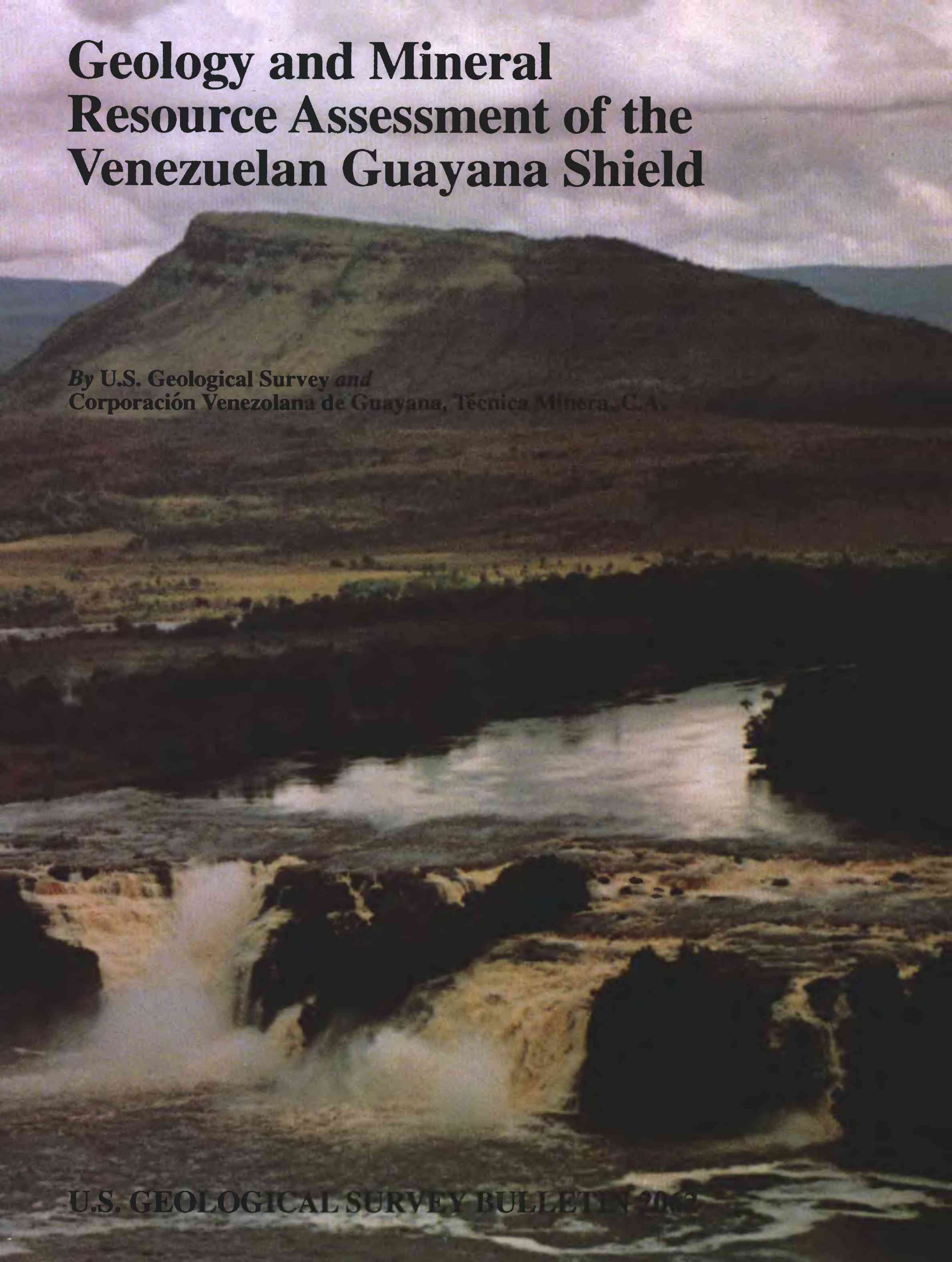
Geology and Mineral Resource Assessment of the Venezuelan Guayana Shield



By U.S. Geological Survey *and*
Corporación Venezolana de Guayana, Técnica Minera, C.A.

U.S. GEOLOGICAL SURVEY BULLETIN 2062

Cover. Rocks of the Early and Middle Proterozoic Roraima Formation, Canaima National Park in the Gran Sabana region of Estado Bolívar, Venezuela. View is south-southeast toward Cerro Venado (left background). The waterfalls in the center foreground are Salto Hacha on Río Carrao; Canaima lagoon is in the foreground. Photograph by Dennis P. Cox, 1987.

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Dallas L. Peck, Director

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FOREWORD

The importance of this volume on the mineral resources of Venezuela lies not only in its delineation of the vast mineral richness of the Guayana Shield but also in its illustration of the productive cooperation between the Corporaci6n Venezolana de Guayana and the U.S. Geological Survey. Geologic research described herein regarding the wise use of mineral resources is a model of cooperative scientific effort that can be used to assist the making of decisions at the highest levels of the government. This information can provide the basis for long-range mineral production and land use policy, for planning strategies for mineral exploration and development, for the direction of future research, and for expanding the inventory of mineral deposits of Venezuela. Special features of this cooperative project included the creation of a Mineral Resources Data System file and the use of mineral-deposit models to estimate the mineral resources of mineralized areas, both known and suspected, in the Guayana Shield and adjacent areas.

This project was funded by the Corporaci6n Venezolana de Guayana. It incorporated aspects of technology transfer, including specialized training for Venezuelan personnel, the acquisition of analytical equipment, and an inventory of mineral resources of the Guayana Shield. Field and laboratory studies by personnel of the U.S. Geological Survey and the Corporaci6n Venezolana de Guayana were started immediately after a Memorandum of Understanding, which described the cooperation, and a Project Implementation Plan were signed in 1987. These studies were completed in December 1991.

This compilation should be viewed as the necessary first step in the development of a long-range policy for mineral resource exploration, mineral production, and land use in Venezuela. Personnel of the Coporaci6n Venezolana de Guayana and the U.S. Geological Survey are to be complimented for the dedication and the outstanding cooperative spirit that they brought to this work and that made this publication possible.

Dallas Peck
Director, U.S. Geological Survey

CONTENTS

PLATES

[Plates are in pocket]

FIGURES

TABLES

GEOLOGY AND MINERAL RESOURCE ASSESSMENT OF THE VENEZUELAN GUAYANA SHIELD

By U.S. Geological Survey *and* Corporación Venezolana de Guayana, Técnica Minera, C.A.

SUMMARY

The Venezuelan Guayana Shield comprises the Precambrian terrane of the southern and eastern half of Venezuela and encompasses more than 415,000 km^2. This report describes the geology and geophysics of the Venezuelan Guayana Shield and presents a mineral resource assessment of the area. It includes a geographic map, geologic and tectonic map, simple Bouguer gravity anomaly map, side-looking airborne radar image, two mineral occurrences maps, and two permissive domain maps. The report is a product of a cooperative project on the Venezuelan Guayana Shield between the U.S. Geological Survey and the Corporación Venezolana de Guayana, Técnica Minera, C.A., that was begun in 1987 and concluded in 1991.

GEOLOGY

The Guayana Shield is the northern part of the Amazonian craton in South America and includes parts of Venezuela, Colombia, Guyana, Brazil, Suriname, and French Guiana. The Guapore, or Western Central Brazil Shield, south of the Amazon River basin, forms the southern part of the Amazonian craton.

The Guayana Shield in Venezuela consists of five lithotectonic provinces: (1) Archean amphibolite- to granulite-facies gneiss terrane (Imataca Complex); (2) Early Proterozoic greenstone-granite terrane(s); (3) Early Proterozoic unmetamorphosed volcano-plutonic complex; (4) Early to Middle Proterozoic continental sedimentary rocks; and (5) Middle Proterozoic anorogenic rapakivi-type granite.

The Archean Imataca Complex consists of gneiss and granulite and minor dolomitic marble and banded iron formation, typically isoclinally folded. The grade of metamorphism in the Imataca Complex ranges from amphibolite facies in the southwestern part of the belt to granulite facies in the northeastern part. The Imataca Complex was intruded by granitic rocks, and injection gneiss and migmatite were developed during the pre-Trans-Amazonian tectonomagmatic event between about 2,800 and 2,700 Ma. South of the Imataca terrane mountainous ridges of subaqueous sequences of tholeiitic mafic volcanic rocks between large domelike masses of granite of the Supamo Complex resemble both Archean and Early Proterozoic greenstone belts. Although the ages of these belts are poorly constrained, they are considered Early Proterozoic in this study. Overlying the Early Proterozoic rocks is a conformable, broad area of tholeiitic to calc-alkaline basalt to rhyolite and an interval of turbiditic graywacke, volcaniclastic rocks, and chemical sedimentary rocks. Ages obtained for the Supamo Complex range from 2,230 to 2,050 Ma; the best ages for the greenstone belts range from 2,250 to 2,100 Ma. The Trans-Amazonian orogeny represents a period of continental collision between about 2,150 and 1,960 Ma; during this orogeny the Imataca and the greenstone-granite terranes were deformed and metamorphosed. Unmetamorphosed volcanic and plutonic rocks of the Cuchivero Group represent postcollisional, post-Trans-Amazonian magmatism between about 1,930 and 1,790 Ma in the Guayana Shield from Venezuela to Suriname. Unmetamorphosed, posttectonic sedimentary rocks of the Roraima Group were deposited in fluvial, deltaic, shallow-marine, and lacustrine or epicontinental environments and are about 1,670 Ma in age. Middle Proterozoic, nontectonized rapakivi granite characteristic of the Parguaza Granite is about 1,500 Ma. At least two ages of tholeiitic diabase dikes intrude rocks of the Guayana Shield.

GEOPHYSICS

Geophysical data available for the southern and eastern parts of Venezuela include aeromagnetic data covering about 60 percent of the Venezuelan part of the Guayana Shield, gravity data covering about 50 percent, and aeroradiometric data covering less than 40 percent. Side-looking airborne radar (SLAR) imagery is available

for the entire Venezuelan Guayana Shield. In areas where the geologic coverage is poorest, such as Territorio Federal Amazonas, the geophysical data were complete enough to permit production of a new geologic and tectonic map that is reasonably even in detail throughout the entire Venezuelan part of the shield.

MINERAL OCCURRENCES

More than 450 mines, prospects, and mineral occurrences were documented in the Venezuelan Guayana Shield, of which more than 200 are gold. Information was compiled for more than 100 diamond mines and occurrences, 14 iron-manganese deposits and prospects, 35 banded iron formation deposits, and 40 bauxite occurrences. Other reported mineral occurrences include manganese, alluvial tin, titanium, barite, kaolin, dolomite, sand and gravel, molybdenum, uranium, rare earth element minerals, and tungsten.

MINERAL DEPOSITS

For purposes of mineral resource assessment, known mineral deposits in the Venezuelan Guayana Shield were classified by mineral deposit type. Most of these deposit types are defined by tonnage and grade distributions based on known deposits. Although deposits can be classified using descriptive models, they must also conform to tonnage-grade models. Known deposit types include Algoma- and Superior-type iron, laterite-type bauxite, sedimentary manganese, low-sulfide gold-quartz veins, placer gold, placer diamond, diamond-bearing kimberlite pipes, residual and sedimentary kaolin, and carbonatite. The mineral resource assessment also considered types of deposits that could be present given the geology of the Venezuelan Guayana Shield but which have not yet been found. For example, no deposits of kuroko-type massive sulfides have been discovered in Venezuela, possibly because of the deep weathering and forest coverage, but the terrane permissive for their occurrence is widespread. Other deposit types for which the geology is permissive include dolomitic marble, thorite-rare earth element veins, tin greisen, veins of plutonic and volcanic association, volcanic-hosted magnetite, unconformity-hosted uranium, synvolcanic-synorogenic nickel-copper-platinum, rhyolite-hosted tin, tin placers, placer titanium, and porphyry copper.

UNDISCOVERED DEPOSITS

In an attempt to quantify our knowledge about the mineral resources of the Venezuelan Guayana Shield, we made probabilistic estimates of numbers of undiscovered deposits by deposit type. Although there are more than 125 known low-sulfide gold-quartz vein occurrences in the shield forming at least 30 deposits that fit the model, we estimate that there is a 50 percent probability of finding 40 additional deposits having a median tonnage of 30,000 tonnes (metric tons) of ore. One carbonatite intrusive body (Cerro Impacto) is known to be present in the Venezuelan Guayana Shield; we estimate that there is at least a 50 percent probability of finding five or more additional carbonatite bodies having a median tonnage of niobium- and rare earth element-bearing zones of about 60 million tonnes. We also estimate that there is a 50 percent probability that 26 or more Algoma-Superior iron deposits having a median ore tonnage of 170 million tonnes remain to be found in Venezuela. We were unable to make quantitative estimates for other deposit types because of a lack of detailed information such as reconnaissance geochemical maps showing the distribution of elements including Cu, Pb, Zn, Ag, Mo, Be, Nb, Ba, and rare earth elements. Lack of geophysical data for the southeastern and northwestern parts of the shield and lack of regional geomorphological maps also hampered our analysis of additional deposit types.

INTRODUCTION

By Jeffrey C. Wynn, Floyd Gray, *and* Norman J Page

The Guayana Shield is the northernmost Archean-Middle Proterozoic craton in South America. It underlies most of Guyana, Suriname, and French Guiana, as well as parts of neighboring Brazil and Colombia (fig. 1). The Venezuelan Guayana Shield underlies all of Estado Bolívar and Territorio Federal Amazonas, as well as that part of Estado Delta Amacuro south of the Río Orinoco (pl. 1). It encompasses more than 415,000 km^2 and is covered primarily by jungle and savannah. The northern part of the shield near the Río Orinoco has relatively flat topography and constitutes the southern margin of the vast plains region referred to as Los Llanos; the Gran Sabana makes up most of the southeastern part of the shield and includes high, flat-topped mountains called tepuis (singular, tepuy). Between these two regions are extensive areas of gently rolling topography covered with jungle. Territorio Federal Amazonas makes up the southwestern half of the Venezuelan Guayana Shield and is a combination of rugged mountainous regions and flat, commonly inundated plains covered by jungle.

This report describes a mineral resource assessment of the Venezuelan Guayana Shield that was done using existing information supplemented extensively by new geologic, geophysical, and geochemical data generated during a cooperative project between the U.S. Geological Survey (USGS) and Técnica Minera, C.A. (TECMIN), a part of the Corporación Venezolana de Guayana (CVG).

Representatives of the CVG first approached the USGS in 1985 to discuss a joint project of mineral resource assessment and mineral exploration. Ensuing discussions and negotiations resulted in the signing of a Memorandum of Understanding in February 1987, and both groups began the planning of a cooperative project to investigate geoscience aspects of the Venezuelan Guayana Shield, with emphasis on mineral deposits. An advisory group of two resident USGS scientists (later three) and as many as ten visiting scientists per year was established to work with CVG–TECMIN. This group was originally based in Puerto Ordaz, Venezuela, but for two years maintained a one-man office in Ciudad Bolívar, Venezuela. The USGS worked principally with two groups from CVG–TECMIN: Grupo de Inventario (Inventory) and Grupo de Prospección (Mineral Exploration). The 5-year project was funded by the CVG and concluded at the end of December 1991.

PROJECT OBJECTIVES

The primary objectives of the USGS–TECMIN cooperative project were threefold:

1. To carry out regional geologic mapping in conjunction with the CVG–TECMIN Inventory Group in order to produce a new geologic and tectonic framework map of the Venezuelan Guayana Shield.
2. To carry out mineral exploration and site evaluations in conjunction with the CVG–TECMIN Mineral Exploration Group.
3. To perform a mineral resource inventory of the Venezuelan Guayana Shield by identifying domains that are permissive for the occurrence of mineral deposit types and estimating the number of undiscovered mineral deposits.

In addition, the cooperative project included specialized training for Venezuelan personnel and technology transfer components.

ACCOMPLISHMENTS

A total of 16 USGS scientists worked with CVG–TECMIN geologists at more than 60 mines, concessions, and mineral prospects in 23 areas and mining districts in Venezuela (table 1).

