

GreaterAntillesMap: A mineral occurrence data set for the Greater Antilles Instructions for MapInfo and ArcGIS users

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Introduction

GreaterAntillesMap is a GIS data set for the Dominican Republic, Haiti, Puerto Rico, Jamaica, Cuba and the Virgin Islands. The *Geography* module provides files for infrastructure (cities, roads, political boundaries, etc.), digital topography (DEM), shaded relief, and bathymetry. *Geology* provides up-to-date published geologic maps and legends for each country in vector format. The *TS Units* module provides a unified tectono-stratigraphic map and legend for the entire region based on publications from government, industry and academia. *Radiometric Dates* compiles 800 ages for intrusive and extrusive igneous rocks, metamorphism, hydrothermal alteration, mineralization, inherited ages and exhumation (cooling). The *Prospect* module locates 800 metallic mineral mines and prospects, classifies them according to 18 deposit types, and assembles current figures for past production, resources and. *Land Status* locates 1300 metallic and non-metallic mineral concessions (attributed with ownership and contract date) and plots the locations of 500 national parks, forest reserves, and other areas of restricted mineral entry.

Multielement geochemical data sets, available separately, assemble rock, soil and stream sediment geochemical data for each country in the Greater Antilles.

GreaterAntillesMap is constantly being revised and updated as new resources are announced for an ever-increasing number of metallic mineral deposits. Geologic and tectonostratigraphic maps are updated or modified to reflect ongoing research. Pricing is covered on the final page of this data set description.

New users should pay special attention to the “Installation” section.

Geography, Geology, TS Unit Modules

The *Geography* and the *Geology* modules of the GreaterAntillesMap data set are displayed by opening “GAGeography” and “GAGeology.” *Geography* includes

shaded relief and bathymetry and is accompanied by digital topography (DEM), infrastructure, topographic map indices and Landsat satellite imagery. *Geology* provides, in addition, a mosaic of published geologic maps and legends (one for each country) all in vector format. *TS Units* provides a unified tectonostratigraphic map for the entire region compiled using published geologic maps as a base but colored with tectonostratigraphic rock unit assignments (e.g. back arc basin basalt of MORB composition) rather than location-specific lithologic descriptions (e.g. Rio Verde basalt). The *Geography*, *Geology* and *TS Units* modules have broad application beyond the mining and exploration industry.

Radiometric Dates Module

The *Radiometric Dates* module compiles over 1100 published radiometric ages along with sample number, sample location, description, analytical method, mineral dated, error and a reference to the literature. Two additional fields record the original and the current interpretation for each date, e.g. the age of: intrusion, volcanism, metamorphism, sedimentation, exhumation, hydrothermal alteration or mineralization.

Prospect Module

The *Prospect* module, which includes the *Geography*, *Geology*, *Radiometric Dates* and *TS Units* modules, is displayed by opening “GAProspects.” Metallic mineral occurrences are plotted using shapes that correspond to deposit types, colors for each metal, and sizes that reflect gross contained metal value. Selecting a specific mineral occurrence with the info tool will call up attached information including location, source of data, deposit type, owners, partners, past production, current resources, current reserves, status (active mine, inactive mine, prospect), drill results, geologic observations, recent sales and joint ventures, and references to the literature as well as calculated fields for overall size (in tons or ounces) and contained metal value in US\$.

Land Status Module

The *Land status* module is displayed by opening “GALandStatus.” Metallic and non-metallic mineral concessions, color-coded and plotted on a shaded relief base map, are attributed with concession type, ownership, status, contract date, and expiration date. Only official government records are used to generate the concession maps. These maps provide a “snapshot” of land status as of the last compilation date. For specific areas of interest, a thorough review of current concession status is always necessary.

The land status data set also shows national parks, forest reserves, Indian reservations, national monuments and other areas where mineral exploration and development is restricted or prohibited.

