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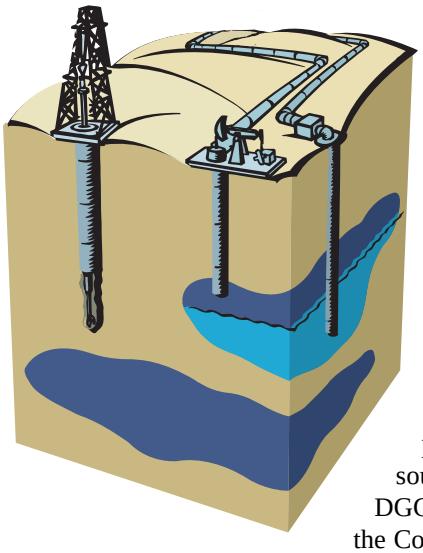
WESTERN ARCTIC ENERGY PROJECT (TINGMERKPUK)

by Charles G. Mull and Ellen E. Harris, Geologists

Over 80 percent of Alaska's state revenues are derived from the production of oil and gas, and of this, the majority is produced on State lands of the North Slope, from Prudhoe Bay, Kuparuk River, Endicott, Point McIntyre, Milne Point, and other associated oil fields located on the northern flank of the Colville Basin. This prolific sedimentary basin, which underlies most of the Arctic North Slope of Alaska, north of the Brooks Range, is one of the most important petroleum basins in North America. When discovered in 1968, the supergiant Prudhoe Bay field on the basin's north flank, with economically recoverable reserves now estimated at about 13 billion barrels, contained almost 25 percent of the United States' oil reserves. The field reached its peak production rate of about 1.6 million barrels per day in 1987 and has now declined to about 627,000 barrels per day. Although increasing production from some of the satellite fields has offset some of the decline from the Prudhoe Bay field, the throughput in the TransAlaska pipeline has declined to about 1.25 million barrels per day from its peak of slightly over 2 million barrels per day in 1988. It is obvious that increased exploration and development of new fields will be necessary in the long run to maintain the level of oil production from the North Slope and the corresponding level of revenues that have paid for many state services for the past 20 years.

For a number of years, the Division of Geological & Geophysical Surveys has supported an ongoing research program aimed at increasing the level of basic geological mapping and other analytical data from the North Slope. This program has had a dual purpose—to provide data for an expanding database of use to the petroleum industry as well as to state and federal agencies involved in land-use planning on the North Slope. As time, personnel, and funding have been available, DGGS has carried out a series of geological mapping projects—primarily in the foothills of the eastern part of the North Slope in the vicinity of the Arctic National Wildlife Refuge (ANWR). However, ANWR remains a subject of considerable controversy, and when it may be opened to industry exploration is uncertain.



In an effort to stem the decline in production, the petroleum industry has continued to develop existing oil fields in the Prudhoe Bay area as well as explore for new reserves primarily in state lands both east and west of Prudhoe Bay. In 1996, an announcement by ARCO Alaska, Anadarko Petroleum, and Union Texas Petroleum of the discovery of the Alpine field near the Colville River attracted attention to the National Petroleum Reserve in Alaska (NPRA), west of the Prudhoe Bay area. With estimated economically recoverable reserves of over 250 million barrels of oil, the Alpine field has turned the eyes of explorationists to the west, to the federal lands of NPRA and even farther to state and Native lands west of NPRA.

Even before the Alpine discovery turned attention westward on the North Slope, DGGS had begun carrying out geological studies on the central and western Brooks Range and adjacent foothills. In 1993, after completing a three-year mapping study of mineralized areas in the northern flank of the Brooks Range in the southeastern part of NPRA, partially funded by the Bureau of Land Management, a DGGS team moved westward to begin preliminary studies of the petroleum potential of the Colville Basin in the southwestern part of NPRA and adjacent state and Native lands.

(continued on page 2)

Joined by geologists from DNR's Division of Oil and Gas, the University of Alaska Fairbanks, and the U.S. Geological Survey, the team spent two weeks in a tent camp on an abandoned airstrip at Eagle Creek, in the foothills of the DeLong Mountains, about 120 miles north of Kotzebue and 40 miles north of the Red Dog mine. The airstrip, close to the western boundary of NPRA, was constructed by Chevron USA for an unsuccessful exploratory well drilled in the early 1980s on lands of the Arctic Slope Regional Corporation. The airstrip is centrally located with respect to surface exposures of rocks of considerable interest in the evaluation of the hydrocarbon potential of the southwestern Colville Basin. Constant vigilance is necessary while camped at Eagle Creek, because the area is the homeland for large numbers of barren ground grizzly bears, and in addition is characterized by frequent high winds that threaten, and on two occasions have blown away portions of the camps.