Previous studies pertinent to the project include geologic, metallogenic, and geophysical investigations. At least two countrywide geologic maps of Venezuela have been published (Bellizzia and others, 1976; Bellizzia, Pimentel de Bellizzia, and Muñoz, 1981). During the course of the USGS–TECMIN cooperative project, extensive new mapping from USGS–TECMIN site visits and information obtained from geologic compilations made by the CVG–TECMIN Inventory Group were acquired. These were combined with side-looking airborne radar (SLAR) images, only some of which were available to previous workers, and with aeromagnetic (Herrero and Navarro, 1989) and gravity data (Graterol, 1988) to assemble a new

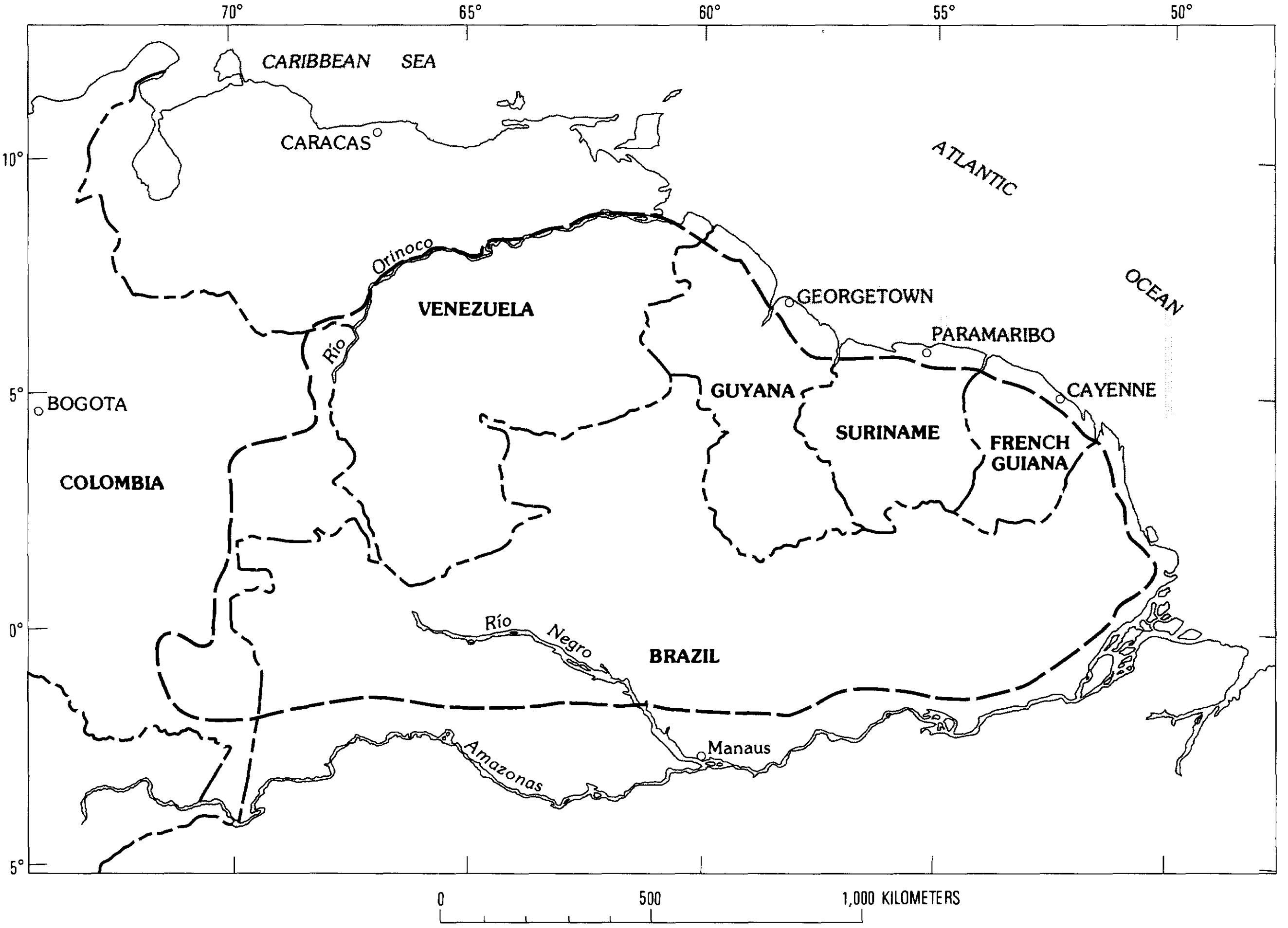


Figure 1. Location of the Precambrian Guayana Shield (dashed line) of northern South America.

1:1,000,000-scale geologic and tectonic map of the Venezuelan Guayana Shield (pl. 2).

Twelve 1:500,000-scale quadrangle maps (fig. 2, pl. 2) were compiled for the area of Venezuela south of the Río Orinoco including Estado Bolívar, Territorio Federal Amazonas, and Estado Delta Amacuro. These maps comprise the most recent geologic and geophysical data and interpretations gathered by CVG–TECMIN and USGS. All of the information on these maps, including drainage and cultural features (pl. 1), was digitized and reprojected to 1:1,000,000 scale using GSMAP (Selner and Taylor, 1991), a USGS-authored Geographic Information System (GIS).

A side-looking airborne radar (SLAR) survey was carried out by Goodyear Aeroservices, C.A., in two stages in 1971 and 1977. Images were acquired originally as 1:100,000-scale flight-strips and compiled and released in Venezuela at 1:250,000 scale. These images were subsequently compiled by the USGS at 1:1,000,000 scale (pl. 3) and printed on a Venezuelan projection called Proyección Cónico Secante Compensada, an equidistant conic projection using lat 4° N. and 9° N. as standard parallels and long 66° W. as the central meridian. This projection is used in numerous Venezuelan cartographic products and was used as the standard for this study.

Simple Bouguer gravity anomaly data, provided by Professor Victor Graterol (Universidad de Simón Bolívar, Caracas, Venezuela) and the U.S. Defense Mapping Agency, were assembled and edited, then plotted at 1:1,000,000 scale (pl. 4). Aeromagnetic data for the Venezuelan Guayana Shield are incomplete, but information from available maps was incorporated into the assembly of the new geologic and tectonic map.

A mineral occurrence map for the Venezuela Guayana Shield (pl. 5) was prepared from a Mineral Resources Data System (MRDS) file assembled by USGS and CVG–TECMIN. This map reflects more than 450 different mineral occurrence sites reported in the published and unpublished literature or identified in the field by cooperative project teams. For reference, a smaller scale map (pl. 6) was compiled using the MRDS database that shows the location of mineral occurrences in northeastern South America; the unedited MRDS data are given in the appendix. Inquiries about information stored in MRDS may be

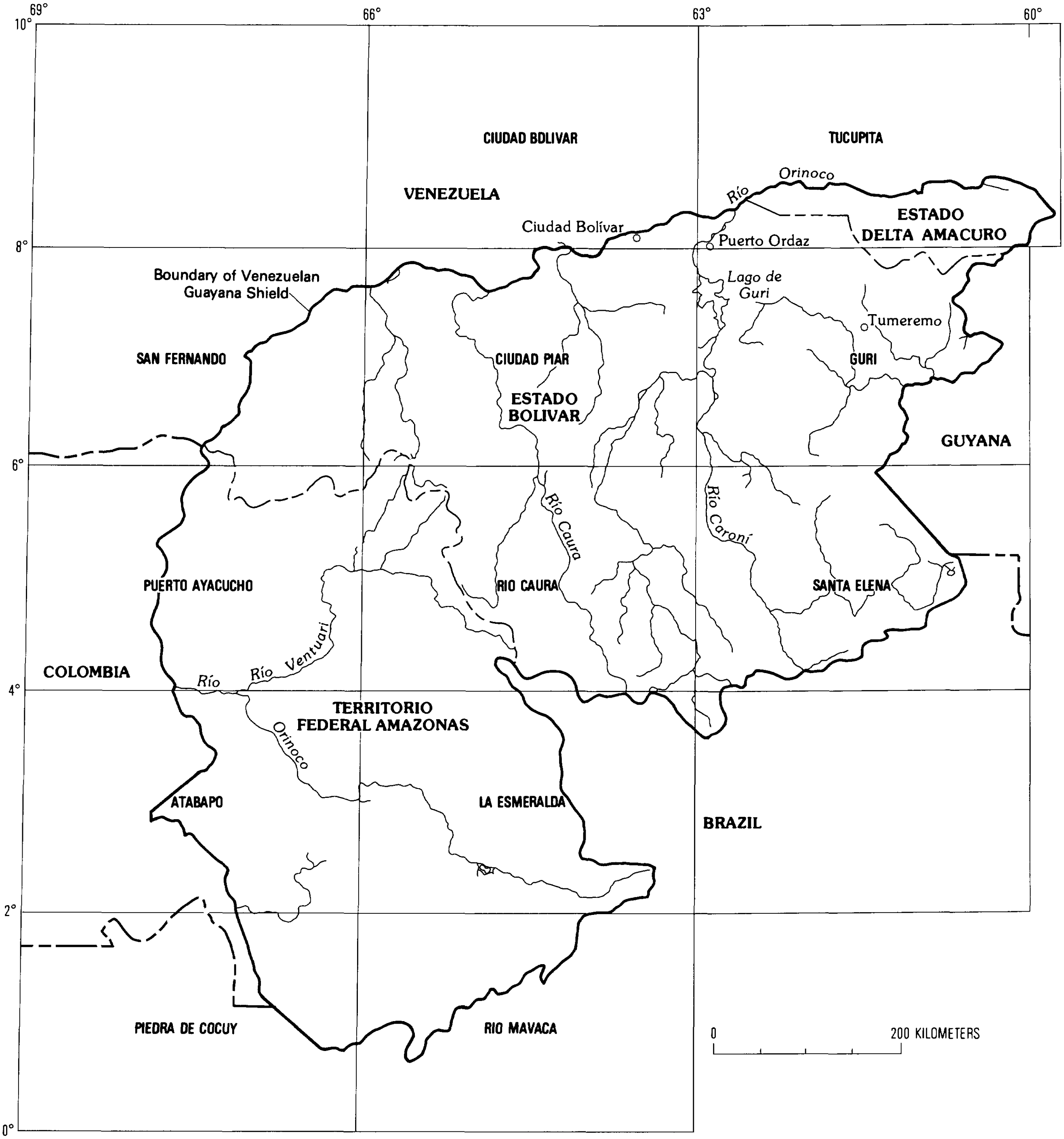


Figure 2. The Venezuelan Guayana Shield and the quadrangles that cover the area at a scale of 1:500,000.

obtained from the regional MRDS representative at the U.S. Geological Survey, Minerals Information Office, Corbett Building, 340 North 6th Avenue, Tucson, Arizona 85705–8325, or at the U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, Virginia 22092.

Two metallogenic maps of Venezuela have been previously published (Bellizzia, Pimentel de Bellizzia, and Rodríguez, 1981; Rodríguez, 1986). During the course of the USGS–TECMIN cooperative project, numerous additional field sites were visited and mineral occurrence sites identified. For a number of deposit types, sufficient geologic and mineral deposit information was available to allow a USGS–TECMIN assessment team to make estimates of the number of undiscovered deposits contained within the Venezuela Shield. Two maps showing permissive domains were developed (pls. 7, 8). These maps

Table 1. Field areas where cooperative geologic mapping took place, Venezuelan Guayana Shield.
[See plate 1 and tables 3 and 9]

Field area
La Flor-Carapo-La Esmeralda area
Cerro Bolívar-San Isídro iron mining district
El Pao-El Palmar iron-manganese mining district
El Callao-Lo Increíble gold mining district
Bochinche area
Las Flores project area
Marwani area
Sierra Verdún-Cerro Piedra de Supamo
Anacoco Sur project area
Anacoco-Los Caribes area
Píston de Uroy-Río Chivao-Cerro Arrendajo gold mining area
Venamo site
Los Pijiguaos bauxite mine
Kilometro 88-Las Cristinas gold mining district
1989–90 northern Amazonas survey
1988–89 southern Estado Bolívar survey
Cavanayán-Camarata area of the northern Gran Sabana
Cerro Roraima-Cerro Cuquenán tepuis
Santa Elena de Uairén-Icabarú diamond mining district
Caño Yagua-Cerro Yapacana 1990 survey
Río Negro-Brazo Casiquiare 1991 survey
Río Negro-Piedra de Cocuy 1991 survey
Upata-El Silencio-El Manteco 1991 survey

identify regions or areas permissive for the occurrence of specific mineral deposit types and can be used to aid in the estimation of undiscovered mineral deposits in the Venezuelan Guayana Shield.

In addition to this report of assembled maps, texts, and tables, additional accomplishments resulting from the cooperative project include more than 70 internal reports, maps, and scientific publications released to CVG–TECMIN, some of which have been published by the USGS.

To assist in accomplishing the primary objectives of the cooperative project, equipment and instrumentation were purchased and installed in CVG–TECMIN facilities in Puerto Ordaz, Tumeremo, and Ciudad Bolívar. These items include computers, plotters, digitizers, and appropriate software, as well as an emission spectrograph and an atomic absorption system. An extensive sample preparation system and analytical support equipment were installed in the CVG–TECMIN facility in Tumeremo, including rock crushers, grinders, centrifuge, furnaces, and digital balance.

Also as part of the objectives of the cooperative project, seven formal short courses, each 1–4 weeks long, were taught in Venezuela (in Spanish), and numerous advisory training sessions for individual CVG–TECMIN professionals were held. One CVG–TECMIN professional spent 11 weeks in the United States training in the operation of the analytical equipment installed in Tumeremo.

Acknowledgments.—Initial planning by Vicente Mendoza S. of Técnica Minera, C.A. (CVG–TECMIN), and Richard Krushensky, Gary Raines, and Norman J Page of the U.S. Geological Survey (USGS) resulted in a 5-year project to do mineral resource assessment and regional geologic mapping of the Venezuelan Guayana Shield and technology transfer to CVG–TECMIN. Planning, coordination, and operation of the project were conducted by Darrell Herd, Floyd Gray, Norman J Page, and Jeffrey C. Wynn (USGS) and by Nestor Angulo, Juan Candelaria, Indalecia de Espinoza, Céysar Gutiérrez, José Gutiérrez, Concepción Suárez, and Fernando Susach (CVG–TECMIN).

Numerous people from CVG–TECMIN were instrumental to this project by providing information and insight into the geology and mineral resources of the shield. They include Enrique Acosta, Juan Acosta, Margarita Alberdi, Jesús Aruspón, Angel Baez, Cruz Briceño, Henry Briceño, Antonio Brojanigo, Gloria Contreras, Freddy Dávila, Maria-Elena Delgado, Yasmin Estanga, Alí Fernández, Luis Franco, Andrés García, Marta García, Acenk Guerro, Luis Guzmán, Luisa Heredia, Yolanda López, Glenda Lowry, Félix Martínez, Miguel Martínez, Giovanny Nava, Fernando Nuñez, Jorge Penott, Freddy Prieto, Jacobo Quesada, Enot Quintana, Haidée Rincón, Ramon Rincon, Ivan Rivero, Nelson Rivero, Ibel Romero, Edixon Sálazar, Henry Sánchez, Reyes Simoza, and Galo Yánez. Additional CVG–TECMIN personnel whose work contributed to this compilation include Reinaldo Balazar, Virginia Behm, Rafael Borges, Henry Brito, Juan Candelaria, Maria Chacon, Eric Dumas, María Escauriaza, Víctor Fernandez, Yajaira Fernandez-Gray, Antonio Ferroro, José Freites, Silverio Galindo, César Gutiérrez, Oliveros Jimenez, Victor Lopez, Elis Lugo, Luis Manzanilla, Iris Marcano, Hector Márquez, Pedro Mata, Jaime Molina, Abigail Morales, Ramon Olivares, Javier Parra, Pedro Petít, Rangel Petít, Carlos Pulido, Inés Rendón, Jesús Rodríquez, Yesenia Síerra, Tommaso Tiosiani, Carlos Torrealba, and Alberto Torres. Other people in Venezuela who contributed to the completion of this project include Louis Gilloux (Bureau de Recherches Géologiques et Minieres of France), Victor Graterol (Universidad de Simón Bolívar), Emilio Herrera (Ministerio de Energía y Minas), Pedro Lira (Ministerio de Energía y Minas), and Alfredo Menéndez (consultant to CVG–TECMIN).

