

Summaries of Important Areas for Mineral Investment and Production Opportunities of Nonfuel Minerals in Afghanistan

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Volume I

Prepared in cooperation with the U.S. Department of Defense Task Force for Business and Stability Operations and the Afghanistan Geological Survey

This report is printed in two volumes; a DVD in the pocket of volume I contains the whole report. Volume I contains the Executive Summary and chapters 1–10C. Volume II contains chapters 11A–26C. The chapters and appendixes 1–3 are also available separately on the Web.

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Executive Summary

The U.S. Geological Survey (USGS) of the Department of the Interior and the Task Force for Business and Stability Operations (TFBSO) of the Department of Defense entered into agreements to study and assess the fuel and nonfuel mineral resources of Afghanistan from October 2009 to September 2011 so that these resources could be economically extracted to expand the economy of the country. This report summarizes results of joint studies on 24 important areas of interest (AOIs) of nonfuel mineral resources that were identified for mineral investment and production opportunities in Afghanistan. USGS-TFBSO activities for oil and gas resources are reported separately. This report is supported by digital data and archival and non-USGS reports on each AOI, and these data are available from the Afghanistan Geological Survey Data Center in Kabul (<http://mom.gov.af/en/>; <http://www.bgs.ac.uk/afghanminerals/>) and for viewing and download on the USGS public Web site (<http://afghanistan.cr.usgs.gov/>) and in a separate viewer at <http://mapdss2.er.usgs.gov/>. For images in the B-lettered chapters that are derived from hyperspectral data, higher resolution files are also available at <http://afghanistan.cr.usgs.gov/minerals>.

Because this report focuses on the 24 AOIs within Afghanistan (fig. ES–1), the potential for early economic mining in each area is discussed for a number of different mineral, commodity, and deposit types. These AOIs were selected and identified in 2007 by the USGS as areas where known deposits and resources had been identified by earlier Soviet and Afghanistan geologists. Mineral deposits and occurrences in the AOIs were studied, sampled, and documented by the Soviet and Afghan geologists, which means that the economic geology in these areas is well documented by archival reports and maps. These AOIs commonly contain known measured mineral reserves or resources that were generated from previous sampling in trenches, drill holes, and (or) underground workings. Road access also is common in most of the AOIs. Therefore, these AOIs contain a number of assets that should reduce investment risk, so they are the most likely places to be mined early, considering the vast number of mineralized areas in the country. A number of the AOIs were field checked by USGS and TFBSO geologists between 2009 and 2011, and the previous geologic interpretations and concepts were confirmed.

The USGS-compiled digital data for each of the 24 AOIs, and an additional 33 subareas within these AOIs, include both previously published USGS data and newly generated data from the joint USGS-TFBSO project. All the data generated by the USGS are published and available and are inventoried in appendix 1. The sum of these data within each AOI comprises a data package (fig. ES–2). These digital data packages have been combined with other existing reports and data generated by the USGS. Data and reports in each AOI are interpreted and summarized in the individual chapters in this report, and these summaries, combined with the archival reports and other information, form *Information Packages* for each AOI. The information packages are intended to be used to assemble *Bidding Packages* that would be constructed by the Ministry of Mines of Afghanistan and distributed to potential bidders (fig. ES–2), as specified by the Mining Law of Afghanistan. The bidding packages provide legal and formal access to the mineral resources, according to the Mining Law of Afghanistan, and allow investors and mining firms in Afghanistan to develop the mineral wealth of the country.

Each chapter in this report summarizes mineral resource studies in the individual AOIs and their subareas and three main chapter types are included: “A” chapters summarize the economic geology, “B” chapters summarize the hyperspectral data and hyperspectral anomalies that may indicate mineralized areas, and “C” chapters summarize the geohydrology of each AOI. An additional chapter “D” is also included for Haji-Gak Iron AOI discussing the ores reserve calculations there.