Subdirectories

Concessions subdirectory:

Concession maps for each country in the Greater Antilles are stored in the Concessions subdirectory. Each concession is attributed with the contract date, ownership, and the expiration date (the contract date plus the maximum number of years that a concession can be held). Expired concessions are not eliminated until they disappear from the official government data set. For up-to-date concession information, the user is referred to the Mines Department in each country.

Geology subdirectory:

The Geology subdirectory contains the most recent published geologic map and legend for each country. Many of these maps are difficult to obtain or out of print. All of the maps and legends have been digitized and are provided as vector files. The scale and publication date of the source maps vary: 1:250,000 for Haiti (1987), Jamaica (1977) and Puerto Rico (1973); 1:500,000 for Cuba (1988) and the Dominican Republic (2010). Each of these published maps has been modified to include more recent published geology for specific areas (e.g. Jolly et al., 2006 and Lidiak et al., 2011 for Puerto Rico).

Prospect subdirectory:

Information pertaining to individual mines and mineral occurrences is stored in an MS Access database (CBPros.accdb). Only published, non-confidential information is provided. CBPros includes the following information for each mineral occurrence: name, alternate names, location, reference for location, deposit type, district name, owners, partners, deals, production, production period, production reference, reserve, reserve reference, resource, resource reference, status (active mine, inactive mine, resource, prospect), geologic observations, overall size (in ounces or tons) and contained metal value (in US\$).

Mineral occurrences are classified according to 18 deposit types, listed in the following table. MapInfo cannot read MS Access queries, consequently each deposit type has a stand-alone table in the Prospect subdirectory.

Metallic Mineral Deposit Classification

Deposit Type	Symbol
Epithermal veins and stockworks (Au, Ag, Cu, Pb, Zn)	1
Epithermal disseminated (Au, Ag, Cu, Zn)	13
Epithermal veins and stockworks of Hg and Sb	8
Volcanogenic massive sulfide (VMS) deposits	2
Sediment-hosted (Sedex) deposits	14
Volcanogenic (Seafloor) manganese deposits	9
Sediment-hosted (U, Th, V) deposits	27
Banded iron formation (Au, Fe, Mn) deposits	21
Porphyry (Cu, Mo, Au, Ag) deposits	5
Skarn (Au, Ag, Cu, Pb, Zn) deposits	3
Iron skarn (Fe) deposits	24
Carbonate replacement (Au, Ag, Cu, Pb, Zn) deposits	22
Iron replacement (Fe) deposits	23
Greisen (Sn, W) deposits	17
IOCG (Iron-oxide copper gold) deposits (Au, Ag, Cu, Mo)	16
IOCG (U, REE, Fe) deposits	25
Alkaline Rocks and Carbonatites (U, Th, V)	18
Alkaline Rocks and Carbonatites (Sc, REE)	26
Orogenic (shear-hosted, mesothermal) deposits (Au, Ag)	4
Magmatic segregation (Cr, Pt, Pd) deposits	11
Lateritic (Ni, Co) deposits	6
Bauxite (Al, REE, Sc) deposits	12
Alluvial (Au, Ag, Pt, Pd) deposits	7
Alluvial (U, Th, REE, Sc) deposits	28
Alluvial (Fe, Sn, W) deposits	29
unassigned	99

Parks subdirectory:

The Parks subdirectory contains national parks, forest reserves, and Indian reservations for each of the six countries in the Greater Antilles. These are areas where mineral development is prohibited or restricted.

Survey Indices subdirectory:

The files in this subdirectory show the location of stream sediment surveys and geophysical surveys conducted by companies, governments and international aid organizations. Stream sediment survey indices record the number of samples collected, area covered, sample density, list of elements run, and the original source of the data. Geophysical survey indices show the type of survey (magnetic and/or radiometric), area covered, and the source of the image or data.

Geophysics subdirectory:

Airborne geophysical survey results including grid files are available for selected areas. Pricing information for these supplemental geophysical data sets is available from Recursos del Caribe (nelson@cbmap.net).

