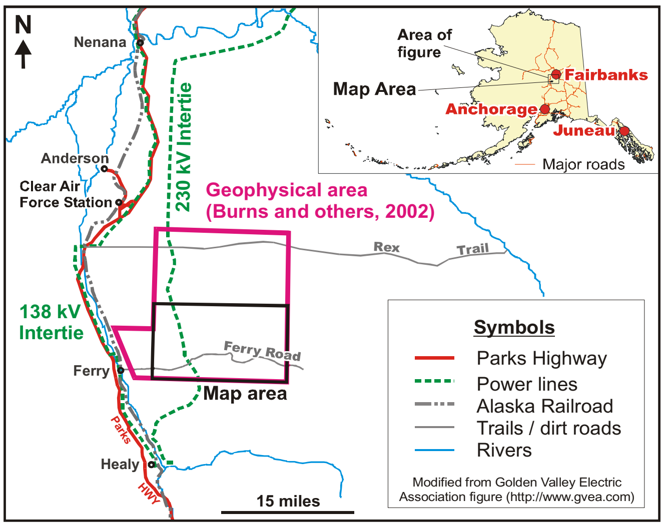
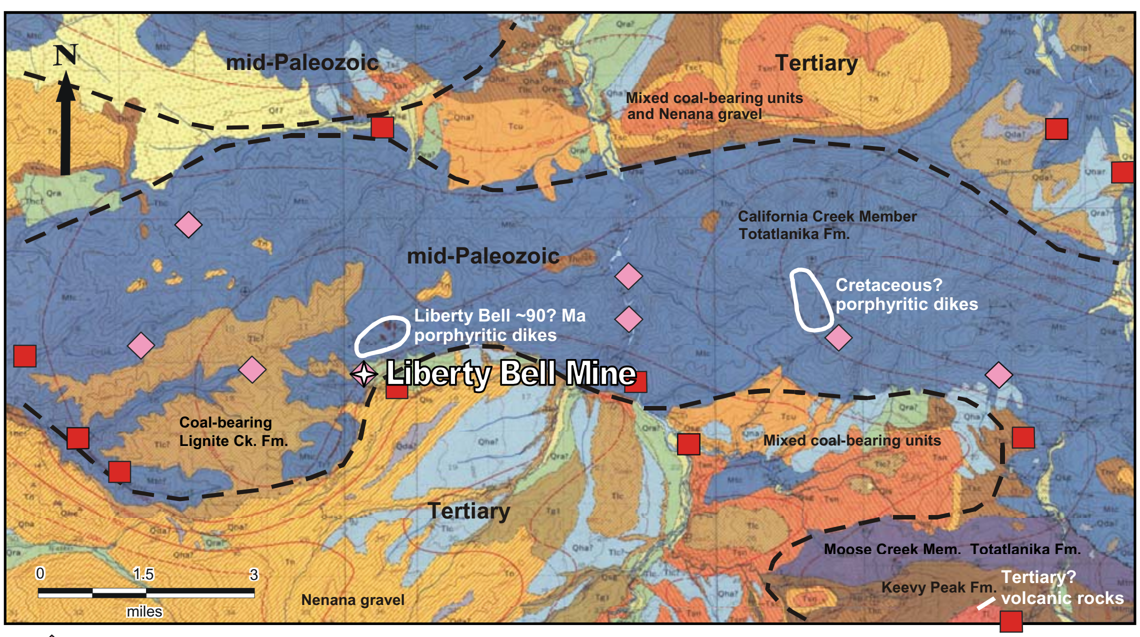


Figure 1. *Location of the Liberty Bell project geologic map area.*

PREVIOUS GEOLOGIC WORK

The Liberty Bell Mine was discovered in 1915 and actively mined during 1932–33, producing a total of 8,400 ounces of gold (Yesilyurt, 1996). The property was purchased by Boyd Blair in 1964, and his estate is currently held in a trust. Since 1973, the Liberty Bell area has been evaluated by more than five exploration companies. A wealth of private information centered around the Liberty Bell Mine is held by companies and individuals, including but not limited to data for more than 33 diamond drill holes totaling 11,706 feet, 28 reverse-circulation drill holes totaling 6,794 feet, surface sampling, and trench and conventional geologic mapping (Yesilyurt, 1996). A Master of Science thesis on the Liberty Bell property commissioned by the mineral industry was completed by Suleyman Yesilyurt in 1993 (Yesilyurt, 1994). DGGS has access to most of the private mineral industry data and will incorporate it into the geologic map and ore-genesis interpretations.