The USGS participated in the planning and execution of several USGS-TFBSO scoping missions to several of the AOIs during 2009, 2010, and 2011. The AOIs visited were the Khanneshin carbonatite, Chaigai Hills travertine, Balkhab copper, Haji-Gak iron, northern Aynak copper and cobalt, Kundalan copper and gold, Zarkashan copper and gold, and Dusar-Shaida copper and tin AOIs (fig. ES-1). Information and data gathered on these scoping missions are incorporated in the summaries of each AOI or are contained within the data or information packages. In each case, new and unique geologic observations were acquired that allowed evaluation and interpretation of the previous Soviet works, which in most cases were confirmed and deemed accurate.

Much USGS work on nonfuel minerals was conducted jointly by the U.S. Geological Survey and the Minerals Team of the Afghanistan Geological Survey from October 1, 2007, to the present. The main AOIs worked in Afghanistan during fiscal year (FY) 2009 and 2010 were Badakshan gold, Balkhab copper, and Panjsher Valley emerald, iron, and silver AOIs (fig. ES-1). Separate reports of this work by the AGS are contained within the information packages for each AOI and are also available through the AGS.

All the AOIs were selected as areas that could potentially support mineral production in the near future. As part of a project prioritization process, a number of AOIs or subareas were identified as important because new information gathered and compiled in 2009 and 2011 confirmed and augmented the geologic concepts or mineral potential that had been interpreted from previous Soviet fieldwork and USGS assessments. These important, higher priority AOIs are Badakshan gold, Balkhab copper, Haji-Gak iron, Aynak copper and cobalt, Zarkashan copper and gold, Kundalan copper and gold, Khanneshin carbonatite, and Dusar-Shaida copper and tin (fig. ES-1). These AOIs have existing outcropping mineralization with favorable geometries and simple metallurgical ore types; these parameters therefore may translate into lower capital costs, lower lead times, and short payback periods. Many of the AOIs may contain ore deposits that could be medium- to world-class in size and tenor.

Activities by the USGS between 2009 and 2011 related to industrial mineral deposits were designed to assess the use of the industrial mineral resources by Afghanistan indigenous industries working closely with TFBSO. This focus was on cement and marble production. Two cement plants, Jabal-e-Saraj and Pul-e-Khumri, were assessed, and planning for marble and phosphorite development was conducted. Results of work on cement are summarized in this report. Additional chapters summarize information on other industrial minerals, such as clays, gypsum, salt, sulfur, sand and gravel, limestone, and other materials.

Geohydrologic activities in support of mineral development involved a number of activities including the completion of the analysis of historical stream flows for Afghanistan. Results of this analysis are available in three separate reports on geohydrologic activities in support of mineral development.