Geochemistry subdirectory:

Multielement geochemical survey indices are provided for all of the Greater Antilles. Sample locations, analytical data and accompanying reports (as pdf files) have been assembled for each country in the Greater Antilles and have been digitized (captured as vector files) for the Dominican Republic. The geochemical data sets are designed to work with GreaterAntillesMap but are sold separately. For an index of geochemical surveys by country, go to:
<http://www.cbmap.net/images/caribbean-stream-sediment-surveys-summary.pdf>.

Shaded Relief and Bathymetry subdirectories:

Shaded relief and bathymetric maps for the Greater Antilles are provided in the Shaded Relief and Bathymetry subdirectories. Ninety-meter (3 arc-second) resolution data used to create shaded relief maps for each country comes from version 2 (2005) of the Shuttle Radar Topography Mission (SRTM) (<http://seamless.usgs.gov>).

Regional bathymetry (as DEM grd files) was downloaded from the Marine Geoscience Data System: Global Multi-resolution Topographic Data portal (MGDS: GMRT) at <http://www.marine-geo.org/portals/gmrt/>. The bathymetric map is created from (shipboard) sonar supplemented, between tracks, by gravity and satellite altimetry data using a process described by Ryan et al., 2009: <http://onlinelibrary.wiley.com/doi/10.1029/2008GC002332/full>. MGDS: GMRT data was re-gridded to produce maps at an approximate resolution of 200m (up to 240m depending on location).

Geography, Satellite images and 50K topo index subdirectories:

The Geography subdirectory includes borders, cities and towns, roads, major drainages, and principal topographic contours from the Digital Chart of the World.

Landsat satellite images, compressed using Mr. Sid software, are assembled in the Satellite subdirectory. Indices to published 1:50,000 scale topographic maps are provided in the 50K topo index subdirectory.

Radiometric Dates subdirectory:

The Radiometric Dates subdirectory compiles ages for 650 samples. Each sample is attributed with sample number, location, lithology, sample description, analytical method, rock type, material dated, age, error and source of information. The data set also includes fields both the original and the current interpretation (e.g. inherited age, intrusion/crystallization age, volcanism/crystallization age, age of metamorphism, age of exhumation, etc.)

TS Units subdirectory:

This subdirectory contains files used to create a tectonostratigraphic (TS) map. The TS map uses the published geologic maps from the Geology subdirectory as a base. Then, based on government, industry and academic publications, geologic map polygons are assigned attributes and colors according to their tectonostratigraphic setting. For instance, rather displaying map units according to their age and lithology (e.g. Jurassic to Cretaceous Duarte basalt), the TS_PGONS file is attributed with origin and tectonic setting (e.g. Pacific ocean floor, intra-oceanic island arc, or back arc basin). The result is a tectonostratigraphic map that is easy to understand and directly applicable to mineral exploration.

Titles and legends subdirectory:

Title blocks, legends, grids, labels, and scale bars are stored here.

UTM subdirectory:

A UTM index is provided for all of the Greater Antilles along with grids for each UTM zone. Grids are provided for the following projections: 1) Latitude/Longitude (Equidistant Cylindrical) projection using the WGS 1984 datum, 2) Lambert Conformal Conic projection (origin latitude 39 degrees north, origin longitude 96 degrees west, standard parallels 33 and 45 degrees north) with the NAD 1927 datum, and 3) MapInfo's Latitude Longitude (Equidistant Cylindrical) projection using no datum.

Ancillary Files subdirectory:

The Ancillary Files subdirectory contains files that modify or supplement the user's GIS software. For ArcGIS users, this subdirectory includes ArcGIS layer files and files for use with ArcToolbox. For MapInfo users, this subdirectory

includes picklists, “MapInfoW.fnt” with special fonts and a file with additional projection information called “add_to_MapInfo_prj.txt.” All are described in the following section on Installation.