The only published geologic map covering the Fairbanks A-4 Quadrangle is one sheet of a 1:63,360-scale series concentrating on the stratigraphy immediately north of the Alaska



ARDF Lode Occurrences

ARDF Placer Gold Occurrences

Generalized boundary of Tertiary and mid-Paleozoic units

Figure 2 . *Geology of the study area after Wahrhaftig (1970b). Gold and polymetallic lode occurrences and gold placer occurrences from Alaska Resource Data Files (ARDF; Freeman and Schaefer, 2001).*

Range (Wahrhaftig, 1970b) (fig. 2). Wahrhaftig's (1968, 1970a–e) Quaternary, Tertiary, and Paleozoic geologic units are broadly defined and frequently mapped as undifferentiated or queried. The maps do not address details of internal stratigraphy, contact relationships, or resources and contain little to no structural interpretation. Modern 1:50,000-scale geologic mapping will provide a more detailed geologic framework to guide mineral exploration efforts, aid in interpreting the recently acquired geophysical data, and afford new insights into plausible regional geotectonic models.

DGGS Geologic Investigations in the Liberty Bell Area

Quaternary and Tertiary units in the Liberty Bell area record an active geologic history. A diverse suite of Quaternary deposits, including glacial, alluvial, landslide, fan, and swamp, discontinuously overlie older units in the area. Placer deposits of unknown age and character are also located throughout the map area, which suggests that multiple sources of lode gold are exposed and eroding. Tertiary Nenana gravels derived from the <10 Ma uplift of the Alaska Range overlie older, partially lithified, Tertiary continental clastic rocks of the coal-bearing Usibelli Group. The Healy Creek and Lignite Creek formations of the Usibelli Group southwest of the map area contain known surface mineable coal reserves in excess of 80 million tons that are currently being processed at Usibelli Coal Mine east of Healy (Szumigala and Hughes, 2005). Occurrences of coal from these formations in the study area were mapped, described, and sampled for energy and trace-element analysis.

Bedrock, exposed and underlying the Quaternary and Tertiary units in angular unconformity, is mapped by Wahrhaftig (1970b) as two greenschist-facies meta-igneous and metasedimentary rock formations, Totatlanika and Keevy Peak (fig. 2). The Keevy Peak Formation, located stratigraphically below the Totatlanika schist, regionally contains quartz–sericite schist, carbonaceous schist, gray–green–purple slate, black quartzite, and stretched conglomerate (Wahrhaftig, 1968). In the map area, the Keevy Peak Formation contains phyllitic quartzite and carbonaceous phyllite. Locally exposed, thinly cyclic, size-graded quartzite–phyllite layers indicate in part a deep-water, turbidite origin.

Wahrhaftig (1968, 1970b) designated five members of the Late Devonian to early Mississippian Totatlanika schist (U-Pb zircon age; Dusel-Bacon and others, 2004); the lower two are present in the map area. The lower Moose Creek Member contains carbonaceous schist, green chloritic schist, and quartz–orthoclase schist/gneiss (Wahrhaftig, 1968). The aerially extensive and stratigraphically younger California Creek Member, which hosts the Liberty Bell gold deposit, contains a variety of metamorphosed volcaniclastic and sedimentary rocks. Wahrhaftig distinguished the lowest (Moose Creek) member from the stratigraphically higher California Creek Member based on color (yellow vs. gray) of the felsic meta-igneous rocks, considered the contact between the members an unconformity, and suggested that both units consisted primarily of crystal-rich metatuff.

Our mapping shows that felsic meta-igneous rocks from both 'members' vary in color; texturally and chemically, they are indistinguishable from each other. The same analyses indicate that the meta-igneous rocks are variably porphyritic metagranite intrusions or rhyolitic volcanic rocks (shallowly emplaced and [or] extrusive). The lower ('Moose Creek') felsic meta-igneous rocks contain local inclusions of the underlying Keevy Peak Formation. We interpret the variable thickness of this lower 'member' to be a result of its igneous nature. In contrast, we have identified a unit of mixed lithologies, historically mapped as a part of the California Creek Member, that does have stratigraphic significance. This unit, consisting of metaclastic rocks, rhyolitic tuff, and calcareous metabasite, is approximately 330–650 feet thick and traceable across the area for at least 15.5 miles (fig. 3, dark purple- and dark blue-colored units). Due to its abnormally high carbonate content, this unit is the preferred ore host in the Liberty Bell area. Because the unit only contains anomalous metals where hornfelsed, the metals were likely sourced by a pluton during its emplacement.