The short 1993 field season permitted the evaluation of a thick interval of sandstones termed the Tingmerkpuk Sandstone, a rock unit that closely resembles the Kuparuk River Formation, which, in the Kuparuk River oil field near Prudhoe Bay, is the reservoir for over 1.5 billion barrels of recoverable oil. Although the Tingmerkpuk Sandstone in the DeLong Mountains is not a potential reservoir, a detailed study of the interval was made by team members Dr. Keith Crowder of the University of Alaska Fairbanks and Karen Adams of the U.S. Geological Survey in order to gain insight into the characteristics of the formation in the subsurface of the Colville Basin. In addition, detailed mapping of the outcrop belt was begun by Ellen Harris, Rocky Reifenstuhl, and Gil Mull of DGGS, and a suite of shale samples was collected for analysis for micropaleontology and organic geochemistry. This field program was followed in 1994 by an abbreviated field season of only one week due to limited funding. The mapping and analyses from the short 1993 and 1994 field programs revealed an area of anomalously low thermal maturity in which the rocks had not been heated as much by burial and mountain building activity as in most of the adjacent areas. Such cooler areas are of particular interest to petroleum geologists because they may be within what is termed "the oil window," in which the organic material in the rocks has not been overcooked—whereas rocks that have been overcooked have only dry gas potential. In addition, analyses revealed that some of the rocks in

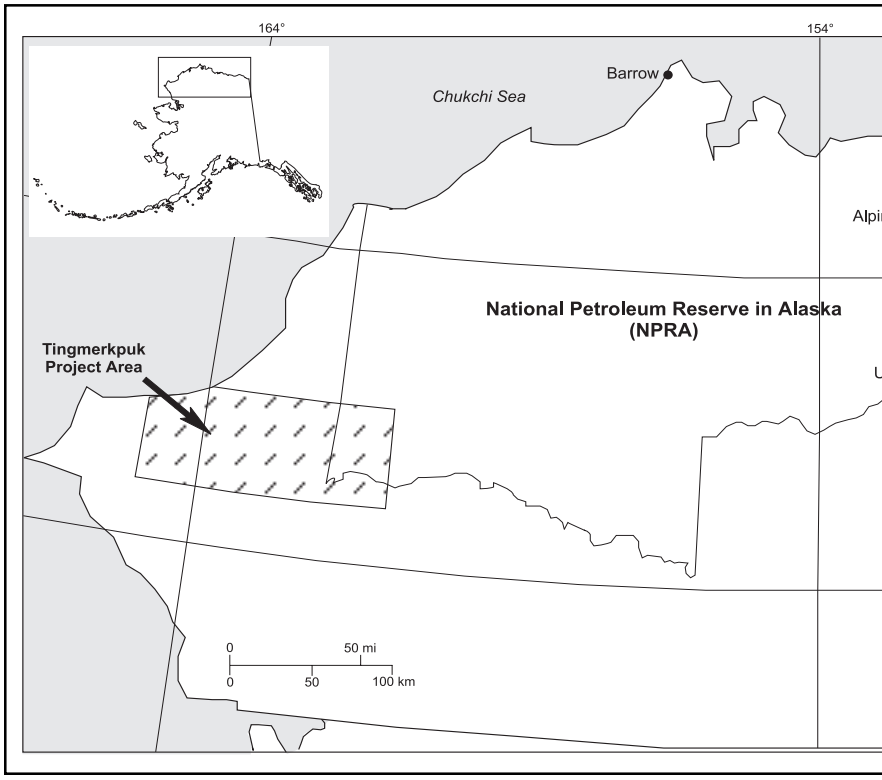
(continued on page 3)

Why is DGGS carrying out field studies in northern Alaska that the well funded oil companies could be doing for themselves?