Colleagues in the USGS who contributed in this project include Lindreth Cordell, Warren Day, John Dohrenwend, Robert Earhart, Andrew Grosz, Steve Ludington, Sherman Marsh, Anne McCafferty, Barry Moring, Stephen Olmore, Robert Oscarson, Jeff Phillips, Gary Sidder, Jack Stewart, Richard Tosdal, and Kenneth Watts. Paul Schruben prepared the geologic-tectonic map, base map, and domain maps using the computer program ARC–INFO; Karen Bolm prepared the mines, prospects, and occurrences maps. An earlier version of this report

(1991) was edited by G.J. Orris and Norman J Page of the U.S. Geological Survey's Center for Inter-American Mineral Resource Investigations (CIMRI) in Tucson, Arizona, and presented to officials of Técnica Minera as a USGS Administrative Report. This bulletin was edited con cariño by Judith Stoeser. Wayne Hawkins prepared the maps and illustrations, Marie Melone typeset the book, Judith Stoeser prepared the tables, and Art Isom designed the cover. Denny Welp and Robert Wells also assisted in the preparation of the book.

GEOLOGY OF THE VENEZUELAN GUAYANA SHIELD

By Dennis P. Cox, Jeffrey C. Wynn, Gary B. Sidder, *and* Norman J Page

In this section we provide, as fully as possible, descriptions of the rock units shown on the geologic and tectonic framework map of the Venezuelan Guayana Shield (pl. 2), and we lay the basis for the discussion of the geologic environments permissive for mineral deposits that follows. We rely heavily on recent reviews of the geology of the Venezuelan Guayana Shield and its relation to the geology of the rest of the Guayana Shield by Sidder and Mendoza (1991, in press). Whereas we emphasize lithologic descriptions, Sidder and Mendoza present a broader view of the relation of major geologic features and the timing of orogenic events.

The rocks of the Venezuelan Guayana Shield can be divided generally into two older terranes and two younger sequences of sedimentary and igneous rocks. The oldest terrane comprises the Imataca Complex, Archean metamorphic rocks of granulite and amphibolite facies. The second terrane comprises the Early Proterozoic Supamo Complex and Pastora Supergroup and is made up of a granite-greenstone belt association and associated younger eugeosynclinal rocks. A transitional suprajacent sedimentary and volcanic sequence is composed of continental clastic rocks and tuff that may be metamorphosed, isoclinally folded, or, in the case of the Cuchivero Group and younger rocks, undeformed. The Cuchivero Group, the most important unit in this sequence, consists of voluminous ash-flow tuff and associated granitic plutonic rocks. A younger suprajacent sedimentary sequence comprises relatively undeformed Early to Middle Proterozoic continental clastic sedimentary rocks of the Roraima Group that cover large parts of the shield. Diabasic dikes and sills of at least two ages, between 1,850 and 1,650 Ma (Early Proterozoic) and between 210 and 200 Ma (Mesozoic), are present in all terranes and sedimentary sequences. Cenozoic deposits are mostly restricted to Tertiary delta sediments of the Río Orinoco and floodplains of modern rivers.

IMATACA TERRANE

The Imataca Complex (unit Ai, pl. 2) is composed of quartz-feldspar gneiss, commonly garnet bearing, and subordinate mafic gneiss of the pyroxene granulite facies and, locally, amphibolite facies of regional metamorphism (Newhouse and Zuloaga, 1929; Kalliokoski 1965a, b, c, d, 1974). Near Cerro Bolívar plagioclase-quartz-pyroxene gneiss makes up 50 percent of the Imataca section, granitic gneiss 30 percent, microcline-quartz-plagioclase-pyroxene and quartz-feldspar-cordierite-garnet-biotite-sillimanite-graphite gneiss each 5–10 percent, and banded iron formation 2 percent (Chase, 1965). In the Upata area, 80 percent of the section is felsic granulite composed of quartz, plagioclase (An30), minor microcline that locally exceeds plagioclase in abundance, and rare pyroxene and biotite; 15 percent of the section is mafic gneiss containing equal proportions of plagioclase (An>40) and pyroxene plus amphibole; and 5 percent of the section is iron formation (De Ratmiroff, 1965). Mafic gneiss and iron formation are closely associated (Kalliokoski, 1965a). The iron formation is composed of thin layers of magnetite interbedded with quartzite and ferruginous quartzite, and variable amounts of manganese oxide lenses are commonly associated with the iron formation. Northeast of Upata a layered sequence of dolomite marble (locally containing forsterite and tremolite), ferruginous quartzite, and manganiferous schist is in a northeast-trending band of outcrops (the Guacuripia Formation of Morrison, 1953; Drovenik and others, 1967).

Dougan (1977, p. 262), on the basis of a geochemical study of the Imataca terrane in a small area near Cerro Bolívar, described the Imataca as a "metamorphosed igneous association which although it exhibits characteristics intermediate between post-Precambrian island-arc calc-alkaline and tholeiitic series and continental calc-alkaline associations, most resembles the calc-alkaline association of active continental margins." The age of the protolith of the Imataca terrane may be as old as 3,700–3,400 Ma (Montgomery, 1979), and Hurley and others (1976) indicated that the first metamorphic event in the Imataca Complex took place at 2,800–2,700 Ma, followed by a second at 2,150–2,000 Ma.

The Imataca terrane includes granitic rocks (unit XWgr, pl. 2) that contain plagioclase and microcline in equal amounts, quartz, biotite, and hornblende. Quartz-feldspar pegmatite forms small bodies. Migmatite (unit XWm) composed of granitic rocks intimately layered with lineated gneiss is associated with granitic rocks of the Imataca terrane. A complex inlier block in the area of La Flor contains an assemblage of younger rocks (units Xsp, Xa) including arkosic and pelitic metasedimentary rocks, manganiferous chert, and amphibolitized metavolcanic rocks (Kalliokoski, 1965d; Olivares, 1991).

The Guri fault, one of the most prominent geologic features of the Guayana Shield, forms the southern boundary of the Imataca Complex, but local outliers mapped as Imataca Complex are present south of this structure. Rocks of the outliers typically are metamorphosed to amphibolite grade. A fault inferred from gravity profiles forms part of the northern boundary of the terrane.

PASTORA-SUPAMO TERRANE

To the south of the Imataca terrane is a broad area of metavolcanic rocks of the Pastora Supergroup (Korol, 1965; Menéndez, 1968) and granitic plutonic rocks of the Supamo Complex (Menéndez, 1968). Some of the metavolcanic rocks are in belts between large domelike masses of granite of the Supamo Complex and resemble Archean greenstone belts, although both the metavolcanic rocks and the Supamo Complex are Early Proterozoic. A broad area of younger (?) metavolcanic rocks in the southeastern part of the Pastora-Supamo terrane, however, lacks a clear relation with the Supamo Complex, and the rocks resemble eugeosynclinal deposits of younger orogenic belts.

Volcanic rocks of the Pastora Supergroup are regionally metamorphosed to greenschist facies and in the northern part of the Pastora-Supamo terrane, within 30 km of the Guri fault, to amphibolite facies. Localized zones of amphibolite schist are developed in mafic volcanic rocks near contacts with the Supamo Complex. Large parts of these areas underlain by volcanic rock can be described as greenstone belts on the basis of their elongate form, greenschist facies metamorphism, and flanking granitic batholiths. In the El Callao area, the Pastora Supergroup has been subdivided into the Carichapo Group, which contains a lower pillow basalt and local talc schist lenses (El Callao Formation, unit Xec, pl. 2) and an upper mafic to intermediate metatuff (Cicapra Formation, unit Xcc) (Menéndez, 1968). Overlying the Carichapo Group is the Yuruari Formation, an extensive unit of mica schist and phyllite (unit Xys) and felsic metatuff (unit Xyf). Similar rock types are present in other greenstone belts that are separated from the El Callao area by wide areas of granite, but in these belts topography is more subdued and jungle cover more dense, and stratigraphic relations between rock types are difficult to determine. It is likely that cycles of mafic and felsic volcanism of several different ages, but all Early Proterozoic (2,250–2,100 Ma), have contributed to the various greenstone belts in the northeastern part of the Venezuelan Guayana Shield. In addition to these volcanic rocks, extensive areas of gabbro (unit Xg1) and peridotite (unit Xu1) make up most of the greenstone belt extending south from El Callao. In our compilation, we retain formation names in the El Callao area but in other belts divide the rocks on a lithologic basis only into unit Xm1, mafic to intermediate rocks containing abundant chlorite and actinolite; unit Xg1, gabbro; unit Xu1, peridotite; unit Xf1, felsic metavolcanic rocks containing abundant quartz and white mica; and unit Xs1, mica schist and phyllite.

Amphibolite (unit Xa, pl. 2) is a strongly foliated hornblende-andesine schist derived from mafic volcanic rocks. It is abundant in metavolcanic tuff sequences in the El Manteco area and within 30 km of the Guri fault. Amphibolite facies metamorphism probably took place during the suture event that formed the Guri fault. Amphibolite is also present at numerous locations where mafic volcanic rocks (unit Xm1) are in contact with the Supamo Complex.

Common to the Supamo Complex (unit Xsp, pl. 2) are domelike batholiths composed of trondhjemite gneiss (Chase, 1965; Dougan, 1976). These biotite-quartz-oligoclase gneisses and subordinate hornblende-quartz-andesine gneisses lack potassium feldspar. They underlie monotonous plains on which outcrops are rare.

A small area of sodic biotite-quartz-oligoclase gneiss near Guri mapped by Dougan (1976) was included with the Supamo Complex by Martín (1975) and by the Inventory Group of Técnica Minera, C.A. (TECMIN), a part of the Corporación Venezolana de Guayana (CVG) (unpub. map, 1988, 1:500,000 scale). Whole-rock oxide and trace-element analyses for 37 samples (Dougan, 1976) indicate that the composition of the gneiss is compatible with a derivation from partial melting of oceanic tholeiite or, alternatively, deep crustal melting of metagraywacke. It is more likely that this gneiss is Imataca and not Supamo Complex.

In the El Callao area, rocks of the Pastora Supergroup are apparently overlain by the Caballape Formation (unit Xcb, pl. 2), a weakly metamorphosed felsic tuff that was deformed only once and is less intensely folded than rocks of the Pastora Supergroup (Menéndez, 1968). Its contacts with the Pastora Supergroup and the granite of the Supamo Complex are not exposed. The name Caballape Formation was extended by Benaim (1972, 1974) across a 30-km-wide area of Supamo Complex and applied to mafic and felsic metavolcanic rocks and phyllite in the basin of the Río Botanamo. Subsequently, this name was applied to metavolcanic rocks in a large area extending south of Kilometro 88 and east to the Río Marwani by the CVG–TECMIN Inventory Group and other CVG–TECMIN geologists. This lithologic correlation is difficult to support because of the distance from the type area and the differences in rock types between the two areas. Contacts between these rocks and the Supamo Complex are rarely exposed, but a post-Supamo age for these rocks is suggested by the absence of amphibolite facies metamorphism where Supamo Complex granite is adjacent to mafic and intermediate metavolcanic rocks. Amphibolite weathers to form hills that are prominent in the radar images even in areas of dense vegetation. The contact between rocks referred to as Caballape Formation and the Supamo Complex is not marked by any such topographic features. Unfortunately, contacts between rocks of the Supamo Complex and volcanic rocks of felsic composition show only minor metamorphic effects that are easily obscured by weathering. Thus, age relations with the Supamo Complex are unclear for large areas of volcanic rocks, including the Caballape Formation, in the type area. In our compilation, we do not use the name Caballape for rocks outside of the El Callao area because of their uncertain relation with the Supamo Complex; instead, we divide these rocks into units Xm2, Xf2, and Xs2, mafic metavolcanic rocks, felsic metavolcanic rocks, and schist, respectively.

These metavolcanic and metasedimentary rocks (units Xm2, Xf2, and Xs2, pl. 2) in the Río Botanamo, Anacoco, Río Marwani, and Kilometro 88-Las Cristinas areas are uniformly metamorphosed to greenschist facies and are strongly folded, judging from the steep dips of bedding and schistosity shown in maps by Benaim (1974), the northeast-trending grain in the radar image (pl. 3), and field observations. They may represent a volcanic environment distinctly different from that of the older greenstone belts. The area of exposure is broad rather than beltlike, and limited petrochemical data from the Anacoco area (Day and others, 1989) indicate that the volcanic rocks belong to a calc-alkaline suite rather than to a bimodal assemblage such as described by Gibbs (1987) for more typical greenstone belts in adjacent areas of Guyana. We refer to these rocks as the eugeosynclinal metavolcanic rocks of northeastern Estado Bolívar.

Gabbro and peridotite intrude volcanic rocks of both age groups. Some of these intrusive rocks are penetratively metamorphosed to greenschist facies, but others are unmetamorphosed. In the Sierra Verdún area, fresh, zoned, calcic plagioclase is in the unaltered interior parts of large gabbro, and plagioclase-bearing pyroxenite intrusive bodies have well-preserved cumulus textures (Floyd Gray and others, written commun., 1991). Narrow zones of shearing and greenschist facies metamorphism along the faulted contacts of these intrusive bodies suggest intrusion during the waning stages of regional metamorphism. In the Píston de Uroy area, auriferous quartz veins cutting an intrusive complex of peridotite and gabbro imply that gold mineralization occurred during the latest stage of regional metamorphism (Wynn, Page, and others, in press). Mafic and ultramafic rocks intruding older greenstone-belt rocks (including amphibolite inliers in the Imataca terrane) are designated units Xg1 and Xu1 on plate 2, respectively, and those intruding the eugeosynclinal metavolcanic sequence are designated units Xg2 and Xu2.

A younger suite of granitic rocks (unit Xgr, pl. 2) intrudes metavolcanic sequences, as well as the Supamo Complex, and forms a characteristic rugged radar image in many areas across the northern part of the shield (pl. 3). These granitic rocks have a wide range of composition and are characteristically more potassium rich than those of the Supamo Complex.

A basement complex (unit Xbc, pl. 2) of probable Early Proterozoic to earliest Middle Proterozoic age (1,640±26 Ma; Miranda and others, 1991) underlying the southern part of Territorio Federal Amazonas is composed of well-foliated granite to granodiorite gneiss. The stratigraphic relations between this unit and rock units in the Imataca-Supamo-Pastora terranes to the north are unknown. On the lower Río Pasimoni, the unit is described as migmatite (Haydée Rincón, CVG–TECMIN Inventory Group, oral commun., 1991). On the middle Río Negro, it is well-foliated, chloritized, quartz-bearing, biotite granite gneiss. One description (I. Marcano, E. Lugo, and N. Rivero, CVG–TECMIN Inventory Group, unpub. report, 1991) includes the term "monzodiorite." The distribution of this unit is inferred from aeromagnetic data. The rocks are moderately magnetic, and the magnetic anomalies show no significant directional trends.

Distinguished from the basement complex by aeromagnetic mapping is a metamorphic-plutonic complex of probable Early Proterozoic age (unit Xmp, pl. 2) covering large parts of the southern Territorio Federal Amazonas. These rocks are best exposed at San Carlos de Río Negro and crop out along most of the Río Guainía and Río Negro. They include granite, porphyritic granite, granite gneiss, and augen gneiss and relatively abundant pegmatite (Marcano, Lugo, and Rivero, CVG–TECMIN, Inventory Group, unpub. report, 1991). This complex is characterized by a series of strong, sinuous, east- to N. 70° W.-trending, elongate magnetic anomalies.

A group of undivided metamorphic and plutonic rocks (unit Xmu, pl. 2) in the upper Río Orinoco and its headwaters resembles greenstone belts in the northeastern part of the shield. This unit includes greenstone, amphibolite, granite gneiss, and granite. Steep magnetic gradients were observed along the upper Río Orinoco; anomalies tend to be sinuous and linear and resemble magnetic anomalies in greenstone belts in eastern Estado Bolívar. Part of the area underlain by these rocks is distinguished by high-amplitude, moderate- to short-wavelength aeromagnetic anomalies that lack the preferred trend characteristic of greenstone belts, and in some places a clear distinction between rocks of unit Xmu and surrounding rocks of the Cuchivero group cannot be made. The unit shows low to moderate topographic relief in the side-looking radar imagery (pl. 3).

TRANSITIONAL SUPRAJACENT SEDIMENTARY AND VOLCANIC ROCKS

Metamorphosed and unmetamorphosed volcanic and sedimentary rocks transitional in age between the Supamo Complex and the Roraima Group are widely distributed over parts of the shield south and west of the areas of the Imataca-Pastora-Supamo terranes. These transitional formations characteristically contain beds having a red coloration and, locally, beds of air-fall tuff indicating a continental origin. They are described below in order of decreasing metamorphism and deformation. All are assigned an Early Proterozoic age.