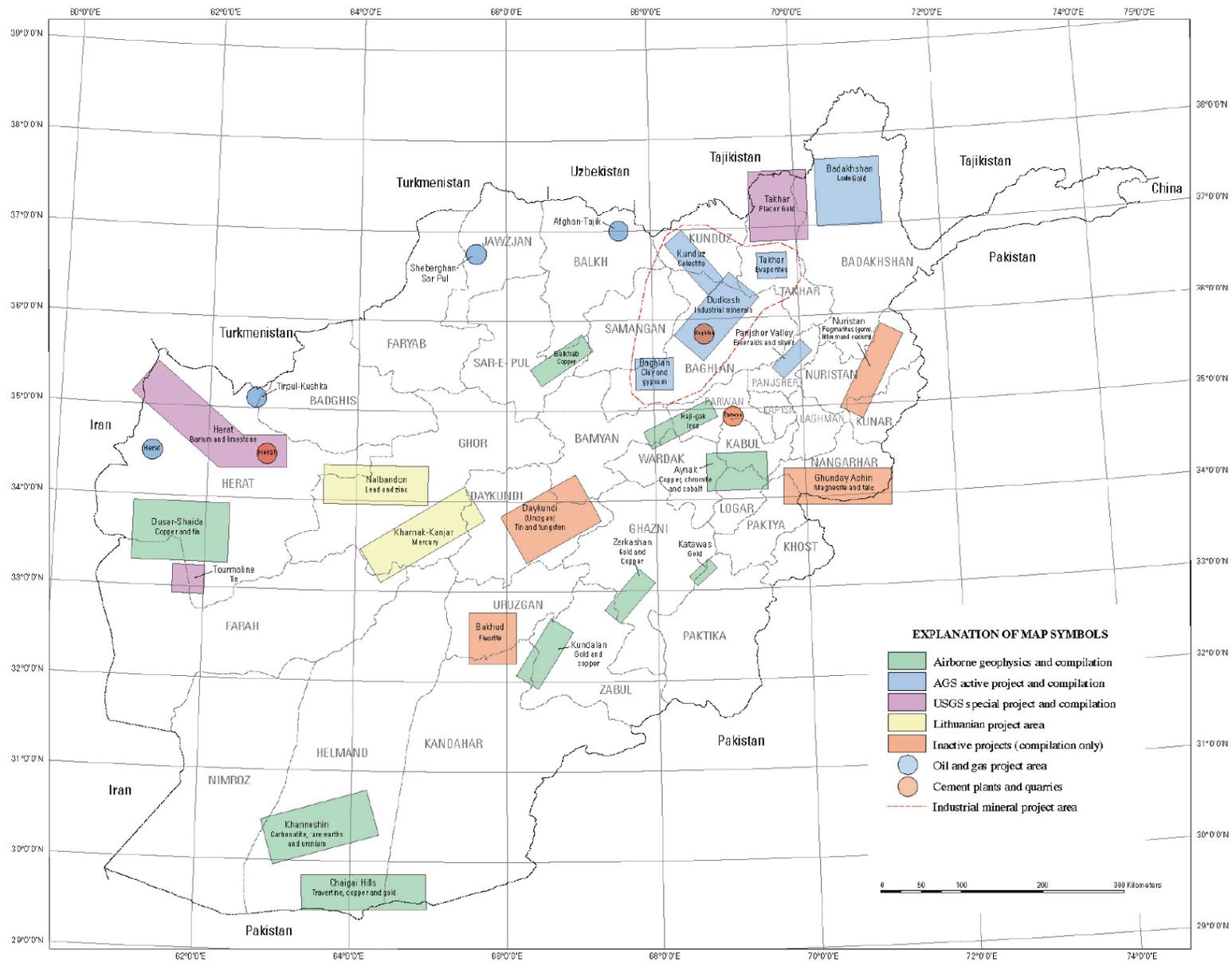
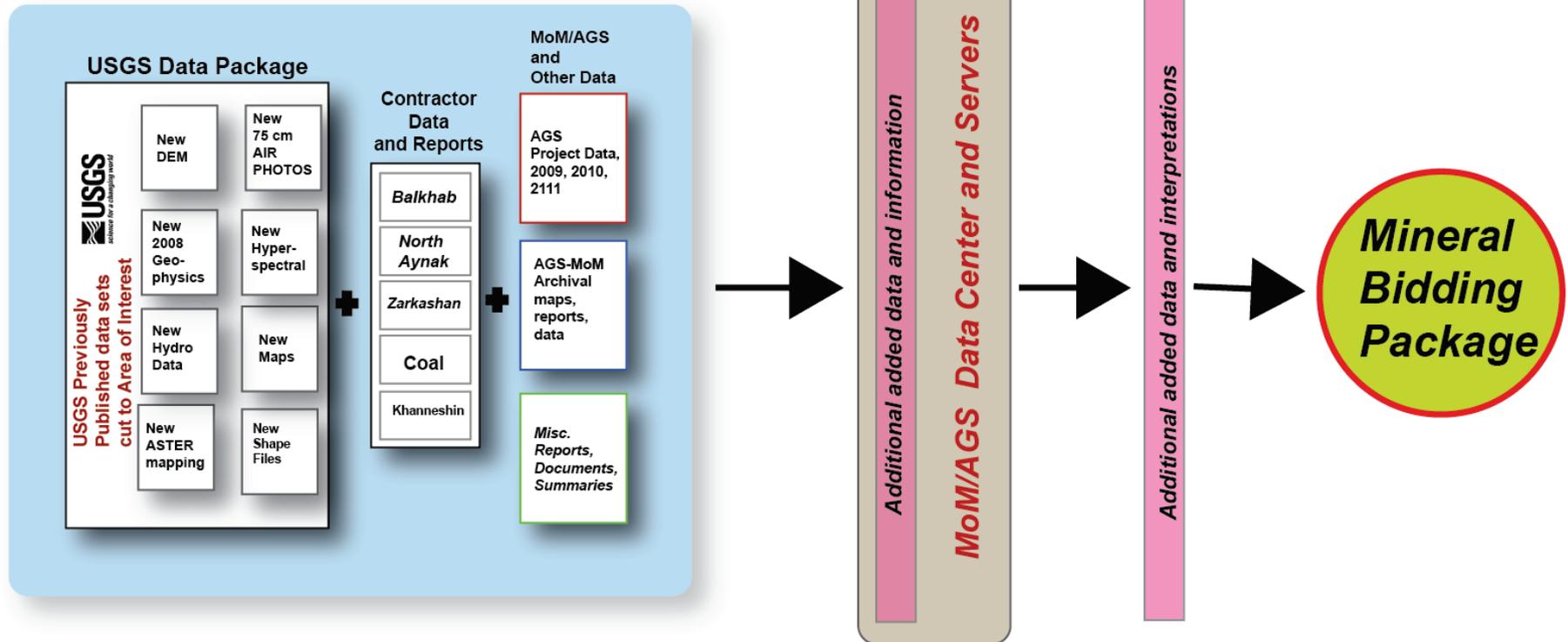