In the United States and Canada, as well as in many other parts of the world, the petroleum industry has traditionally relied heavily on the available reconnaissance field studies of governmental agencies as a source of regional data on which to base its much more detailed subsurface studies. In northern Alaska, in particular, field mapping studies are extremely expensive and time consuming, and most companies prefer to allocate their people to subsurface studies in which they have more expertise. In addition, geologists in the petroleum industry are commonly transferred rather frequently to other areas in order to enhance their familiarity with a diversity of geological conditions, whereas geologists with government agencies tend to provide a thread of continuity over a period of years. In addition, state and federal governments need to have a reliable source of publicly available data to aid in land-use planning decisions. Most industry studies, no matter how good they may be, remain in private company files, where they are rarely available to the public.

Why is DGGS interested in studying the geology of NPRA, which is federal land?

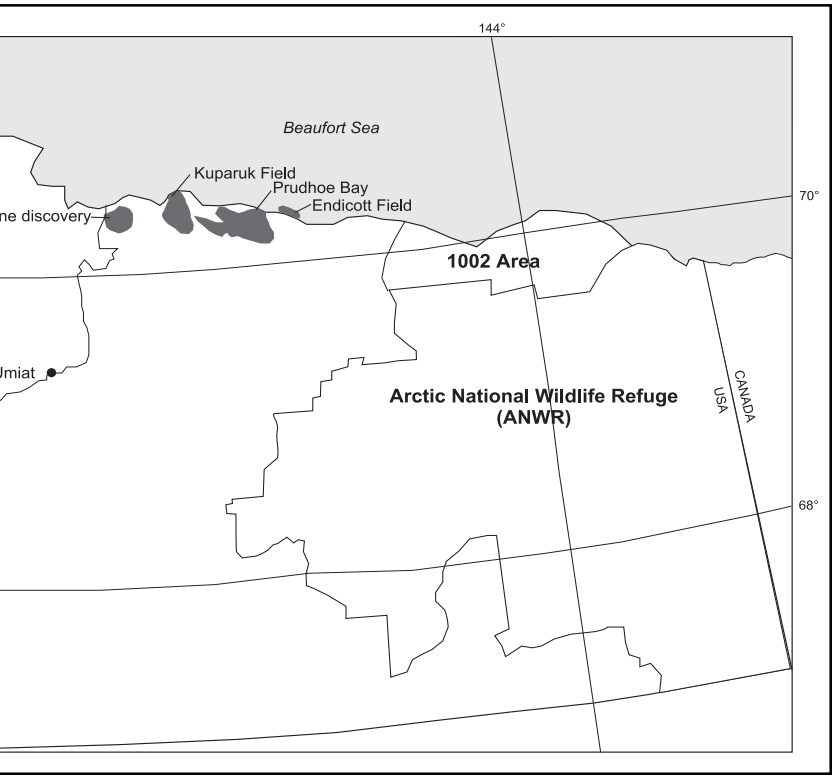
Not only does the State of Alaska receive 50 percent of the revenue that the federal government may receive from federal lands, but in addition, exploration on any lands in the state benefits the state by the jobs it creates as well as the taxes that are paid by the landowner.



the area are rich oil and gas source rocks in which organic material is capable of maturation and generation of oil. The implication of these studies was that there are anomalous areas in the western Brooks Range that cannot be completely explained by geological models developed elsewhere in northern Alaska. This suggested that the foothills of the western DeLong Mountains warranted a much more detailed mapping and sampling program than was possible with the limited funding available. The results of the preliminary work in the area were combined in a proposal and request for funding for additional field studies. The package was submitted to the oil industry and other corporations interested in development of natural resources in northern Alaska.

As a result of the funding request, an industry consortium composed of ARCO Alaska, Anadarko Petroleum, BP Exploration, Phillips Petroleum, the Arctic Slope Regional Corporation, the North Slope Borough, and Alfred James, an independent oil producer from Kansas, provided funding that allowed us a one-month field season in 1996 that included additional field mapping, stratigraphic studies, and sampling for an extensive analytical program. The geochemical analyses by contractor DGSI Inc. and mapping by Ellen Harris, Gil Mull, Rocky Reifenstuhl, and Marwan Wartes of DGGS, and Tom Moore of the USGS revealed and expanded the regional extent of an area in which some extremely rich oil-prone source rocks with as much as 20 percent total organic carbon are present. These rocks also proved to be within the oil window and are indicative of anomalous geological conditions not previously known in the southern part of the Colville Basin.