The Moriche Formation (unit Xmo, pl. 2) is characterized at its type locality (Cerro Moriche on the middle Río Ventuari) as metasedimentary oligomictic conglomerate, breccia, quartzite, subgraywacke, phyllite, and, locally, felsic tuff (Ghosh, 1977; Mendoza and others, 1977). In the Cerro Moriche area and along the middle and upper Río Orinoco and Río Mavaca, these rocks are highly magnetic and generally form long, linear magnetic anomalies suggestive of rocks folded during regional metamorphic events. A structural grain, parallel with these anomalies, is commonly visible in the radar imagery (pl. 3). Map unit Xmo includes two other, possibly correlative formations: the Cinaruco Formation (McCandless, 1962) consisting of micaceous quartzite, phyllite, and conglomerate and the Esmeralda Formation (Sellier de Civirieux, 1966) composed of quartz-chlorite-epidote schist and fine-grained quartzite. These formations typically are isoclinally folded.

Metasedimentary rocks of Río Oris (unit Xo, pl. 2) (Maracapra Formation of Martín, 1975) are composed of hematitic quartzarenite, reddish phyllitic siltstone, feldspathic arenite, conglomeratic arenite, quartz-sericite phyllite, and red laminated fine-grained meta-arenite that has graded bedding and erosional channels (Félix Martínez, CVG–TECMIN, Inventory Group, oral commun., 1991). The unit is folded on an east-west axis.

The Cuchivero Group (McCandless, 1965) represents a major postorogenic magmatic episode in the Guayana Shield. The group is divided into volcanic and plutonic units of calc-alkaline composition (Sidder and Martínez, 1990) (units Xc and Xcg, respectively; pl. 2). The volcanic unit, the Caicara Formation (unit Xc, pl. 2), includes widespread crystal- and lithic-rich rhyodacitic to rhyolitic ash-flow tuff and dacitic and andesitic lava flows. The more mafic rocks are commonly hydrothermally altered. The ash-flow tuff is unaltered to only slightly contact metamorphosed and typically shows well-preserved, devitrified glass shards and contorted flow banding. Andesitic to basaltic dikes and rhyodacitic granophyre intrude the volcanic rocks. Rocks of the Caicara Formation unconformably overlie the Pastora-Supamo terrane and are in sharp contact with overlying volcanic rocks in the Ichún area. The volcanic rocks in the Ichún area, named the Ichún Formation by Briceño and others (1989) to call attention to their unmetamorphosed, undeformed character, are in a well-stratified sequence of tuffaceous rocks that closely resembles the Caicara Formation in composition. The age of the Cuchivero Group ranges from about 1,930 to 1,790 Ma (Sidder and Mendoza, in press). Circular structures, as much as 10 km in diameter, visible in radar imagery (pl. 3) possibly represent calderas. In some places these structures correlate with arc-shaped gradients in the aeromagnetic pattern. Gravity data in this area are too sparse to show correlation with these structures.

In eastern Estado Bolívar, the Los Caribes Formation (Benaim, 1972) (unit Xs3, pl. 2) is composed of weakly to unmetamorphosed red arkose and polymictic conglomerate and minor intercalated felsic tuff. The unit overlaps the Marwani fault, which separates greenstone-belt rocks (units Xm1, Xf1, Xs1) from eugeosynclinal metavolcanic and sedimentary rocks (units Xm2, Xf2, and Xs2). Clasts in the conglomerate are predominantly unmetamorphosed felsic volcanic rocks that resemble tuffs of the Caicara Formation; fragments of metavolcanic rocks typical of the underlying greenstone belts and eugeosynclinal metavolcanic sequence are absent. The Los Caribes Formation probably was derived from sediments eroded from a highland composed of Caicara-type rocks lying to the south of the Río Cuyuní and now covered by strata of the Roraima Group. Deposition of the Los Caribes was under continental conditions. Although many gold prospects are known to be present in the underlying metavolcanic rocks, none have been found in the Los Caribes Formation (Juan Acosta, CVG–TECMIN Mineral Exploration Group, oral commun., 1990). The Orapu conglomerate in French Guiana is equivalent to the type section Los Caribes Formation, and it is gold bearing (Ledru and others, 1991; Milési and others, 1992).

The term "pre-Roraima Group sedimentary rocks" (unit Xpr, pl. 2) was applied by Briceño (1982) to an unmetamorphosed sequence of rocks underlying the basal Roraima Group along the Río Caroní near Canaima. The sequence includes fine-grained to very fine grained, clay-rich sandstone that locally contains granule-size quartz grains and is interbedded with red shale and sandy shale (Briceño, 1982). Rocks of this sequence are commonly cut by quartz veins. They overlie, with apparent unconformity, the Caicara Formation and are gently folded and mildly discordant with the overlying beds of the Roraima Group. They weather to low-relief terrane broken by low cuestas (Ghosh, 1977; Briceño, 1982). To the east, in the headwaters of the Río Chicanan, the Roraima Group is underlain by the Urico Formation of Alberdi and Contreras (in press). The Urico is composed of graywacke, shale, mudstone, breccia, and volcaniclastic and quartz-rich sandstone; some of the strata are pyritic, indicating that their environment of deposition was chemically different from the more oxidized rocks typical of the transitional suprajacent sedimentary sequence.

The Ichún Formation of Briceño and others (1989) (unit Xi, pl. 2) is composed chiefly of interlayered ash-flow tuff and clastic sedimentary rocks. The Ichún Formation is concordant with the overlying Roraima Group and discordantly overlies volcanic rocks of the Caicara Formation. The Ichún Formation crops out extensively around the Ichún and Guanacoco tepuis and from Raudal Los Brasileros on the Río Paragua to Salto Espuma on the Río Ichún. Three major members comprise the Ichún: a basal member consisting of lapilli and ash tuff and volcaniclastic sandstone and andesite flow rocks; a middle member consisting primarily of quartzarenite, andesitic flow rocks, volcaniclastic sandstone, and ash-flow tuff; and an upper member consisting of lithic and crystal-rich tuff interbedded with minor volcaniclastic sandstone (Briceño and others, 1989). The well-stratified tuffs and sedimentary rocks of the Ichún Formation suggest deposition in an environment distal to volcanic centers, perhaps during the waning stages of Cuchivero magmatism.

GRANITIC ROCKS OF POST-SUPAMO, PRE-RORAIMA AGE

Granitic rocks (unit Xcg, pl. 2) of the Cuchivero Group of Early Proterozoic age are hypabyssal biotite granite and granodiorite that have equigranular to porphyritic, medium- to coarse-grained textures. Hypabyssal porphyritic intrusive rocks near Canaracuni that have a microaplitic groundmass texture indicate that high-level plutons of this group were locally preserved from deep erosion. Granitic rocks of the Cuchivero Group represent possible batholithic source rocks for the ignimbrites of the Caicara Formation.

Granitic rocks (unit Xgu, pl. 2) of probable Early Proterozoic age underlie waterflooded plains and jungle in southeastern Territorio Federal Amazonas. Where present south and east of San Fernando de Atábapo, they are described as biotite hornblende granite and granite gneiss (Marcano, Lugo, and Rivero, CVG–TECMIN Inventory Group, unpub. report, 1991). These rocks are weakly magnetic, and the magnetic pattern shows no apparent trend. Contacts between the granitic rocks and other rocks have not been observed, but interpretation of the aeromagnetic pattern suggests that the granitic rocks intrude the Cuchivero Group.

Granite and other silicic plutonic rocks (unit Xg, pl. 2) west and north of Cerro Duida in Territorio Federal AmazonYas were described by Félix Martínez (CVG–TECMIN Inventory Group, unpub. report, 1991) as massive, coarse-grained, gray, equigranular biotite granite having rapakivi textures similar to granite of the Parguaza batholith. These rocks are weakly to moderately magnetic; they commonly show east-west to west-northwest trends in the magnetic anomalies and pronounced west-northwest-striking lineaments in the side-looking radar imagery, especially in the Atábapo quadrangle (fig. 2).

A carbonatite intrusive body (unit YXci, pl. 2) at Cerro Impacto has an unknown but probable Early to Middle Proterozoic age. This feature, originally thought to be an impact structure, is an irregularly shaped depression as much as 20 km in diameter and includes outcrops of tonalite, granodiorite, and granite (unit Xcg) that show some signs of fenitization. Most of the area is covered by a 200–300-m-deep laterite containing anomalous amounts of niobium and rare earth elements that are inferred to be derived from weathering of a carbonatite (Aarden and others, 1973). A prominent north-trending ridge in the center of the circular feature contains abundant barite float. The circular structure is surrounded by a set of radial fractures visible in the radar imagery (pl. 3). A distinctive annular magnetic anomaly (negatively polarized ring and positively polarized central core) is characteristic of the southern part of the structure. A strong thorium anomaly corresponds partly to the north-trending ridge but has a broad extension to the west.

RORAIMA GROUP

The Roraima Group of Early and Middle Proterozoic age is composed of quartzarenite, arkose, silty arenite, conglomeratic arenite, conglomerate, siltstone, shale, and minor tuff and has a total thickness of more than 3,200 m (Reid and Bisque, 1975). Bedding is cross stratified, laminated, or massive and flat lying or gently inclined. The unit weathers to form high tepuis (flat-topped mesas) and ledge-and-slope topography. Based on direct and indirect isotopic dating, the range of possible ages of the entire group is from 1,900 to 1,500 Ma (Sidder and Mendoza, in press; see also Ghosh, 1985). In Estado Bolívar, the group rests with probable unconformable relation on the Los Caribes Formation south of the Río Cuyuní, on the Pastora Supergroup and Supamo Complex, on Cuchivero volcanic and plutonic rocks, and on pre-Roraima rocks. It rests conformably on the Ichún Formation.

Strata of the Roraima Group preserved in erosional remnants in Territorio Federal Amazonas show a lack of correlation with Roraima Group strata in the Gran Sabana in Estado Bolívar. The beds in Territorio Federal Amazonas rest on eroded Parguaza Granite (1,545 Ma; Gaudette and others, 1978) and are probably younger than the rest of the group; these rocks are shown on plate 2 as Roraima Group undivided (unit YXr, pl. 2). Ghosh (1985) showed that the age of Roraima-type deposition decreases from west to east in the shield. He (p. 38) described five sedimentary environments represented by the Roraima strata: "1) low-sinuosity river channels and flood plains; 2) delta distributaries above tranquil interdeltaic and inter-distributary lakes; 3) coastal lagoons to interdeltaic bays; 4) wave-dominant non-barred beach and tidal environment; 5) intertidal mud flat environment, etc." Ghosh showed, using paleocurrent data, that the source of the Roraima sediment was northeast, east, or south of the present outcrops.

The Roraima Group was divided regionally by Yánez (1985) into three formations, the Canaima, the Guaiquinima, and the Auyántepuy; Reid and Bisque (1975) had previously subdivided the group into four formations. The subdivisions of Yánez were used in compiling the geologic map (pl. 2) because the distribution of the units was presented in map form by Yánez (1985).

The Canaima Formation (unit YXrc, pl. 2) is composed of quartzarenite and arkose, conglomeratic arenite, conglomerate, siltstone, and shale; cross strata are abundant in the arenite and arkose units. The formation weathers to form cliffs of resistant arenite, arkose, and conglomerate and slopes underlain by relatively nonresistant siltstone, shale, and silty arenite. It is about 1,100–2,000 m thick and is equivalent to the Uairén and Cuquenán Formations and the lowermost part of Uaimapué Formation of Reid and Bisque (1975).

The Canaima Formation is conformably overlain by the Guaiquinima Formation (unit YXrg, pl. 2). The Guaiquinima is made up of fine-grained quartzarenite and arkose that are cross stratified, laminated, and massive; siltstone and graywacke; and red, green, and greenish-gray jasper composed of devitrified and (or) silicified volcanic ash and small crystals of quartz and feldspar. The formation weathers to form flat or gently sloping topography, and the upper part of the formation is mostly covered by debris from the overlying Auyántepuy Formation. The Guaiquinima is several hundred meters thick and is equivalent to all but the lowermost part of the Uaimapué Formation of Reid and Bisque (1975).

The Auyantepuy Formation (unit YXra, pl. 2) is the youngest part of the Roraima Group. Composed mainly of quartzarenite and minor arkose, it forms steep cliffs 300–700 m high and flat-topped mesas. It is equivalent to the Matauí Formation of Reid and Bisque (1975).

INTRUSIVE ROCKS OF PROBABLE POST-RORAIMA AGE

The Middle Proterozoic Parguaza Granite (unit Yp, pl. 2) is a massive, coarsely crystalline, porphyritic granite and biotite granite commonly having rapakivi textures. It contains xenoliths of fine-grained granite and rhyolite (Gaudette and others, 1978) and pegmatite bodies enriched in tin and tantalum (Mendoza and others, 1977; Rodríguez and Pérez, 1982). The Parguaza Granite was reported by Mendoza and others (1977) and Ghosh (1985) to be unconformably overlain by the Roraima Group, although isotopic ages for the Parguaza Granite (zircon age, 1,545 Ma; Rb/Sr age, 1,531±39 Ma; Gaudette and others, 1978) are within the possible age span of the Roraima Group. These age relations can be explained if the Roraima Group varies significantly in age within the Guayana Shield; that is, the Roraima Group may be relatively young (less than 1,545 Ma) in the western part of the shield, where it reportedly rests on the Parguaza Granite, but may be older in the eastern part of the Guayana Shield (Ghosh, 1977, p. 47, 48).

The Parguaza Granite is characterized by low-amplitude intermediate-frequency magnetic anomalies that have no preferred trend. In the southwestern part of the batholith, a number of narrow, dikelike bodies observed in the side-looking radar imagery (pl. 3) form radial patterns. In the same area, several large, generally east trending magnetic anomalies were observed that have negative polarization. Modeling profiles of these anomalies yield depths of 1–5 km for their presumed source. In addition, gravity data in this area indicate a dense body 5–15 km below the surface. Together, these results suggest a batholith feeder or a later intrusion postdating emplacement of the Parguaza batholith.

In southern Territorio Federal Amazonas, Middle Proterozoic granitic rocks (unit Ylg, pl. 2) typically penetrate through and dome strata of the Roraima Group. An intrusive body in Caño Yagua was described as coarsely equigranular granodiorite having rapakivi textures. In the southern part of the Río Negro basin, a similar body named the Piedra de Cocuy was described as a granodiorite containing 30 percent quartz, 40 percent feldspar, 20 percent biotite, and 10 percent hornblende (Marcano, Lugo, and Rivero, CVG–TECMIN, Inventory Group, unpub. report, 1991). This intrusive body is characterized by small, subrounded, generally strong magnetic anomalies and produces erosional patterns visible in side-looking radar imagery (pl. 3).

Silicic to intermediate intrusive rocks (unit Xgd, pl. 2) of probable Early Proterozoic age form small domes intruding and folding strata of the Ichún Formation in the Río Caura quadrangle. One of these small plutons, northwest of Cerro Ichún, was described as a granite (Félix Martínez, CVG–TECMIN Inventory Group, oral commun., 1991). Another, on the east side of Cerro Ichún, was described as felsic intrusive rocks (Briceño and others, 1989). These silicic to intermediate rocks are generally strongly and heterogeneously magnetic; tightly compressed, high-frequency magnetic anomalies are centered on a typically elliptical core. Erosion of these rocks produces patterns that are visible in Landsat imagery but not clearly identifiable in side-looking radar imagery (pl. 3).

Some circular structures as much as 5 km in diameter and visible in side-looking radar imagery (pl. 3) are believed to represent alkaline intrusive complexes of probable Middle Proterozoic age (unit YXac, pl. 2). At La Churuata, at the base of the eastern flank of Cerro Duida southeast of Cerro Marahuaca, one such complex has a Rb/Sr age of 1,300 Ma and is described as "saturated syenites, quartz-syenites, nepheline syenites, and granites" containing aegerine, riebeckite, and monazite or bastnaesite (Soares, 1985). A complex mapped south of the Santa Elena quadrangle (fig. 2) and just north of the Brazilian border (lat 3°59′ N., long 63°01′ W.) is a coarsely crystalline gabbro that has flow-aligned phenocrysts of plagioclase 1–2.5 cm long in a fine-grained groundmass. Rocks in these alkaline intrusive complexes commonly are commonly only very weakly magnetic.