The bulk of the California Creek Member is meta-graywacke (probably volcaniclastic in origin), meta-arkose, meta-sandstone, and porphyritic to equigranular metagranite with lesser metarhyolite tuff. The felsic meta-igneous rocks contain high Nb+Y values, consistent with an extensional setting; rare metabasite similarly displays within-plate trace-element compositions. The combination of mostly felsic (porphyritic dacite and rhyolite, and aplite) and occasionally mafic sub-units indicates an ancient, bimodal volcanic system. The bimodal chemistry, elevated concentration of high-field-strength and rare-earth elements, and presence of carbon-rich basinal sediments suggest that these rocks formed in an extensional tectonic setting such as an attenuated continental margin (Dusel-Bacon and others, 2004).

Both the Totatlanika and Keevy Peak schist formations are associated with volcanogenic massive sulfide (VMS) occurrences (commonly containing galena + sphalerite ± chalcopyrite ± pyrite); the closest occurrence is located about 7 miles southeast of the map area in the central Bonnifield mining district (Wahrhaftig, 1970c; Freeman and Schaefer, 2001; Ellis and others, 2004). No stratabound base-metal sulfide occurrences were located during the recent mapping project. We currently interpret the absence of volcanogenic massive sulfide prospects in this portion of the Totatlanika schist to be a result of the scarcity of volcanic rocks; the center of the ancient volcanic system was possibly tens to hundreds of miles away, and (or) it occurred later (higher in the stratigraphic section).

Gold mineralization is associated with unfoliated, Cretaceous quartz–feldspar porphyritic bodies that intrude the mid-Paleozoic metamorphic units (Yesilyurt, 1996; Dusel-Bacon and others, 2004). This study determined that many more felsic dikes and mineralized veins occur in the field area than are shown on the published map of the quadrangle (Wahrhaftig, 1970b). Mineralization in the study area primarily includes arsenopyrite ± gold ± bismuth minerals ± tourmaline + quartz veins and replacements, and pyrrhotite ± gold ± arsenopyrite + actinolite + biotite skarn (this study; Yesilyurt, 1996). Cu-, Sb-, Pb- and Zn-bearing ore minerals are associated with gold–arsenopyrite mineralization and (or) are present as distal expressions of Au–As–Bi mineralization. Enriched gold values are associated with potassium silicate (alkali feldspar–biotite–tourmaline–quartz), chlorite–sericite–quartz, and widespread quartz–sericite alteration assemblages (Yesilyurt, 1996). Secondary biotite and sericite from altered rocks yield ~92 Ma ages (K-Ar, 91.6 ± 0.9 and 93.0 ± 1.0 Ma, respectively; Yesilyurt, 1996). The nearby granitic intrusions, potential sources of mineralizing fluids, are usually composed of altered, reduced, porphyritic to rarely equigranular (± biotite) granite and minor hornblende–biotite granodiorite and tonalite. Pending Ar-Ar ages from the intrusions, if similar to the ~92-million-year age of alteration, will show that the intrusions are an intrinsic part of Liberty Bell's plutonic-related mineralized system. Liberty Bell mineralization has the same general age, chemistry, and character seen in Tintina gold belt plutonic-related gold systems.

Evidence of recent igneous activity is found in and adjacent to the study area. Wahrhaftig (1970a–e) mapped numerous Tertiary(?) basalt, diabase, andesite, and rhyolite bodies in the quadrangles adjacent to the Fairbanks A-4. Two Holocene maars, vesicular basalt erupted into the water table, are exposed as pond-filled craters 3 miles east of the map area (age from radiocarbon-dated charcoal; Albanese, 1982). Jumbo Dome, located 1.5 miles south of the map area, is a 2.8 Ma hornblende dacite body (K-Ar age; Wahrhaftig, 1970d). New Ar-Ar ages and chemistry of dacite flows in the southeastern corner of the map area (fig. 3, magenta-colored units) and gabbro dikes to the north may extend the Jumbo Dome volcanic rocks north or indicate a period of igneous activity previously unrecognized in this area.

A complex system of dormant and active faults displaces the geologic units discussed above. It is clear that the structural picture for the region is considerably more complex than shown on the previously published map. Recent regional and primarily photogeologic studies suggest that the northern Alaska Range foothills are actively undergoing compression, resulting in a wedge-shaped fold and thrust fault belt propagating north from the Alaska Range (Thoms, 2000; Ridgway and others, 2002; Bemis, 2004). Because important Alaskan infrastructure traverses the Northern Foothills thrust, and national defense facilities are located nearby, one of the objectives of DGGS's Liberty Bell project was to collect data that could help provide a better understanding of the regional tectonic framework. Through detailed surficial and bedrock mapping and interpretation of linears in the electromagnetic and magnetic geophysical data (Burns and others, 2002) and aerial photography, we recognize sets of high-angle faults with differing orientations (northwest-, northeast-, and east–west-trending) and relative ages that truncate geologic units and mineralization. Our geologic mapping found no evidence of the postulated thrust faults in the map area. If present, the near-surface expression of this basement-involved, regional