Detailed stratigraphic studies by consultant Tor Nilsen and Division of Oil and Gas geologist Mark Myers, and studies by contract paleontologists Will Elder and Mike Mickey provided new insight into the depositional environment of the Tingmerkpuk Sandstone as well as new data for correlation with the subsurface of the North Slope. These data showed an expanded area of rich source rocks and other geological anomalies in the previously little studied western part of the project area. Although the thickness of the organic-rich section of rocks is unknown, these results have again attracted the attention of the oil industry. A consortium of companies is planning to fund another field season to follow up on the findings resulting from the 1996 studies. A team, composed of DGGS geologists Ellen Harris, Gil Mull, and Rocky Reifenstuhl, UAF research assistant Russ Kirkham, and USGS geologists Tom Moore and Karen Adams, plans to spend most of July again camped at Eagle Creek in a program to wrap up the field studies in this remote part of the western Arctic Slope. In the final days of the field season, they will be joined by Dave LePain, a petroleum geologist and recent addition to the DGGS staff, and Jim Clough, as well as representatives of many of the companies sponsoring the field studies. The team believes that the analytical data resulting from this final field season of the Tingmerkpuk project will allow the compilation of a detailed geologic map and a comprehensive report on the geology of the foothills of the western DeLong Mountains and some implications concerning the hydrocarbon potential of the western part of the Colville Basin in NPRA and adjacent lands.



Check it out

- Publications from the Alaska Geological Society will be availabe through our office. If you are interested in seeing a list of these publications, please contact us.
- Did your receive your copy of IC 43, Alaska's Mineral Industry 1997: A Summary. **Table 3** on page 3 needs correcting. *Gold estimated values* for 1997 should read $198,420,000 NOT $8,420,000. **Table 4**, page 5, *Total base metals* should read $133,880,000.

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Dear Readers:

I am pleased to introduce to the readers of our newsletter **Dr. David Szumigala**, the newest member of the Alaska Division of Geological and Geophysical Surveys. David Szumigala joined our staff in May 1998, as the *Senior Minerals Geologist*. This is the position held by Thomas Bundtzen until his resignation last August.

Dave has twenty years of experience in mineral exploration and ore deposit research, with field experience in the western U.S. and Alaska. He has conducted work focused primarily on gold deposits, but also has broad experience with other metals and deposit types. His mineral exploration experience ranges from "grass-roots" regional programs to mine feasibility drilling projects.

Dave was born and raised in Toledo, Ohio. Upon graduating from high school, he headed west, attending the Mackay School of Mines at the University of Nevada, Reno. After graduating with a B.Sc. degree in geological engineering, Dave worked in the Great Basin for Noranda Exploration and Chevron Resources, exploring for precious metal deposits.

After working in exploration for 1½ years, Dave decided to return to school. His search for graduate schools led him to Alaska. He attended the University of Alaska Fairbanks and completed the M. Sc. degree program in Geology advised by Dr. Rainer Newberry. Dave's thesis examined the Tin Creek Pb-Zn-Ag skarn deposits in the Farewell Creek mineral belt. He was able to work with a number of DGGS geologists during that time, primarily Tom Bundtzen, as part of DGGS field studies in the McGrath Quadrangle.

Dave completed his formal graduate education with a Ph.D. in Geology from UCLA. His dissertation dealt with gold mineralization related to igneous rocks in the Kuskokwim Mountains of southwestern Alaska. Much of Dave's fieldwork and some of his laboratory research were supported by the mineral industry.

Since coming to the state in 1982, Dave has worked for a number of large mining companies in many areas of Alaska. These companies include Kennecott Exploration, Battle Mountain Exploration Co., Amax Gold Exploration Inc., Cyprus Gold Exploration Inc., and Placer Dome Exploration Inc. His most recent work was with Placer Dome on the Donlin Creek deposit in southwestern Alaska.

Dave will have major responsibilities for generating the state's annual *Alaska's Mineral Industry* report. In that role Dave has said "I look forward to meeting everyone involved in the Alaska mineral industry. I hope to see as many of you as I can in the "field"—at your placer mines, exploration camps, and mining operations. I expect to meet many of you at various functions, especially the AMA convention and conferences. Otherwise, feel free to visit me at the DGGS offices in Fairbanks. Best of luck for a productive summer!"