Figure ES-1. Map of Afghanistan showing the areas of interest (AOIs), which are summarized in this report and which were the focus of the U.S. Geological Survey-U.S. Department of Defense Task Force for Business and Stability Operations scoping project that took place during fiscal years 2009–2011.

Total Information Package Compiled by USGS



Data packages + contractor data + other reports and data = Information Packages

Processing of Data Packages and Information Packages to produce Bidding Packages

Figure ES-2. Flow chart and classification of data and information packages for each mineral area of interest leading to a bidding package. The area in blue is the information package that is a combination of U.S. Geological Survey and other data. Each data and information package complements the chapters in this report and is available on the Web at <http://afghanistan.cr.usgs.gov/>.

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[Numbers and letters at left designate the chapters. This report is printed in two volumes; the first contains the Executive Summary, chapters 1–10C, and appendixes 1–3; the second contains chapters 11A–26C. For images in the B-lettered chapters that are derived from hyperspectral data, higher resolution files are also available at <http://afghanistan.cr.usgs.gov/minerals>]

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Appendixes

[The appendixes are not printed. A DVD in the pocket of volume I contains the whole report, including appendixes 1–3]

- Appendix 1. Inventory Spreadsheets for Data Packages Compiled for Each Area of Interest.
- Appendix 2. Streamflow Statistics at Ungaged Sites in Areas of Interest.
- Appendix 3. Groundwater Hydrographs at or Near Areas of Interest.

Conversion Factors

Multiply	By	To obtain
Length		
millimeter (mm)	0.03937	inch (in.)
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
Area		
square centimeter (cm ²)	0.1550	square inch (in ²)
square meter (m ²)	10.76	square foot (ft ²)
square kilometer (km ²)	247.1	acre
Volume		
cubic meter (m ³)	35.31	cubic foot (ft ³)
Flow rate		
cubic meter per second (m ³ /s)	70.07	acre-foot per day (acre-ft/d)
cubic meter per second per square kilometer [(m ³ /s)/km ²]	91.49	cubic foot per second per square mile [(ft ³ /s)/mi ²]
Mass		
gram (g)	0.03527	ounce avoirdupois (oz)
kilogram (kg)	2.205	pound avoirdupois (lb)
megagram (Mg) [metric ton (t)] (1,000 kg)	1.102	ton, short (2,000 lb)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$^{\circ}\text{F}=(1.8\times^{\circ}\text{C})+32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$^{\circ}\text{C}=(^{\circ}\text{F}-32)/1.8$$