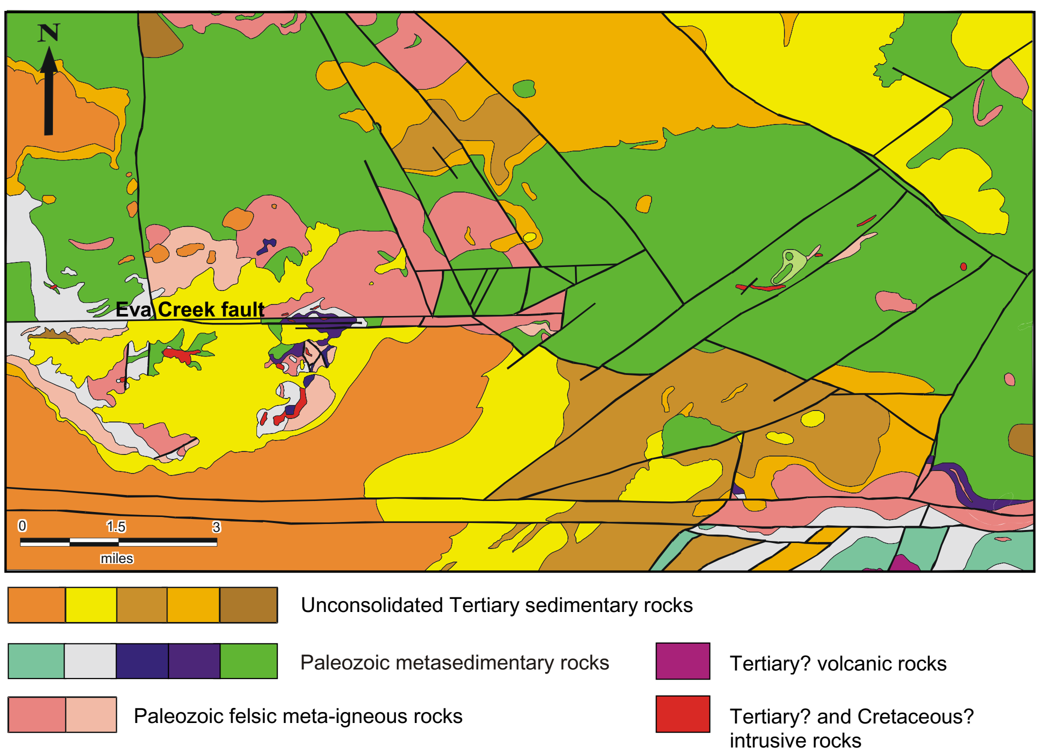


Figure 3. *1:50,000-scale draft geologic map of the Liberty Bell area (this study). Pending Ar-Ar ages from unmetamorphosed igneous rocks will help to define periods of igneous activity in this area and allow comparison with other igneous rocks in the Interior, specifically plutons associated with the Tintina Gold belt, and south of the study area.*

structural system may be either active in conjunction with, superimposed on, or possibly reactivating high-angle faults.

Of particular interest is the Eva Creek high-angle (70–90°) fault, which displaces mineralization and hornfels in the Cody Creek–Liberty Bell Mine area (fig. 3). Plots of ore-element concentrations from rock samples suggest that relative movement on this fault is south-side-up; Te and Cu, elements found more proximal to plutons in hydrothermal systems, are concentrated south of the fault while Sb, Pb, and Zn, elements found more distal to plutons in hydrothermal systems, are more concentrated to the north of the fault. This elemental evidence suggests a possible vertical offset of more than a thousand feet. Mapping from this study and Freeman and others (1987) noted the opposite sense of movement on a section of this fault in the Liberty Bell Mine area; the fault is north-dipping and south-side-down (reverse), and several hundred feet of offset is indicated. Either the Eva Creek fault has been later reactivated within a different stress regime or the fault is actually composed of several en echelon faults with different directions and amounts of offset. This fault is important because it offsets a 4.5-mile-wide magnetic high mapped as pyrrhotite-bearing hornfels and the ore-element geochemical anomalies discussed above. Small, scattered intrusions are unlikely to have provided enough heat to produce the high volume of hornfelsed rock. The offset hornfels ring and geophysical signatures indicate the hornfels surrounds a buried pluton, suggesting the potential existence of a large mineralized system at depth.