Dark-gray to greenish-gray, fine- to coarse-grained, tholeiitic diabase (unit d, pl. 2), locally containing disseminated pyrite, is present as dikes, laccoliths and sills in the Roraima Group and older rocks. Isotopic dating of these dikes throughout the Guayana Shield indicates that the dikes formed from about 1,850 to about 1,650 Ma and from about 210 to 200 Ma (Teggin and others, 1985; Sidder and Mendoza, in press).

CENOZOIC DEPOSITS

Near Puerto Ordaz and westward, the Imataca Complex is overlain by a sequence of sedimentary rocks correlated with the Pleistocene and Pliocene Mesa Formation of Hedberg and Pyre (1944). This unit (unit Tm, pl. 2) is composed of massive to laminated, generally reddish siltstone and sandy siltstone and light-tan or pink to gray claystone. The unit grades upward into unconsolidated gravel and sand. No fossils other than petrified wood have been found. The formation may represent a remnant of extensive delta deposits of the Río Orinoco (Gonzales de Juana, 1946).

Deposits of sand, gravel, and silt of Quaternary age (unit Qa, pl. 2) cover large areas in the lower reaches of Río Orinoco and are present sporadically along rivers and small streams throughout the shield. This unit includes terrace gravels containing rounded pea-size clasts at locations along the Río Caroní.

GEOPHYSICS OF THE VENEZUELAN GUAYANA SHIELD

By Jeffrey C. Wynn

Geophysical data, principally side-looking airborne radar, gravity, and aeromagnetic data, are primary sources of information for geologic mapping, mineral exploration, and mineral resource assessment. These types of data are particularly useful in the weathered, densely forested geological environment of the equatorial area of Venezuela. Side-looking radar imagery of the Earth's surface displays fine detail and spectacular relief and thereby illuminates a variety of surficial geological features. Gravity data are used to distinguish hidden boundaries between lithologic units having different densities and to estimate the depth to bedrock in sediment-filled basins. Aeromagnetic data are used to distinguish differences in magnetic susceptibility, such as between volcanic and sedimentary rocks or between fresh and hydrothermally altered rocks. Aeromagnetic data provide a measure of the content of magnetite and other magnetic minerals in rocks and, as such, provide information on the distribution of different rock types at the surface and at depth.

Geophysical data for the Venezuelan Guayana Shield are available but uneven in coverage. Nevertheless, they provided crucial information for the compilation of the new geologic and tectonic map of the shield (pl. 2) and for the mineral resource assessment, especially in areas where geologic information is sparse due to remoteness or to extensive laterite and jungle cover. A provisional interpretation of these data delineated areas having similar gravimetric, radar reflectance, and magnetic properties that are useful in synthesizing the geology and in determining the boundaries of areas permissive for specific types of mineral deposits. Fortunately, where the ground-based geologic coverage is poorest, such as Territorio Federal Amazonas, geophysical coverage is relatively good. This circumstance allowed compilation of a new geologic map that is reasonably consistent in the overall quality of its detail for the entire shield.

Table 2 describes the geophysical characteristics of many of the geologic map units shown on plate 2.

AVAILABLE DATA AND PROCESSING TECHNIQUES

SIDE-LOOKING AIRBORNE RADAR

X-band side-looking airborne radar (SLAR) imagery was acquired for the entire Venezuelan Guayana Shield by Goodyear Aeroservice Corporation in 1971 and 1977. The data were acquired using a Goodyear electronic mapping system (GEMS) flown at 12,000 m elevation; flightlines were generally east-west in Estado Bolívar and north-south in Territorio Federal Amazonas, and the radar antenna illuminated the land toward the west and north, respectively. To obtain the precise location of the aircraft during the survey an array of some 30 points throughout the Amazon Basin was established by the transit satellite (Jensen and others, 1977). At each point a transponder was set up for a shoran radio-positioning system. By simultaneously receiving the broadcast from two such points the position of the aircraft was determined to an accuracy of about 75 m and was checked every 6 seconds. During the survey the plane's position was recorded on magnetic tape, along with its altitude and other significant data. The acquisition system used a transmission wavelength of 3.12 cm. Image strips were compiled at 1:100,000 scale and assembled into mosaics at 1:250,000 and 1:500,000 scales. Resolution of the images is 10 m. Registration disagreements of as much as 5 km are apparent between these images and Venezuela's National Cartographic Base. The mosaics formed the base maps for all geologic studies.

A 1:1,000,000-scale image mosaic of the Venezuelan Guayana Shield was assembled by the U.S. Geological Survey using density-corrected 1:500,000-scale sheets compiled onto a Venezuelan polyconic grid base called Proyección Cónico Secante Compensada (pl. 3), an equidistant conic projection using lat 4° N. and 9° N. as standard parallels and long 66° W. as the central meridian. Because of the selection of wavelength, the radar imagery commonly penetrates vegetation and thus is an important

Table 2. Geophysical characteristics of geologic map units in the Venezuelan Guayana Shield.

[Geologic map units are shown on plate 2 and described in text. Side-looking radar imagery (SLAR) is shown on plate 3. Location of quadrangles is shown in figure 2]

Unit	Name	Regional geophysical signature
Qa	Alluvial deposits	None on a regional scale. In the SLAR imagery no pattern is recognized.
d	Diabase	Strong, high-frequency, generally northeast trending (Guri, Río Mavaca, Santa Elena, and Puerto Ayacucho quadrangles) or northwest trending (Atabapo, Santa Elena, and Piedra de Cocuy quadrangles) linear magnetic anomalies. Some of these bodies are visible in the SLAR imagery as narrow linear features.
Ylg	Late granite	Small, subrounded, and generally strong magnetic anomalies. Unit is commonly visible in the SLAR imagery as small, relatively homogeneous rings in the drainage pattern.
YXac	Alkaline complexes	Very weakly magnetic. Unit is commonly visible in the SLAR imagery as small, faint, relatively smooth textured, circular or subcircular bodies.
Yp	Parguaza Granite	Intermediate-frequency, low-amplitude magnetic anomalies without any preferred trend. Internal to the batholith, several large, buried, generally east trending bodies having negative magnetic polarization have been observed, as well as narrow, high-frequency linear anomalies (probably diabase dikes). At least one dense, disklike body can be seen in gravity data and appears as a domelike expression in the southwest margin of the batholith. In the SLAR imagery the batholith shows as areas of generally high relief and prominent N. 45°–60° E.-trending faults and shear zones (some right- and left-lateral movement).
YXr	Roraima Group (arenite and conglomerate)	No magnetic mineral content. These units are effectively transparent to aeromagnetic data (units beneath them could possibly be mapped using aeromagnetic data). Resistant strata are very distinctive and show clearly in the SLAR imagery as long jagged shadows on the distal side of the aircraft flight path.
Xpr	Pre-Roraima Group sedimentary rocks	Apparently nonmagnetic, but no direct measurements have been made to verify this. In the SLAR imagery rocks appear as relatively smooth textured, low-relief material.
Xi	Ichún Formation (volcanic-sedimentary rocks)	Rock descriptions suggest that these rocks should be highly magnetic, but no direct measurements have been made. The unit forms very pronounced bands or laminations in the SLAR imagery.
Xgu	Intrusive rocks, undivided	Weakly magnetic with no apparent orientation to patterns (southwest Territorio Federal Amazonas).
Xgd, Xgr	Silicic to intermediate intrusive rocks (forming small domes)	Generally strongly and heterogeneously magnetic, showing tightly compressed, high-frequency magnetic anomalies centered on a (typically) elliptical core. In Landsat imagery generally subrounded structures have slightly different vegetation color, but in SLAR imagery rocks of unit are generally difficult to distinguish from surrounding rocks, which have similar characteristics.
YXci	Carbonatite intrusion of Cerro Impacto	Distinctive annular magnetic anomaly (negatively polarized ring having a positively polarized central core) overlies southern part of intrusive body, and strong thorium anomaly overlies the north-south ridge and extends to the west. A prominent set of radial fractures is visible in the SLAR imagery, and the surrounding plain shows as an irregularly shaped area of low relief.
Xg	Calc-alkaline granite	Weakly to moderately magnetic; apparent west to west-northwest trends common in magnetic anomalies. In the SLAR imagery pronounced west-northwest-striking lineaments are characteristic, especially in the Atabapo quadrangle.

geologic mapping tool. Distinct changes in lithology generally produce consistent differences in the pattern of radar reflectance. Geological analysis of images can suggest areas for detailed mapping, and preliminary structural interpretation of images can provide clues for revising and expanding information (Sardi and others, 1988). Side-looking radar imagery is a useful tool to complement field mapping that can help identify the extent of regional structure and gross lithologic units.

On the radar image mosaic (pl. 3) rivers are shown as solid dark lines; this is due to the strong absorption of radar energy by water. Distinctive platy laminae are visible in most places where rocks of the Roraima Group or Ichún Formation are present; cliffs of the Roraima Group give distinctive long, thick black shadows that assist further in its identification. Strong topographic relief in the northeastern part of the shield is due to greenstone-belt rocks that rise above the relatively flat lying topography of the Supamo terrane. Vast areas of Territorio Federal Amazonas are almost featureless in the radar image due to the fact that they are mostly flat, water-inundated plains.

GRAVITY DATA

Available gravity coverage in the Venezuelan Guayana Shield was acquired from the U.S. Defense Mapping

Table 2. Geophysical characteristics of geologic map units in the Venezuelan Guayana Shield—Continued.

Unit	Name	Regional geophysical signature
Xcg	Granitic rocks of the Cuchivero Group	Moderate magnetic anomalies without preferred trends. Unit forms medium to high topographic relief in the SLAR imagery.
Xc	Caicara Formation (volcanic rocks)	Very strong, high-amplitude, high-frequency magnetic anomalies without preferred directional orientation. In the SLAR imagery these rocks have low to moderate relief and local directional orientation of the drainage patterns; several 5–10-km-diameter circular structures can be identified (possibly calderas?).
Xmu	Greenstone-belt rocks in Territorio Federal Amazonas (volcanic-plutonic terrane)	Almost identical in aeromagnetic expression to undifferentiated volcanic rocks of the Caicara Formation discussed above. Extremely limited reconnaissance geologic sampling indicates the presence of Caicara volcanic rocks, as well as rapakivi-textured granitic rocks, greenstone-belt volcanic rocks (with extensive illegal gold exploitation reported in the national press), and some amphibolite. In the SLAR imagery this terrane is very similar to that of Caicara volcanic rocks, and some of the granite bodies are clear, circular to subcircular features as much as 13 km in diameter.
Xsp	Supamo Complex (intrusive rocks)	Nonmagnetic rocks, at least in the eastern Guri quadrangle; some intrusive rocks mapped as Supamo in the Sierra Verdún area have magnetic signatures very similar to units Xgd and Xgr and are probably related younger granitic intrusive rocks. In the SLAR imagery Supamo rocks generally form a terrane of low topographic relief.
Xmo	Moriche Formation (metaconglomerate)	High-amplitude magnetic anomalies (linear when the bodies are long and narrow, as in the La Esmeralda quadrangle). Anomalies follow structural lows along the middle and upper Río Orinoco and Río Mavaca; some of the linear bodies show folding by regional metamorphic events. These shapes are visible in both aeromagnetic maps and SLAR imagery.
Xm1,2, Xf1,2, Xg1,2, Xu1,2	Greenstone-belt rocks	Highly magnetic; high- to medium-frequency anomalies reflect units at different depths. In places in northeastern Estado Bolívar rocks are apparently covered by Supamo rocks. Ultramafic (units Xu1, Xu1) and mafic (unit Xm1) rocks are generally the most magnetic; the other rocks are slightly less magnetic. The granitic rocks (units Xg1, Xg2) cannot be distinguished from the rocks that they intrude. Some magnetic anomalies are without preferred orientation, but many are linear in one place and bent into broad arcuate structures in another. In the SLAR imagery these rocks show as zones of significant topographic relief having pronounced shadows and lineaments standing above surrounding Supamo rocks (especially in Bochinche and Marwani areas, at El Callao, and south along Sierra Verdún).
Xmp	Metamorphic-plutonic terrane of San Carlos	Strong and distinctive, sinuous, east- to N. 70° W.-trending, elongate magnetic anomalies stacked together. In the SLAR imagery these rocks form an almost featureless, flat plain.
Xbc	Basement complex	Moderately magnetic terrane, generally without complex significant directional trends. In SLAR imagery these rocks form an area of generally low relief and little or no textural pattern.
Ai	Imataca Complex	Generally highly magnetic, reflecting ridges of iron formation and amphibolite; magnetic patterns suggest broad regional folds. In SLAR imagery, these rocks appear as areas of moderate relief with preferred N. 60° E. trends in the drainage pattern east of the Río Caroní. The pattern changes to broad arcs, as well as generally noncoherent textural trends, west of Río Caroní.

Agency (DMA) Library, 3200 South Second Street, St. Louis, Missouri 63118–3399, and from the Universidad de Simon Bolívar (USB), Caracas, Venezuela, through Professor Victor Graterol. The extent of the gravity coverage is shown in figure 3. A Bouguer gravity anomaly map was compiled based on the available data (pl. 4). Coverage is almost nonexistent in the southern parts of the shield but relatively complete in the northern parts where there is substantial road and river access. Data are sufficient in areas around and south of Puerto Ayacucho to permit some limited modeling to better understand the core of the Parguaza granite batholith (discussed later). Station identification, latitude, longitude, elevation, and observed gravity were compiled for each gravity station using the principal facts provided by DMA and USB. Simple Bouguer anomalies were calculated using formulas published by the International Association of Geodesy (1967) and a Bouguer reduction of 2.67 g/cm^3.

Gravity data provide information about the distribution of masses of rock at depth that have different densities. These densities may reflect different degrees of metamorphism or simply different mineral assemblages (such as clays from hydrothermal alteration, which reduce density, or higher contents of ferromagnesian minerals, which generally increase density). In areas where gravity stations are available in sufficient density, it is possible to

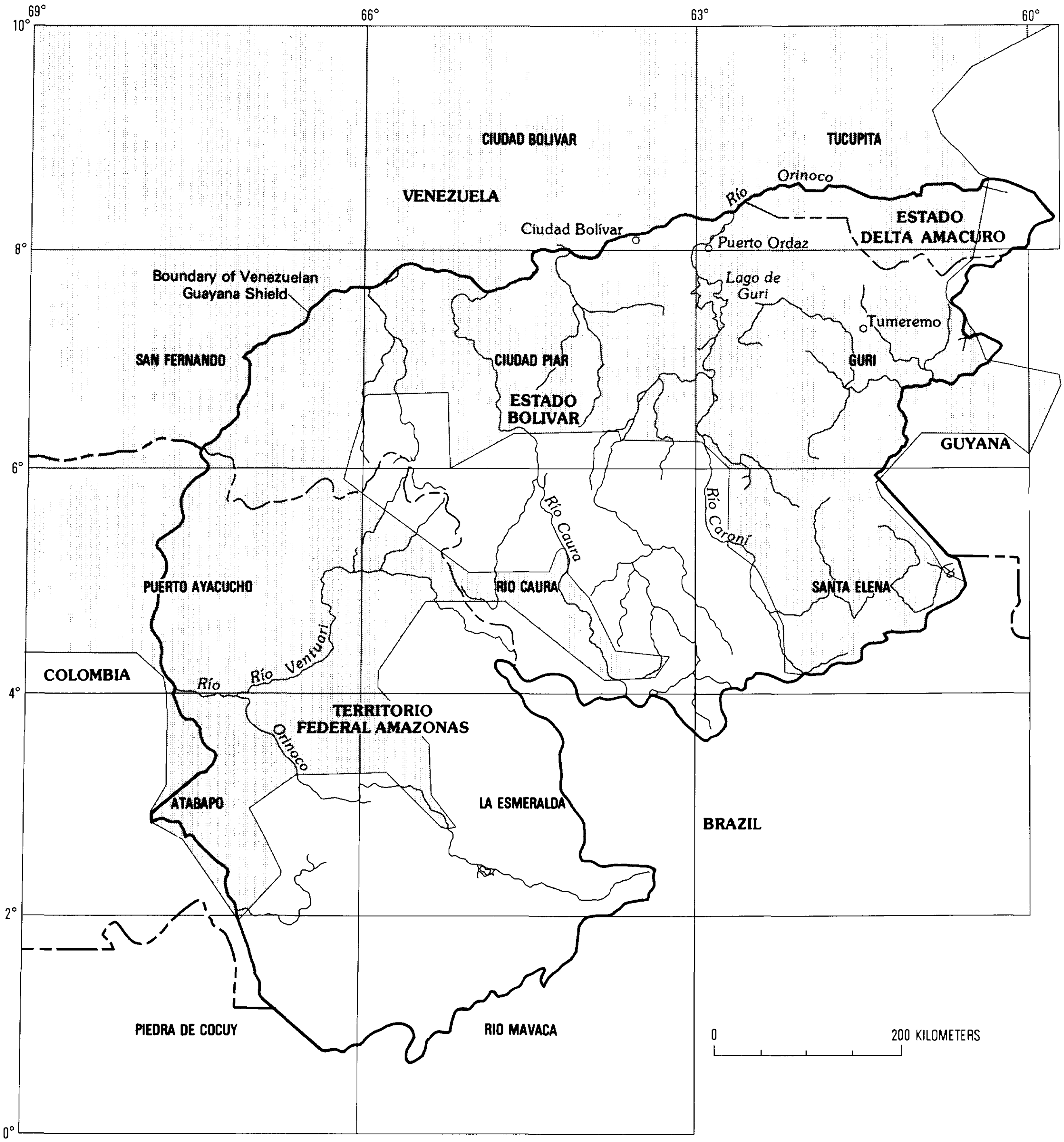


Figure 3. Gravity coverage (shaded area) of the Venezuelan Guayana Shield. Names of individual 1:500,00-scale quadrangles are shown in uppercase letters.

model the buried masses of different densities and learn something about the three-dimensional distribution of rocks at the surface. Because of the paucity of gravity data in the Venezuelan Guayana Shield and because of difficulties in data reduction due to lack of reliable elevation data, gravity data were used only rarely in the compilation of the geologic and tectonic map (pl. 2).