A file called “deposit_size_calculations_2018.xlsx” lists the formulas that are used in calculating deposit size and gross contained metal value. For instance:

Au and Ag deposit size = past production in ounces + (resource in metric tonnes * resource grade in ppm * 1/31.1034768) + (reserve in metric tonnes * reserve grade in ppm * 1/31.1034768)

Base metal, Aluminum, Nickel, Cobalt and Chromium deposit size = past production in tons + (resource in tonnes * 2204.623 / 2000 * resource grade in percent / 100) + (reserve in tonnes * 2204.623 / 2000 * reserve grade in percent / 100)

Deposit value = deposit size (in ounces for precious metals, in tons for base metals, aluminum, nickel and cobalt) * metal price. Polymetallic deposit values represent the sum of each of the contained metals.

Plots subdirectory:

The Plots subdirectory contains high resolution tiff images for the metallogenic map and the land status map of the Greater Antilles.

MapInfo Installation

Start by checking that Microsoft Access and MapInfo version 15.0 (or higher) are installed on your computer. If this is an update, backup your previous version before erasing the old data set. Copy the new GreaterAntillesMap data set to the root directory (C:\) of your hard drive. Rename the folder CBMap (C:\CBMap).

Fonts

GreaterAntillesMap map uses several customized fonts that are not delivered with standard MapInfo software. Follow these steps to replace your “MapInfo 3.0 Compatible font” with the customized version provided in the Ancillary_Files subdirectory.

- Exit MapInfo if it is running.
- Be sure that you are displaying hidden files and folders.
 - On a machine that is running Windows 10, open Windows Explorer and go to File > “Change Folder and Search Options.” Select the “View” tab. Then, under “Hidden files and folders” select the option to “show hidden files, folders and drives”.
- Locate the file MAPINFOW.FNT on your computer.
 - On a machine that is running Windows 10, it is found in:
C:\Users\YOURUSERNAME\AppData\Roaming\MapInfo\MapInfo\Professional\1500
(for MapInfo version 15)

- Rename MAPINFOW.FNT; call it MAPINFOW_FNT.OLD
- Copy "MAPINFOW.FNT" from the Ancillary_Files subdirectory into the folder where "MAPINFOW_FNT.OLD" is located.

Datums

GreaterAntillesMap map uses several local datums that are not delivered with standard MapInfo software. Although the data set will continue to function without making changes, it is preferable to add the custom datums provided with GreaterAntillesMap to the MapInfo projection file.

To do so, use any text editor to open "MapInfow.prj" from: C:\Program Files(x86)\MapInfo\Professional (for Windows 10). This file contains all of the projections that ship with your MapInfo software. From the Ancillary_Files subdirectory, copy the text contained in "add_to_mapinfow_prj_file.txt" and paste it into MapInfow.prj (at the end of the file will work just fine). MapInfow.prj will now provide all local datums called by GreaterAntillesMap.

Picklists

GreaterAntillesMap map uses MapInfo Discover picklists to assign colors to tectono-stratigraphic units, parks and concessions. Although neither Discover nor the picklists are required to run GreaterAntillesMap, users who want to edit the picklists (to change colors or add categories) will need to copy the .xml files from the Ancillary_files subdirectory and paste them to the subdirectory: C:\Users\username\AppData\Roaming\Encom\Discover\Picklists

Microsoft Access Database

Mineral occurrence information is stored in a Microsoft Access database, CB_Proc.accdb, located in the Prospect subdirectory. Prospects, a table in the Access database, compiles information for each mineral occurrence including: location, deposit type, owners, partners, past production, current resources, current reserves, published sources for past production, resource and reserve figures, status (active mine, inactive mine, prospect), salient drill results, geologic observations, ownership, terms of recent sales and joint ventures, and references to the literature. Calculated fields show the total precious metal content in ounces, base metal content in tons, and total contained metal value in US dollars.

New mineral occurrences can be added and changes can be made to existing mineral occurrence information by using MSAccess to modify the CB_Proc database. CB_Proc.accdb also contains a series of queries that select all deposits for each of the deposit types listed on page 4.