CONCLUSION

DGGS believes that by conducting new geologic mapping with interpretation of geophysical data in historic mining areas such as the western Bonnifield district, which contains lode gold deposits and occurrences with relatively easy access to infrastructure, we will provide information that could lead to mineral development, stimulate the local economy, and provide jobs for Alaskans. This project's products will be a bedrock-geologic map at 1:50,000 scale, and reports containing geological, geochemical, and geophysical data compilations. DGGS is conducting a simultaneous surficial-geologic study in the field area largely from interpretation of aerial photography, revision of historical data, and limited field work. From this additional study, we anticipate the completion of a comprehensive-geologic and a surficial-geologic map. DGGS expects to have the maps and data published and available to the public on its Web site (http://wwwdggs.dnr.state.ak.us/) in 2006.

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Dear Readers:

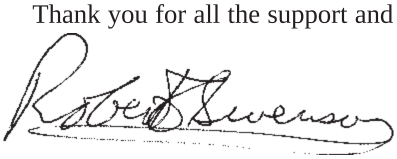
Now that the holiday season is behind us and a new field season approaches, it is a perfect time to review last year's work and outline some plans for the coming season. Our feature article, by one of our field geologists, Jen Athey, is a perfect example of the excellent products coming from our Mineral Resources section and Geologic Communications staff. As you can see, the airborne geophysical/geological mineral inventory program provides a much higher resolution of geologic mapping than can be attained through surface exposures alone, and shows that we are committed to using all the tools necessary to map the geology of Alaska in the greatest detail possible.

This coming season our field work plans include mapping in the Council mining district of western Alaska and the Kavik area of the central Brooks Range mountain front, and we will be initiating surface geologic work along the proposed pipeline corridor from Delta Junction to the Canadian border. This latter project will incorporate the airborne geophysical survey that has just recently been completed, and will focus primarily on geohazards, surficial deposits, and bedrock geology along that route. These are just a few of the exciting projects we have planned and I encourage you to visit the DGGS Web site <http://www.dggs.dnr.state.ak.us> or stop by the office and discuss some of the other programs we have underway.

On the personnel front, I am happy to announce the addition and movement of some important staff. David LePain has taken a job as a Geologist IV in the Energy Resources section and will be leading a new program looking at frontier areas of producing basins, primarily Cook Inlet. David worked for DGGS for a number of years and we are very happy to see him come back to Fairbanks and Alaska geology after a time at the Wisconsin Geological and Natural History Survey. Emily Finzel has taken a Geologist III position in the Energy Resources section and will be in charge of field logistics and mapping for the group.

This year is shaping up to be very exciting and full of great geology.

Thank you for all the support and I hope to see you in the coming year.



Bob Swenson
Acting Director & State Geologist

NEW DGGS PUBLICATIONS

GEOPHYSICAL MAPS & REPORTS

GPR 2006-1. Line, grid, and vector data and plot files for the airborne geophysical survey data of parts of the southern National Petroleum Reserve–Alaska, Northwest Alaska, by Laurel E. Burns, U.S. Bureau of Land Management, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2006. 3 CD-ROMs. Line data in ASCII format; gridded data in Geosoft and ER Mapper formats; vector files in Autocad version 13 dxf files. Includes 19 maps (aeromagnetic or resitivity) listed below as GPR2006_1_xy as plot files in both HPGL/2 format and postscript printer format, and as Adobe Acrobat format files. For the plotter files, software is needed with ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter or postscript files designed for an HP Design Jet 5000/5500 using Postscript 3 printer driver v5.0. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. $30.

GPR 2006-1-1a. Total magnetic field of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-1b. Total magnetic field of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains magnetic contour lines. $52.

GPR 2006-1-2a. 7200 Hz coplanar resistivity of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-2b.- 7200 Hz coplanar resistivity of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $52.

GPR 2006-1-3a. 900 Hz coplanar resistivity of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-3b. 900 Hz coplanar resistivity of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $52.

GPR 2006-1-4a. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Misheguk Mountain C-1, C-2, D-1, and D-2 quadrangles, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4b. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass C-5 and D-5 quadrangles, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4c. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass C-4 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4d. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass C-3 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4e. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass C-2 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4f. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass C-1 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4g. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass B-5 and C-5 quadrangles, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4h. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass B-4 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4i. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass B-3 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4j. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass B-2 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4k. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, parts of Howard Pass B-1 Quadrangle, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-5a. 56,000 Hz coplanar resistivity of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-5b. 56,000 Hz coplanar resistivity of parts of southern National Petroleum Reserve–Alaska, Northwest Alaska, 4 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $52.

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