AEROMAGNETIC DATA

Available aeromagnetic coverage of the Venezuelan Guayana Shield is shown in figure 4 and was mostly acquired by Goodyear Aeroservice in 1959 and 1961. Handcontoured aeromagnetic data at 1:50,000 scale are available from CVG–Técnica Minera, C.C. Chilemex,

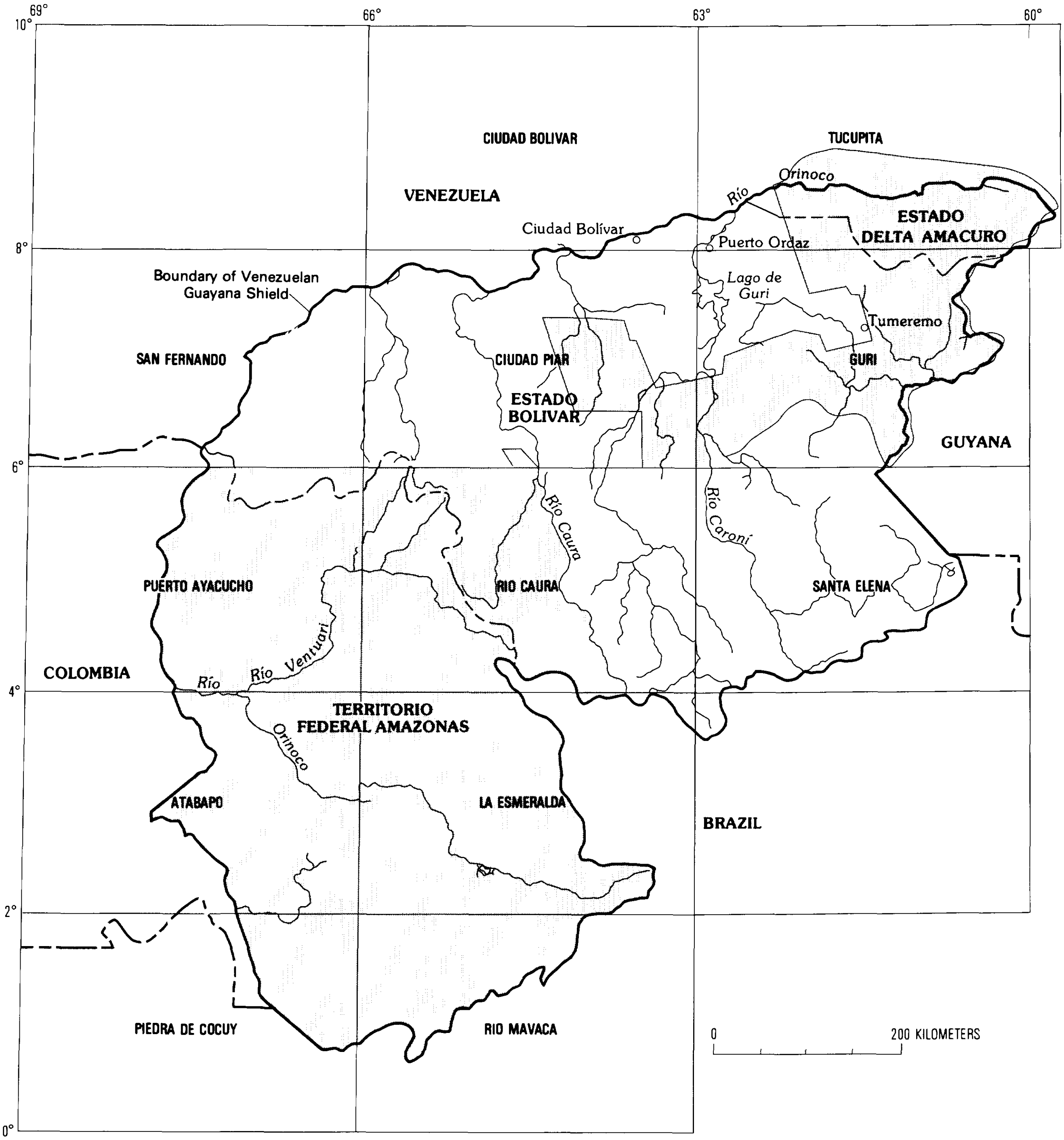


Figure 4. Aeromagnetic coverage (shaded area) of the Venezuelan Guayana Shield. Names of individual 1:500,000-scale quadrangles are shown in uppercase letters.

Piso 1, No. 6, Puerto Ordaz, Venezuela. The original flightlines were spaced roughly 1 km apart and were flown at 152-m mean terrain clearance in a N. 22° W. orientation that was chosen to cut across the trend of regional foliation. Internal evidence, such as poor correlation between surveys spaced two years apart, suggests that incorrect registration of fiducial marks may have led to errors in horizontal location of as much as 2.5 km.

Aeromagnetic contour maps at 1:50,000, 1:100,000, and 1:200,000 scales available from the Venezuelan Ministerio de Energía y Minas were analyzed for information on depth-to-source and horizontal boundaries for discrete anomalies and also to delineate distinctive magnetic domains based on characteristic aeromagnetic signatures (Ministerio de Energía y Minas and Corpoven, 1989). These maps were one of the prime sources of information on the distribution of rock types in the southern part of Territorio Federal Amazonas where geologic mapping has not been done except as the most general regional reconnaissance. A preliminary map was assembled using these data and previous geologic maps and radar images, then field checked by geologists of the U.S. Geological Survey (USGS) and Técnica Minera, C.A. (TECMIN), a part of the Corporación Venezolana de Guayana (CVG), who found good correlation despite the fact that geologic unit identifications in the field are not usually based on magnetite content.

A widely spaced (4–6 km) aeromagnetic survey was flown in the Gran Sabana region (southeastern Venezuela) during the 1970's, but the data were never reduced to contour maps and have never been released (Emilio Herrero, Ministerio de Energía y Minas, oral commun., 1987, 1990).

During the early 1970's, a combined airborne magnetic and radiometric survey was flown in Territorio Federal Amazonas. Although digital tapes were provided to the Ministerio de Energía y Minas by Hunting–UK, the contractor, the location data were provided in a nonstandard format, and the flightline sheets were not made available in a format that permits conversion of the data to digital form. These data are of sufficient quality, even in contoured form, to permit modeling in some cases. Apparently, no large-scale magnetic data acquisition has been carried out in the Venezuelan Guayana Shield since the mid-1970's, and no regional geophysical data are available for the area between the Ríos Caura and Caroní in Estado Bolívar.

AERIAL GAMMA-RAY SPECTROMETRY

Aerial gamma-ray spectrometry data were acquired as part of the airborne aeromagnetic data acquisition effort in Territorio Federal Amazonas. An aerial gamma-ray system flown near ground level effectively detects terrestrial gamma radiation from an area along the flightline. Aerial gamma-ray measurements represent the near-surface (<50 cm) distribution of the natural radioelements potassium (K), uranium (eU), and thorium (eTh). (The "e" prefix, for equivalent, denotes the potential for disequilibrium in the uranium and thorium decay series.) The only data available to the author for the Venezuelan Guayana Shield were interpretations in the form of generally, but not always, closed domains of radiometric anomalies for uranium and thorium on the 1:200,000-scale compilations of aeromagnetic data for Territorio Federal Amazonas.

In some areas, overlaps and inconsistent compilation make it impossible to tell which side of a decorated line the anomaly is on, especially if the anomaly covers a large area. Where there are unequivocal anomalies (generally small in size) of uranium and thorium, they were incorporated into the geologic map. In some areas, these anomalies coincide with a feature on the radar imagery, with a magnetic anomaly, or with a discrete feature mapped on the ground. Important examples are the thorium anomaly associated with the Cerro Impacto carbonatite (pl. 2, lat 5°50′ N., long 65°15′ W.) and some discrete uranium-enriched areas associated with local subcircular magnetic anomalies along the border between the Puerto Ayacucho and Río Caura 1:500,000-scale quadrangles (fig. 2).

PROCESSSING OF GEOPHYSICAL DATA TO COMPILE THE GEOLOGIC AND TECTONIC FRAMEWORK MAP

The normal procedure for utilization of airborne geophysical data in geologic mapping is to convert the data to digital form (if it is not provided digitally) and then to develop a series of derivative products such as low pass filtered, horizontal gradient of pseudogravity, reduced to the pole, and terrace magnetization images. These derivative maps can be used to provide information on structure and on contacts between geologic units that have different magnetic mineral contents (magnetite, ilmenite, or pyrrhotite). An example of this type of analysis is the study of the Bochinche area reported in Wynn, McCafferty, and Salazar (in press). A complete geophysical analysis usually concludes with modeling of individual anomalies of significance for one reason or another or, rarely, with developing a complex three-dimensional model for an entire area.

In Venezuela, it proved impossible to obtain digital aeromagnetic data except by digitizing hand-contoured maps. Digitization of the Bochinche 1:50,000-scale quadrangle alone required a person-week of effort, as well as time for editing, and resources were not available to devote to digitizing the several hundreds of 1:50,000-scale maps in the Venezuelan Guayana Shield. For this reason, a different approach was taken in the analysis of the Venezuelan airborne geophysical data.

The analysis, and its incorporation into a new geologic and tectonic map, was done using a multistep procedure. Initially, a number of anomalies were modeled for differently shaped two-dimensional bodies at different depths. The unusual deep source negative magnetic anomaly at lat 5°15′ N., long 67°40′ W., south of Puerto Ayacucho, for example, can best be modeled as a three-dimensional prism having a strong remanent magnetization (figs. 5, 6). A model of the magnetic anomaly of a shallowly dipping peridotite body from the Píston de Uroy area is shown in figure 7, and a model of the magnetic anomaly of a vertically dipping mafic dike south of

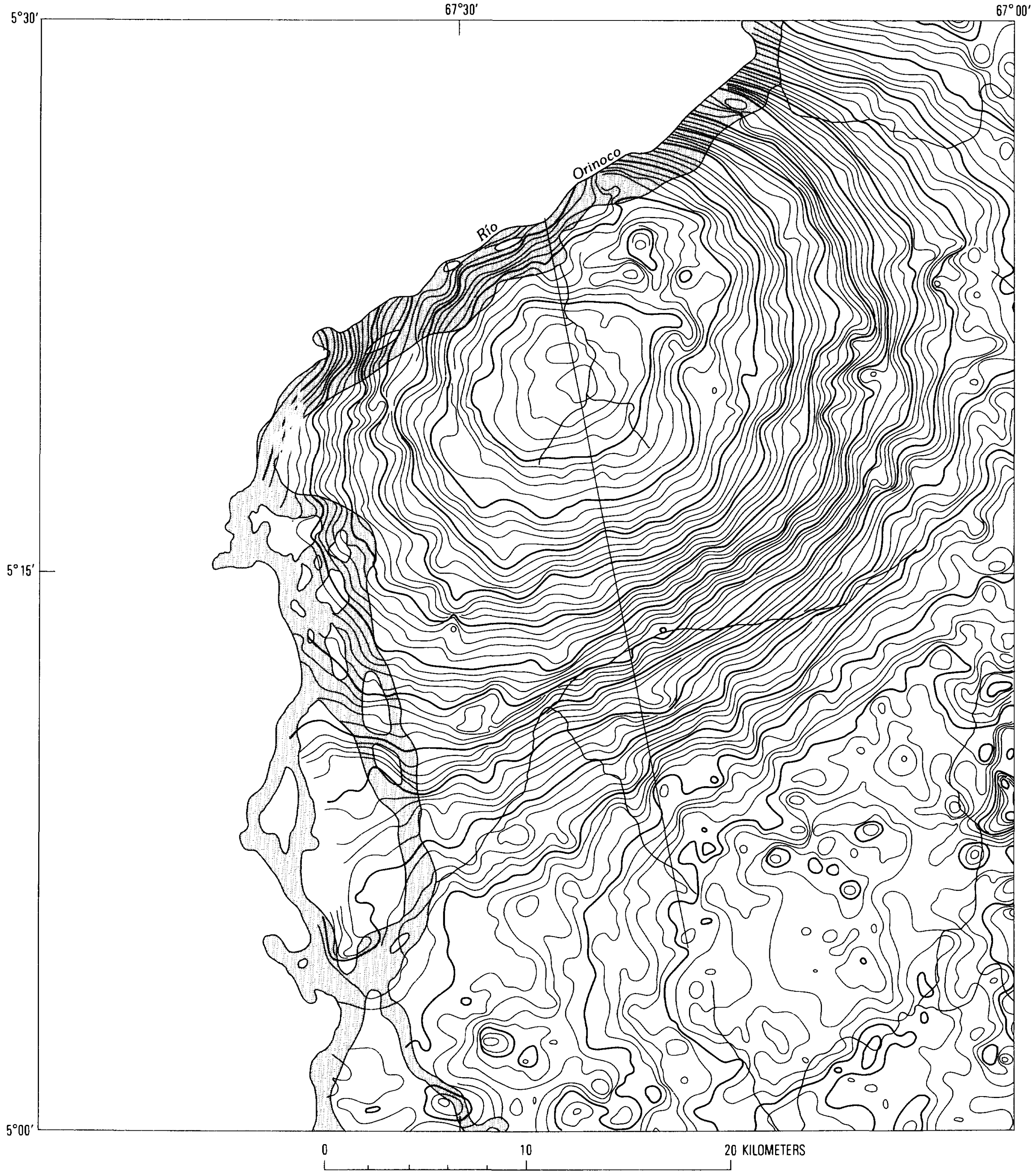


Figure 5. Contours of total field aeromagnetic data in the area of an unusual, deep-source negative magnetic anomaly south of the city of Puerto Ayacucho, Territorio Federal Amazonas. Contour interval 10 nT. Line of profile of model in figure 6 is also shown. Modified from Ministerio de Energía y Minas and Corpoven (1989).

Cerro Autana in Territorio Federal Amazonas is shown in figure 8.

This kind of forward modeling was necessary because the inclination of the Earth's magnetic field in southern Venezuela is about 35°–40°. Because of this shallow inclination, anomalies are distorted and shifted; the normal positive anomaly is diminished and shifted laterally as much as several kilometers in a S. 22° E.