A form in CB_Proc.accdb, "Update Deposit Size and Value" must be used to update gross contained metal values whenever changes are made to production,

resources or reserves. This form can also be used to change the metal prices used in the calculation of gross contained metal value.

When adding records to the MSAccess database (CB_Proc.accdb), any nulls (empty fields) should be replaced with zeros (0's) in the entries for production, resource and grade since the calculation of deposit size and value draws numeric values from those fields.

Open Database Connectivity - ODBC Issues

MapInfo connects to the Prospects database (CB_Proc.accdb) via a dsn file (CBPros1.dsn) which resides in the Prospect subdirectory. All changes made to the database in MapInfo automatically flow through to the Access database when the MapInfo table CBPros1.tab is saved. (MapInfo may ask you to browse to the location of the MSAccess database.) Once changes have been saved to the MSAccess database, MapInfo will give you the option to “refresh” the linked MapInfo table. Answer “yes.” If inconsistencies arise between the data in the Access database and the data in the MapInfo tables, MapInfo will issue a warning message that prompts the user to resolve the conflict.

It is best to refresh the linked MapInfo tables, including CB_Prospects.tab, whenever changes are made to the mineral occurrence information whether from within MapInfo or from within Microsoft Access. After refreshing the MapInfo linked tables, close any open DBMS connections using “file > close DBMS connection” or the “disconnect DBMS” button.

MapInfo cannot read MSAccess queries. For this reason, deposit type selections are saved not only as queries in the MSAccess database but also as linked MapInfo tables in the Prospects subdirectory.

You are now ready to run GreaterAntillesMap. Open the prospects data set and metallogenic map by opening GAProspects. Open the land status data set and concession map by opening GALandStatus. You can also create your own workspaces (MapInfo) or project files (ArcGIS).

ArcGIS Installation

Install ArcGIS version 10.6 (or higher) on your computer. If this is an update, backup your previous version before erasing the old CBMap directory. Copy your new data set to the root directory of your hard drive (C:\CBMap).

ESRI Geodatabase management

All mineral occurrence information is stored in CB_Proc.gdb, an ArcGIS geodatabase located in the Prospects subdirectory. Additions or changes to mineral occurrence information are made directly to the Prospects table in CB_Proc.gdb.

Most users will not need to make changes to the information that is stored in CB_Pro.s.gdb. However, if changes are made to production, reserves or resources, then deposit size and value fields should also be updated. These updates are made by running the Python script “UpdateProspects.pyt.” The following instructions explain how to add “UpdateProspects.pyt” to ArcToolbox.

- Copy the file "UpdateProspects.pyt" from C:\CBMap\Ancillary_Files\ into the "My Toolboxes" folder. A common path to this folder, for ArcMap 10.6, is:
C:\Users\[your username]\AppData\Roaming\ESRI\Desktop10.6\ArcToolbox\My Toolboxes\
- Start ArcMap, and click on the ArcToolbox button
- In the ArcToolbox window, right-click in open space below the list of toolboxes, and select "Add Toolbox"
- Navigate to the "My Toolboxes" directory and select (single-click) UpdateProspects.pyt, and then click Open.
- Select UpdateDepositSizeandValue > right click in the open space underneath > save settings > to default
- Note that the UpdateProspects.pyt file only needs to be installed once, even if you have more than one data set (e.g. CBMap and EMap) installed.

Now that “UpdateProspects.pyt” is installed, follow these instructions to update deposit size and value fields in CBPros.gdb:

- Open any ArcGIS mxd file.
- In the ArcToolbox window, if the UpdateDepositSizeandValue toolbox is not present, right click on open space and load settings > from default.
- In the ArcToolbox window, double-click the UpdateDepositSizeAndValue toolbox. A list of update scripts will be displayed.
- Double-click the script appropriate for the database table you have installed (e.g. if you have installed CBMap, double-click on CBProsUpdate). A window will appear.
- Click OK to begin running the script. Calculations may take some time ... a couple of minutes for a thousand prospect records is typical. For more records, a proportionately longer time period is needed.
- Save the mxd

Source File Connections

If the GreaterAntillesMap data set is copied to a location other than the root directory, some mxd files will not open properly. Broken links can be repaired by resetting the links. Select (click on) the “list by source” icon. Right click on the file that is not opening properly, select properties > source > “set data source,” and browse to the source location, for example: C:\CBMap\Prospect\CB_Pro.s.gdb.