Dave's Fairbanks office phone numbers and e-mail address are- phone (907) 451-5025, fax (907) 451-5050; and Dave_Szumigala@dnr.state.ak.us.

Sincerely,

Milton Wiltse
Director and State Geologist

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RI 98-8. **Total field magnetics for the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, 1998, 2 sheets, scale 1:63,360. Magnetic contour lines included. Full color plot from electronic file, 600 dpi. Made on request. $26.

RI 98-9. **900 Hz coplanar resistivity contours for the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, 1998, 2 sheets, scale 1:63,360. Resistivity contour lines included. Full color plot from electronic file, 600 dpi. Made on request. $26.

RI 98-10. **4200 Hz coplanar resistivity contours for the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, 1998, 2 sheets, scale 1:63,360. Resistivity contour lines included. Full color plot from electronic file, 600 dpi. Made on request. $26.

PDF 98-19. **Flight line path of the 1997 geophysical survey for the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 2 sheets, scale 1:63,360. Blueline. Topography included. $6.

PDF 98-20. **Total field magnetics and electromagnetic anomalies for the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 2 sheets, scale 1:63,360. Clear diazo film. Magnetic contours and topography included. Made on request. $52.

PDF 98-21. **900 Hz coplanar resistivity contours for the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 2 sheets, scale 1:63,360. Blueline. Resistivity contours and section lines included. $6.

PDF 98-22. **4200 Hz coplanar resistivity contours for the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 2 sheets, scale 1:63,360. Blueline. Resistivity contours and section lines included. $6.

PDF 98-23. **Zip disk containing gridded files and section lines of 1997 geophysical survey data for northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 1 disk. $15.

PDF 98-24. **CD-ROM digital archive files of 1997 survey data for northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska,** by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 1 CD-Rom. $150.

PDF 98-26. **Portfolio of aeromagnetic and resistivity maps of the northeastern portion of the Koyukuk mining district. Includes color and shadow maps. Maps fit on 8½" x 11" sheet,** by L.E. Burns and S.A. Liss, May 1998, 21 p. $8.

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

PDF 98-34. Micropaleontology of Cretaceous and Jurassic shales from the northwestern DeLong Mountains, western Brooks Range, Alaska, 1994-1997, by M.B. Mickey and Hideyo Haga, March 1998, 193 p., 1 disk, $28.

PDF 98-35. Organic geochemistry of Cretaceous, Jurassic, and Triassic shales from the northwestern DeLong Mountains, western Brooks Range, Alaska, 1994-1997, by Wallace G. Dow, March 1998, 181 p., 1 disk, $29.

PDF 98-39. Rock geochemistry from the Manley mining district (Tanana A-1 & A-2 Quadrangles with some samples from adjacent quadrangles), by S.A. Liss, R.R. Reifenstuhl, K.C. Clautice, T.K. Bundtzen, R.J. Newberry, J.H. Dover, and R.B. Blodgett, March 1998, 41 p., 1 disk. $9.

PDF 98-40a. Total field magnetics and detailed electromagnetic anomalies of the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska, by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 1 sheet, scale 1:31,680 (parts of the Wiseman A-1, A-2, and B-1 quadrangles). Blueline. $6.

PDF 98-40b. Total field magnetics and detailed electromagnetic anomalies of the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska, by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 1 sheet, scale 1:31,680 (parts of the Wiseman B-1 and C-1 quadrangles). Blueline. $3.

PDF 98-40c. Total field magnetics and detailed electromagnetic anomalies of the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska, by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 1 sheet, scale 1:31,680 (parts of the Wiseman A-1, B-1, Chandalar A-6 and B-6 quadrangles). Blueline. $6.

PDF 98-40d. Total field magnetics and detailed electromagnetic anomalies of the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska, by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 1 sheet, scale 1:31,680 (parts of the Chandalar C-5 and C-6 quadrangles). Blueline. $6.

PDF 98-40e. Total field magnetics and detailed electromagnetic anomalies of the northeastern portion of the Koyukuk mining district, eastern Brooks Range, Alaska, by DGGS, Online Exploration, and SIAL Inc. Staff, May 1998, 1 sheet, scale 1:31,680 (parts of the Chandalar C-4, C-5, D-4, and D-5 quadrangles). Blueline. $6.

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