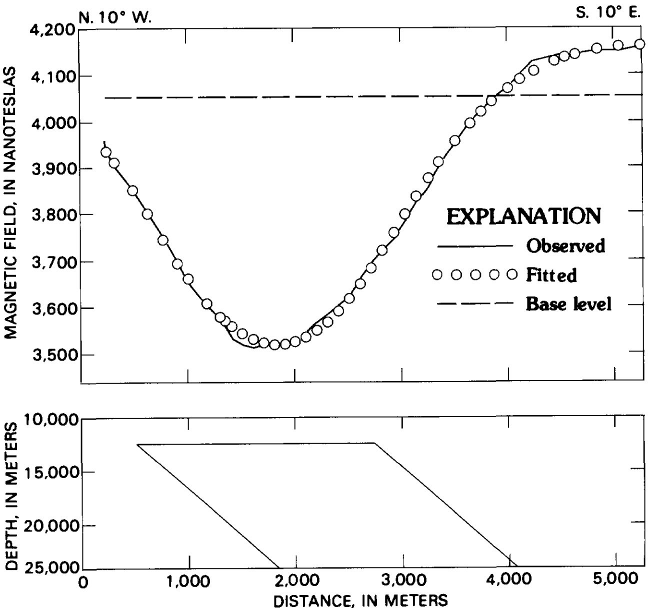


Figure 6. Model of the negative magnetic anomaly south of the city of Puerto Ayacucho shown in figure 5. A three-dimensional prism was used to model the source; depth to top of source is 12.4 km, upper surface of cross section is 10.0 km by 11.0 km, and body dips 41° S. Thickness of source body is 19.1 km and susceptibility is 3.8×10^{-3} emu. The best fit is obtained by using a remanent magnetization to susceptibility magnetization ratio (Koenigsburger ratio) of 10, a remanence field inclination of –23°, and a remanence field declination of –10°. The Earth's field strength is taken to be 35,000 nT, field inclination 40°, and declination –11°.

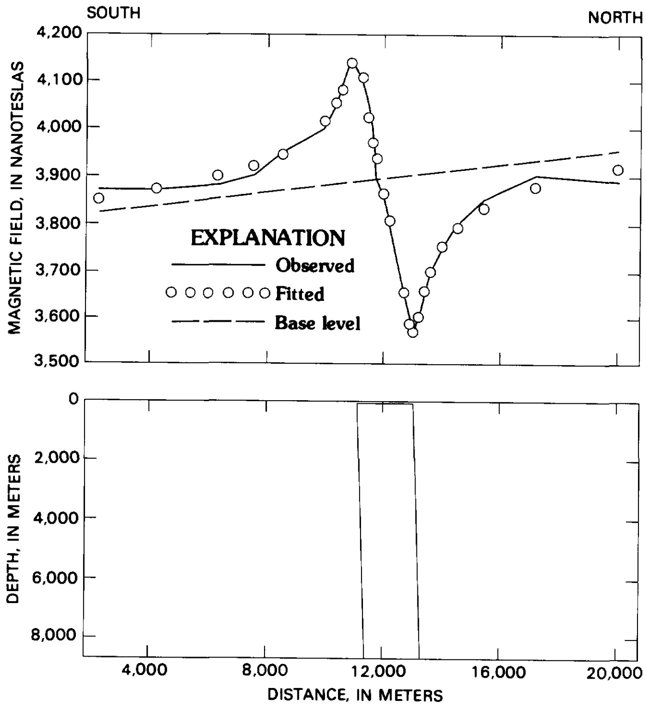


Figure 8. Model of a moderately magnetic, steeply dipping dike (probably diabase) south of Cerro Autana, Territorio Federal Amazonas. The best susceptibility fit uses a long, narrow body that is buried 84 m below the surface, dips 88° N., and has a half-width of 947 m. The modeled susceptibility is 2.08×10^{-3} emu. The Earth's field strength is taken to be 35,000 nT, field inclination 40°, and declination –11°.

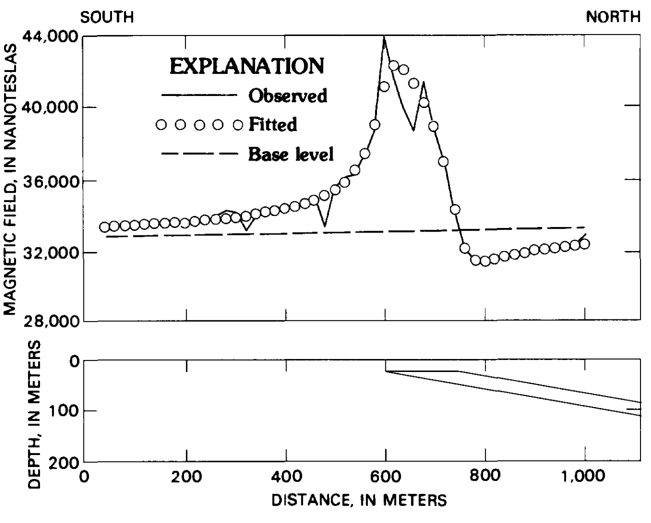


Figure 7. Model of a highly magnetic, shallowly dipping peridotite body at the Píston de Uroy gold prospect, Río Chicanan, Estado Bolívar. The best susceptibility fit uses a long, narrow body that is buried 24 m, dips 10° N., and has a half-width of 72 m. The modeled susceptibility is 0.358 emu. The Earth's field strength is taken to be 32,700 nT, field inclination 31°, and declination –11°.

direction. The normally subtle negative part of the dipolar magnetic anomaly is enhanced and is shifted as much as a kilometer in the direction N. 22° W. (the direction of the Earth's field declination) from the source body. In areas of complex anomalies, this shift can lead to mixing and overlap that make interpretation extremely complicated (Grauch and Cordell, 1987).

In areas where discrete anomalies could be identified, they were interpreted for depth of burial—(1) superficial, (2) burial by at least 500 m overburden, (3) burial by at least 1,500 m of overburden—and for horizontal boundaries. These data were incorporated into an overlay that was then used in assembling the preliminary geologic map through digitizing the interpreted boundaries and reprojecting them at 1:500,000 scale. Where there was extensive overlap of anomalies, boundaries were drawn around zones having different magnetic signatures such as different frequency of components, presence or lack of directional trends and their orientations if present, and so forth.

A series of 1:500,000-scale geophysical interpretation maps were developed, geologic maps were assembled, and the information was evaluated and incorporated. This was a difficult and mostly subjective process because some of these maps were made from photo interpretation with as little as three field sample points in a 1°×1° quadrangle area. Extensive interviewing was carried out by the author and other USGS colleagues of those individual geologists, both within and outside of CVG–TECMIN, who had worked in the areas of interest to incorporate their observations and to examine the rocks they had collected. Indisputable radiometric anomalies and some gravity data modeling results were added at this stage to generate new preliminary geologic maps at 1:500,000 scale.

Following assembly of these preliminary geologic maps, the side-looking radar imagery was evaluated and compared. At this point, serious registration problems were discovered of as much as several kilometers between the side-looking radar imagery and the 1:500,000-scale preliminary geologic maps, due mostly to the fact that the side-looking radar images were mosaiked on a Cartesian base (no projection) with poor geodetic control, as well as to scaling problems between adjacent radar image strips. For example, it is possible to see cliffs in the Roraima Group offset by as much as 2 km between adjacent strips (for instance, along the southern margin of Auyán Tepuy). These disparities are probably caused by deviations from the horizontal in the flightpath of the acquisition aircraft. The problem is aggravated by the fact that different generations of geologic maps used bases of differing quality.

The side-looking radar imagery was therefore used only to refine the previously developed 1:500,000-scale preliminary geologic maps, overlaying small parts (areas no wider than 15–20 km) where drainages were clearly visible on both the geology base and the side-looking radar imagery. Side-looking radar imagery was very helpful when used in this fashion, particularly in refining mapping of the Roraima Group and the Ichún Formation in Estado Bolívar. It nevertheless became obvious at this stage that side-looking radar imagery is not always reliable as a mapping tool, particularly when trying to resolve contacts between volcanic and granitic rocks of the Cuchivero Group.

As a final step, the 1:500,000-scale preliminary geologic maps, refined using side-looking radar imagery, were combined into a single 1:1,000,000-scale map. Several iterations followed to resolve edge conflicts, usually by additional interviews with geologists who had worked in the field and by returning repeatedly to all the layers of data incorporated to that point.

REPRESENTATION OF GEOPHYSICAL DATA IN THE GEOLOGIC MAP

CIRCULAR FEATURES

More than 30 circular or subcircular features identified using geophysical data (not including the Nuria ring-dike complex, which is transparent in both magnetic and gravity data) are shown on the geologic map of the Venezuelan Guayana Shield (pl. 2). A few of these features are apparent only in the aeromagnetic data, such as the 70-km-diameter subcircular structure on the west side of the middle Río Caura (lat 5°10′ N., long 64°20′ W.), which has an intensely magnetized core and a superimposed uranium anomaly. In two areas of the northwestern part of Territorio Federal Amazonas (lat 4°00′ N., long 67°25′ W., and lat 4°20′ N., long 66°20′ W.), the magnetic signatures and proximity of Cuchivero volcanic rocks suggest that these circular features represent hidden volcanic centers. Other circular features in southern Estado Bolívar visible in radar imagery (for example at lat 4°50′ N., long 62°55′ W.), for which aeromagnetic data are unavailable, may also represent calderas in Cuchivero volcanic rocks. These features are all relatively large, on the order of 10 km in diameter, and they imply an enhanced potential from the point of view of economic geology.

Numerous smaller circular and subcircular features are visible in the side-looking radar imagery for which we have no ready explanation. Several near Puerto Ayacucho have been investigated on the ground without determining any apparent cause for their existence (Vicente Mendoza, CVG–TECMIN, oral commun., 1988). They may represent buried intrusive bodies, similar to the feature exposed at La Churuata, or perhaps hidden carbonatite intrusive bodies.

DEEP HIGH-DENSITY BODIES

In parts of the Puerto Ayacucho 1:500,000-scale quadrangle (fig. 3), there is sufficiently close spacing of gravity data to observe and model two pronounced Bouguer gravity anomalies. One of these anomalies (fig. 9) is centered around lat 4°30′ N., long 67°30′ W., and is represented on the geologic map (pl. 2) by a coarse-mesh square hachure pattern. The modeled source body (fig. 10) is a dense mass buried beneath about 5 km of granite and a thin veneer of alluvium; two circular subanomalies may be deeper extensions. Another deep dense body (shown using the same map pattern) is about 150 km east of Puerto Ayacucho at approximately lat 5°15′ N., long 66°00′ W. Although other deep high-density bodies may be present, gravity coverage is insufficient to provide direct identification. The first, and larger, body may have domed up the older Parguaza granite, exposing the underlying Santa Rosalía granite.

POSSIBLE RIFTLIKE FEATURE IN TERRITORIO FEDERAL AMAZONAS

South of Puerto Ayacucho and crossing the west-flowing part of the Río Orinoco is a large linear feature, trending about N. 30° W., that is mostly apparent only in

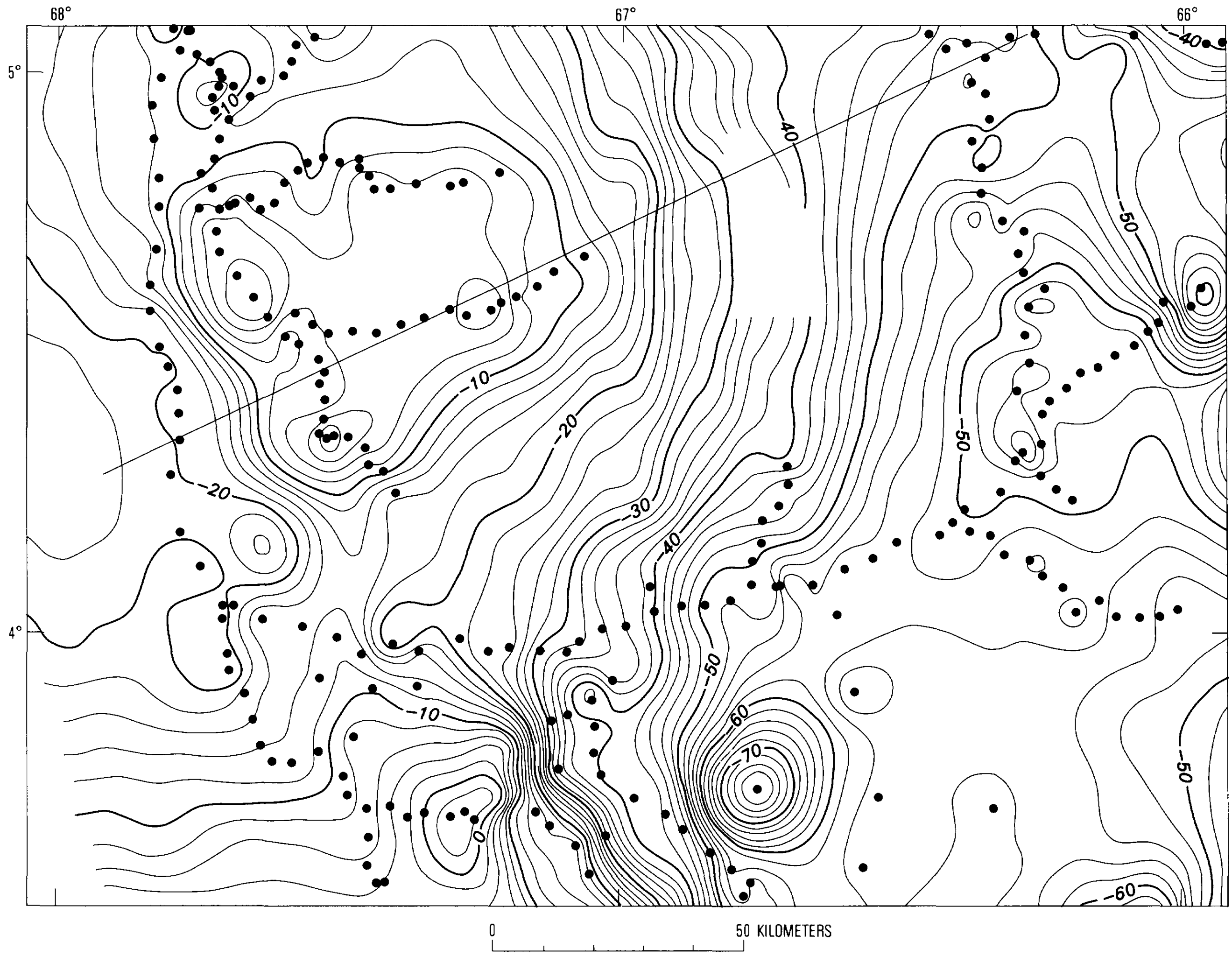


Figure 9. Contours of the simple Bouguer gravity anomaly in the area of a deep high-density body east of Río Orinoco and south of the city of Puerto Ayacucho, Territorio Federal Amazonas. Contour interval 2 mGal. Solid circles are gravity stations. Line of profile of model in figure 10 is also shown.

the geophysical data. It begins in the south at lat 3°00′ N., long 67°00′ W., and is manifested south of the west-flowing branch of the Río Orinoco by a 10–20-km-wide band of highly magnetic rocks interpreted in the geologic map as Cuchivero volcanic rocks (unit Xc, pl. 2). In the gravity data (pl. 4), a sharp gradient follows the southern half of this axis; the lower density side is to the east and possibly represents the downthrown side of a major fault. This gravity gradient bends around the east side of the high-density body discussed previously.

North of where the structure crosses the Río Orinoco, this feature extends at least to lat 4°45′ N., long 67°45′ W., and is manifested in both magnetic and gravity anomalies. A volcanic center is interpreted to be present at lat 4°05′ N., long 67°25′ W. The northern two points anchoring this feature are the possible feeders for the deep high-density body referred to previously. We interpret this feature as a possible ancient rift system, with volcanic rocks filling the edifice. This feature is barely visible in the radar imagery, mainly because the area is a plain of low relief. The main exception is the long linear course of the Río Guayapopo, which is north of the west-flowing branch of the Río Orinoco that follows the axis of this string of geophysical anomalies.

HIDDEN, HIGHLY MAGNETIC BODIES

A number of magnetic anomalies, generally of high frequency (shallow source) and linear in form, are represented in the geologic map (pl. 2) as diagonal hachures without a solid border. If the source body was interpreted to be negatively polarized (for instance, the body at lat 5°15′ N., long 67°40′ W., modeled in fig. 6), it is represented by horizontal hachures.