You are now ready to run GreaterAntillesMap. Open the prospects data set and metallogenic map by opening GAProspects.mxd. Open the land status data set and

concession map by opening GALandstatus.mxd. Use the mxd files provided with the GreaterAntillesMap data set or create new ones.

Ordering information, copyright and disclaimer

The GreaterAntillesMap GIS data set including the *Geography, Geology, TS Units, Radiometric Dates, Prospect* and *Land Status* modules (in MapInfo or in ArcGIS format or both) is available through Recursos del Caribe, S.A. To order the data set or for any questions, write to Carl Nelson at: nelson@cbmap.net.

Information on pricing is provided below. Updates are provided for free for a year and at half price for four additional years. Prospective clients are invited to “test drive” the data sets via a screen sharing session before making a purchase. Examples of the maps that can be generated using the data sets are displayed on the web site at www.CBMap.net.

Reasonable efforts are made to ensure that the information contained in the GreaterAntillesMap data set is accurate and up-to-date. Carl Nelson and Recursos del Caribe, S.A. do not warrant the accuracy of information in GreaterAntillesMap.

GreaterAntillesMap is the property of Carl E. Nelson and Recursos del Caribe, S.A. It is intended for the sole use of the purchaser. The data set cannot be copied, sold, transferred, or distributed without express written permission.

Pricing

GreaterAntillesMap: a GIS data set for the Dominican Republic, Cuba, Haiti, Jamaica, Puerto Rico and the Virgin Islands. Available as a package in **either** MapInfo or ArcGIS format for: US \$30,000
Or in **both** ArcGIS and MapInfo format for: US \$37,500

GreaterAntillesMap is also available in modules as follows:

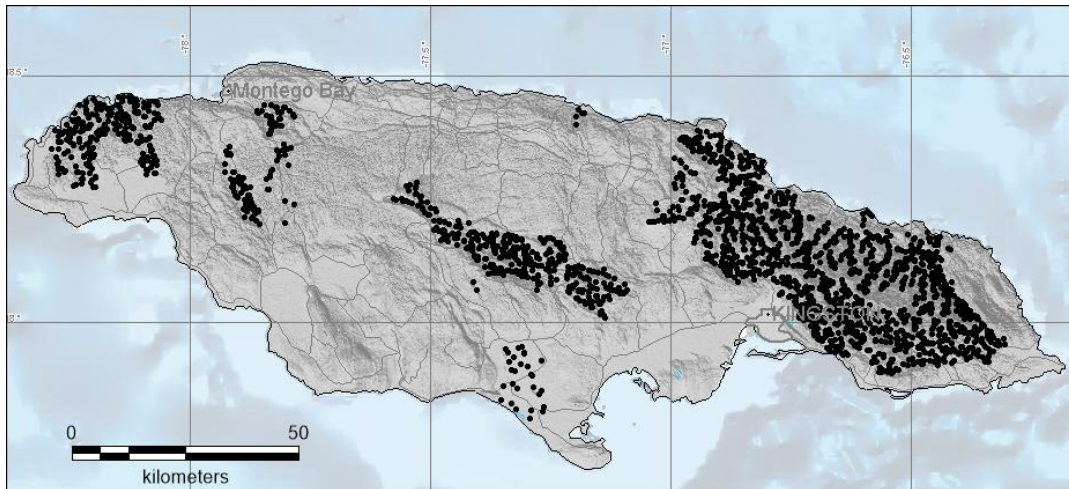
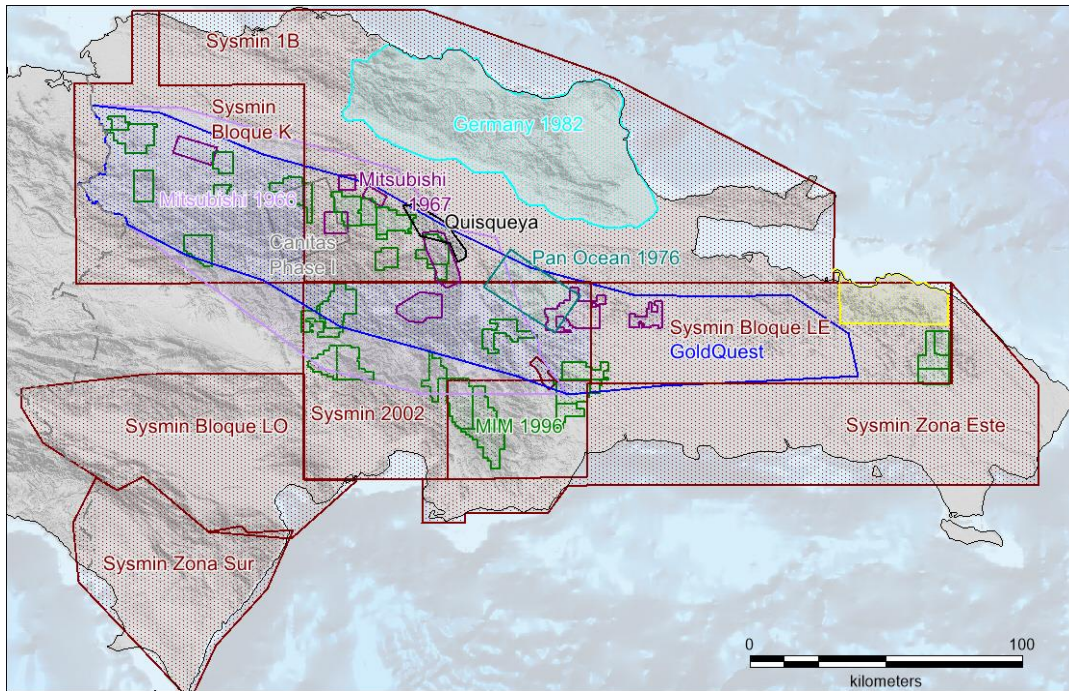
<i>Geography</i> (infrastructure, DEM, and shaded relief):	\$ 5,000
<i>Geology</i> (<i>Geography</i> plus vector geology for all 6 countries):	\$ 10,000
<i>Radiometric Dates</i> (radiometric dates only, with locations):	\$ 5,000
<i>TS Units</i> (<i>Geography, Geology</i> and <i>Radiometric Dates</i> plus a regional tectono-stratigraphic interpretation):	\$20,000
<i>Prospects</i> (<i>TS Units</i> plus metallic mines and prospects):	\$30,000
<i>Land status</i> (<i>Geography</i> plus metallic mineral concessions and reserve areas, national parks, forest reserves and other protected areas):	\$10,000
<i>Plots</i> (a high resolution tiff image of the metallogenic map):	\$ 5,000

A data set for an individual country includes *Geography, Geology, TS Units, Radiometric Dates, Prospects, and Land status* for: \$10,000

Greater Antilles Multielement Geochemical Data sets:

These data sets contain multielement stream sediment geochemical data for each country in the Greater Antilles. Data is provided in vector format for 8466 samples from the Dominican Republic accompanied by pdf copies of reports and sample location map for an additional 24,000 samples. Similar multielement data sets are available for Haiti (362 samples) and Jamaica (2397 samples).

Stream sediment sample coverage for the Dominican Republic and Jamaica is shown on the maps, below. More detail is available at: www.cbmap.net or upon request from nelson@cbmap.net.



Geophysics: Airborne geophysical images including raw data, as grd files. Contact nelson@cbmap.net for coverage and pricing information.