Where there is sufficient aeromagnetic coverage, such as in the northeastern reaches of Estado Bolívar, in

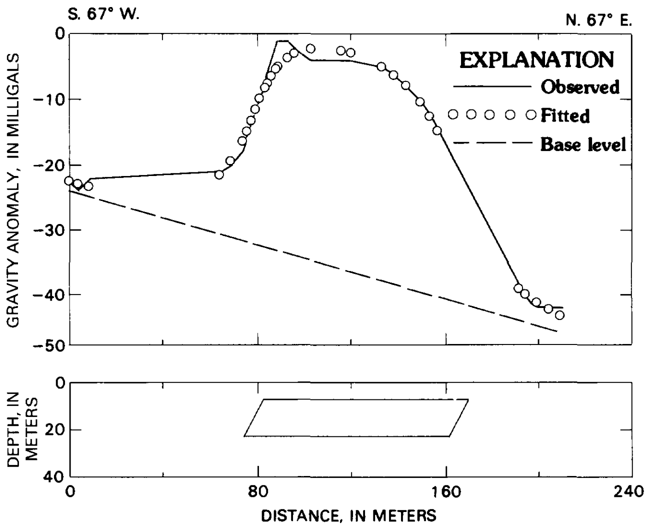


Figure 10. Model of the simple Bouguer gravity anomaly of the deep high-density body east of Río Orinoco and south of the city of Puerto Ayachuco shown in figure 9. Best fit is achieved by a prismlike body that is buried 6.84 km below the surface, is approximately 15 km thick, and has an upper surface of 87 km by 42 km and a density contrast of 0.064 g/cm^3. The body dips 61° SW.

Territorio Federal Amazonas, and in southwestern Estado Bolívar adjacent to the latter, these generally linear anomalies have been interpreted, in most cases, to be buried mafic dikes (unit d, pl. 2). For some of these anomalies, depth-to-source calculations have been done using the steepest tangent method (Vacquier and others, 1951). The results of these calculations are indicated on the geologic map as integers representing the depth of burial in kilometers.

In Territorio Federal Amazonas and southwestern Estado Boívar, results of the aeromagnetic interpretation are represented on plate 2 as hachures or dashed lines for buried bodies and as geologic units when the magnetic data or side-looking radar imagery indicate surficial sources. For most of the latter interpretations ground verification is available that permitted me to characterize the units geologically in some detail and to describe the stratigraphic relations. In some cases, side-looking radar imagery was used to strengthen my interpretation and correlation with similar, known features. In the upper Río Orinoco drainage, only sparse geologic information is available (Vicente Mendoza, CVG–TECMIN, oral commun., 1991), and airphoto information was used to supplement geologic sampling, aeromagnetic data, and radar imagery (Yánez, 1991) to complete assembly of the geologic map.

MAGNETIC GRADIENTS

In several areas, strong magnetic gradients extend for very long distances, sometimes more than 100 km. These gradients are represented as strings of heavy, relatively widely spaced dots on the geologic map (pl. 2) (not to be confused with the closely spaced dots in the Imataca Complex that represent ridges of silicified iron formation). Several interpretations are possible for these magnetic gradients, including sutures or accretions of Precambrian terranes or margins of failed rift systems.

In several areas, strings of high-frequency (shallow-source "d" hachures) magnetic anomalies follow the axis of the lower frequency (deeper source) magnetic gradients. These probably represent dikes intruding a major crustal fracture or zone of weakness. Particularly good examples are in the northeastern part of the Guri quadrangle (Wynn and Cox, unpublished data) and in the Puerto Ayacucho quadrangle (the radial dikelike features over the deep gravity anomaly previously discussed, fig. 9). In the latter area, the strings of high-frequency anomalies are centered over the apparent deep intrusive mass and form a radial pattern suggestive of dikes radiating from a large buried pluton and extending to the surface. The close spatial correlation strongly suggests a genetic relation between the narrow radial dikes and the buried pluton.

HIDDEN LATE GRANITE INTRUSIVE BODIES AND DOMES IN ROCKS OF THE RORAIMA GROUP AND ICHUN FORMATION

In a number of areas, a magnetic signature distinct from the surrounding terrane suggests the presence of a hidden intrusive body. In a few examples along the border between the Puerto Ayacucho and Río Caura quadrangles, these anomalies also apparently coincide with uranium radiometric anomalies and possibly represent extremely shallow, if not superficially exposed, granitic intrusive bodies. In one example in the upper Orinoco drainage, a single outcrop in the river allowed identification and characterization of a granite body visible in the magnetic data but not apparent in the Landsat or radar imagery.

CONCLUSIONS

Regional geophysical data, including aeromagnetic, radiometric, and gravity, and side-looking radar and airphoto imagery, have proven valuable in helping to map remote areas of Territorio Federal Amazonas and southern Estado Bolívar in Venezuela, especially where soil and vegetation cover is extensive. These data contributed significantly to the compilation of the geologic and tectonic framework map of the Venezuelan Guayana Shield included herein and were used to guide the delineation of geologic contacts and buried tectonic features. Reconnaissance geologic mapping was used wherever possible to confirm the geophysically derived contacts and to assign geologic names and descriptions to units defined by means of these regional data sets.

MINES, PROSPECTS, AND OCCURRENCES OF THE VENEZUELAN GUAYANA SHIELD

By G.J. Orris, Norman J Page, Karen Sue Bolm, Floyd Gray, William E. Brooks, Marguerite M. Carbonaro, *and* Richard Kibbe

More than 450 mines, prospects, and occurrences within the area underlain by the Venezuelan Guayana Shield were compiled for this report. These sites are shown on plate 5 and listed by map number in table 3. Some of these sites are given in earlier compilations including those by the Ministerio de Minas e Hidrocarburos (1958, 1959a, b), Bellizzia, Pimentel de Bellizia, and Rodríguez (1981), Rodríguez (1986), and Sidder (1990). Additional information was obtained from the literature or from field observations made during this project. Although the Venezuelan Guayana Shield is rich in a wide variety of mineral resources, identification and location of known mines and occurrences in the literature is uneven and incomplete. Gold, diamonds, iron, and bauxite are the major exploited resources of the study area and are better documented than other commodities. Even for these commodities, only a few major deposits are discussed with any detail, and maps are extremely rare. Other commodities reported in the Venezuelan Guayana Shield include manganese, kaolin, dolomite, dimension stone, tin, sand and gravel, barite, phosphate, minerals of the rare earth elements, titanium, molybdenum, uranium, thorium, and tungsten. Information on these commodities is erratic. Notably absent in the mining record are occurrences of primary deposits of nickel, platinum-group elements, and the base metals (copper, lead, and zinc).

Precise location of the known mines and occurrences, even at a map scale of 1:1,000,000, was the most difficult part of this compilation. Many sites were located solely using written descriptions. Other sites were located using sketch maps with inconsistent base information. Locations shown on plate 5 represent the best estimate of the position of the mine or occurrence given available information and relative to the mapped geology of plate 2 and named rivers, roads, and towns. A list of some of the mines and occurrences that have not yet been located is given at the end of table 3. The symbols for the deposits shown on plate 5 represent commodity and deposit type. At some locations two commodities are shown. Commodities for each numbered deposit shown on the map are given in table 3.

Of the compiled mineral sites, more than 200 are for gold. Native gold in quartz veins is reported at 125 sites (table 4), and placer workings are reported at more than 80 locations (table 5). At some sites both weathered vein and alluvial deposits are present. More than 70 of the vein gold mines and occurrences are in the El Callao and Lo Increíble districts; they represent only a third of the more than 230 gold-quartz veins reported to be present in these districts (Rodríguez, 1986). The vast majority of the vein-gold deposits and prospects can be classified as belonging to the low-sulfide gold-quartz vein deposit model (Cox and Singer, 1986). The placer operations mine alluvial deposits for the most part but locally may exploit residual gold from older terrace deposits or weathered veins.

More than 106 diamond mines and occurrences, most of which are alluvial, have been identified in the Venezuelan Shield (table 6). Fourteen iron-manganese deposits, more than thirty-five banded iron formation, seven sedimentary(?) manganese deposits (table 7), and more than forty bauxite occurrences (table 8) are known. An alphabetical listing of mines, prospects, and mineral occurrences in the shield, with reference to map number as shown on plate 5, is given in table 9.

The mineral occurrence data, as compiled for this report, have been entered into the U.S. Geological Survey's Mineral Resources Data System (MRDS). MRDS consists of computerized data for more than 92,000 mineral occurrences (as of December 1992) and deposits worldwide and the computer software necessary to access that data. During this project, MRDS was installed on personal computers belonging to Técnica Minera, C.A., a part of the Corporación Venezolana de Guayana, in Puerto Ordaz and Ciudad Bolívar. Inquiries about information stored in MRDS may be obtained from the regional MRDS representative at the U.S. Geological Survey, Minerals Information Office, Corbett Building, 340 North 6th Avenue, Tucson, Arizona 85705–8325, or at the U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, Virginia 22092.

For reference, a smaller scale map (pl. 6) was compiled using the MRDS database that shows the locations of mineral occurrences in northeastern South America; the unedited MRDS data for this area are given in the appendix.

Table 3. Mines, prospects, and mineral occurrences of the Venezuelan Guayana Shield.

[Prepared using the Mineral Resources Data System (MRDS); see text for explanation. Shown by map number on plate 5. States: AM, Territorio Federal Amazonas; BO, Estado Bolívar; DE, Estado Delta Amacuro]

Map No.	Site name	State	District or area	Commodity	Deposit type	Host rock	
						Age	Type
1	Cardona	AM		Diamond	Diamond placer		
2	Avispa	AM		Diamond	Diamond placer		
3	Guaibal-El Mango	AM		Diamond	Diamond placer, alluvial		
4	Solano	AM		Diamond	Diamond placer, alluvial		
5	Unnamed gold occurrence	AM	Alto Orinoco Sur	Gold	Unknown	Precambrian	Foliated basement-complex greenstone
6	Casiquiare	AM		Bauxite	Laterite, residual		Platform-cover rocks
7	Unnamed gold occurrence	AM	Alto Orinoco Garimpiero	Gold	Unknown, vein?	Precambrian	
8	Mavaca-Casuquare	AM		Diamond	Diamond placer		
9	Platanal II	AM		Bauxite	Laterite		Felsic rocks
10	Guaramoni	AM		Diamond	Diamond placer, alluvial		
11	Platanal I	AM		Bauxite	Laterite		Felsic rocks
12	Alto Orinoco	AM		Diamond	Diamond placer		
13	Tamatama	AM		Iron	Stratiform chemical sediments, banded iron formation	Precambrian	Felsic rocks
14	Cunucunuma	AM		Molybdenum	Vein or shear zone		Felsic rocks
15	Unnamed gold occurrence	AM	Upper Río Ocamo	Gold	Unknown	Precambrian	Volcanic rocks?
16	La Churuata uranium anomaly	AM		Uranium			Sandstone
17	Churuata	AM		U, Th, rare earth elements, Zr, Sn	Laterite	Precambrian	Sandstone
18	El Padamo	AM		Iron	Banded iron formation, laterite		Felsic rocks
19	Mina Nueva	BO		Gold	Vein	Proterozoic	Sandstone
20	Mina Plataneal	AM	Cerro Yapacana	Gold	Vein	Proterozoic	Quartzite
21	Unnamed gold occurrence	AM	Central Río Cunucunuma	Gold	Unknown	Precambrian	Granitic rocks
22	Unnamed gold occurrence	AM	Upper Río Cunucunuma	Gold	Unknown	Precambrian	Granitic rocks
23	Cerro Yapacana I	BO		Gold	Alluvial, vein		Quartzite
24	Caño Maraya	BO		Gold	Alluvial		Quartzite, metasedimentary rocks
25	Alto Paragua	BO		Tin		Precambrian	Rhyolitic tuff
26	Paramichi placers	BO		Diamond	Diamond placer, alluvial		Gravel
27	Merevari geochemical anomaly	BO		Gold, silver	Epithermal vein	Early Proterozoic	Rhyolite, andesite, tuff
28	Pumpiri	BO		Gold	Placer, alluvial		Alluvial sediments
29	Los Caribes placers	BO		Diamond	Diamond placer, alluvial		Gravel
30	Agua Colorada	BO		Diamond	Placer diamonds, alluvial	Proterozoic	Gravel, quartzite
31	Maijia placers	BO		Diamond	Diamond placer		Gravel
32	Icabarú placers	BO	Río Caroní	Gold, diamond	Placer, alluvial	Quaternary (Holocene?)	Quartz and sandstone pebbles, conglomerate
33	La Bandera placers	BO		Diamond, gold	Placer, alluvial		Gravel
34	Hacha placers	BO		Diamond, gold	Placer, alluvial	Cenozoic	Gravel
35	San Luis placers	BO		Diamond, gold	Placer, alluvial		Gravel

36	Uaiparu placers	BO		Diamond, gold	Placer, alluvial	Cenozoic	Gravel
37	Cinco Ranchos placers	BO		Diamond, gold	Placer		Gravel
38	Río Marevari	BO		Diamond	Diamond placer, alluvial		
39	Uonan placers	BO		Diamond, gold	Placer, alluvial	Cenozoic	Gravel
40	Paraitepuy placers	BO	Río Caroní	Diamond	Diamond placers	Quaternary (Holocene?)	Quartz gravel
41	El Infierno	BO		Diamond	Diamond placer, alluvial	Cenozoic	Alluvial sediments
42	La Hollada placers	BO		Diamond, gold	Placer, alluvial		Gravel
43	Río Merevari	BO		Diamond	Diamond placer, alluvial		
44	Divina Pastora	BO		Bauxite	Laterite, residual		
45	Santa Teresa	BO		Diamond	Diamond placer, alluvial		
46	El Polaco placers	BO	Río Caroní	Diamond, gold	Placer, alluvial	Cenozoic	Quartz gravel
47	Santa Elena de Uairén placers	BO		Diamond	Diamond placer, alluvial	Quaternary	Gravel
48	La Pena placer	BO		Diamond, gold	Placer, alluvial	Cenozoic	Gravel
49	C.O.D.S.A.	BO		Diamond	Alluvial, placer	Cenozoic	Sediments
50	La Faisca placer	BO		Diamond, gold	Placer, alluvial		Gravel
51	Chiricayen placer	BO		Gold, diamond	Placer, alluvial	Holocene	Gravel
52	El Paru	AM		Bauxite	Laterite, residual		
53	Río Aponguau placers	BO	Río Caroní	Diamond	Diamond placer, alluvial		Quartz gravel
54	Gran Sabana	BO		Diamond	Diamond placer, alluvial		
55	Aponguao	BO		Diamond	Diamond placer, alluvial		
56	Alto Kukenan	BO		Diamond	Diamond placer		
57	Gran Sabana	BO		Diamond	Alluvial, placer	Cenozoic	Gravel
58	Unnamed in Gran Sabana placers	BO		Diamond, gold	Placer, alluvial		Gravel
59	Conoroto placers	BO		Diamond, gold	Placer		Gravel
60	Flora Blanca placers	BO		Diamond	Diamond placer, alluvial	Cenozoic	Gravel
61	Alto Ventuari	AM		Diamond	Diamond placer, alluvial		
62	Yiguiripin placers	BO		Diamond	Placer, alluvial		Gravel
63	Alto Ventuari	BO		Diamond	Diamond placer, alluvial		
64	Pao	BO		Gold	Placer, alluvial		
65	La Paragua placers	BO		Diamond	Diamond placer, alluvial		Gravel
66	Gran Sabana	BO		Diamond	Alluvial		
67	Maria Varela	BO	La Sabanita	Diamond, gold	Alluvial, placer	Cenozoic	Gravel
68	Caruay	BO		Diamond	Diamond placer, alluvial		
69	Unnamed in Gran Sabana placers	BO		Diamond, gold	Placer, alluvial		Gravel
70	Arabopo	BO		Diamond	Diamond placer		
71	Alto Ventuari	BO		Diamond	Diamond placer		
72	Los Frijoles placers	BO		Diamond	Diamond placer, alluvial		Gravel
73	Aparuren	BO		Diamond	Diamond placer		
74	El Loco placers	BO		Diamond	Diamond placer, alluvial	Cenozoic	Gravel
75	Santa Elena de Uairén anomalous radioactivity	BO		Uranium, thorium	Unknown	Proterozoic (1.6 Ga)	Sandstone

Table 3. Mines, prospects, and mineral occurrences of the Venezuelan Guayana Shield—Continued.

Map No.	Site name	State	District or area	Commodity	Deposit type	Host rock	
						Age	Type
76	Río Antavari	BO		Diamond?	Alluvial		
77	Alto Aponguao	BO		Diamond	Diamond placer		
78	La Sabanita placers	BO		Diamond	Diamond placer, alluvial		Gravel
79	Unnamed in Gran Sabana placers	BO		Diamond, gold	Placer, alluvial		Gravel
80	Avequi placers	BO		Diamond	Diamond placer		Gravel
81	Guacharaquito	BO		Diamond	Diamond placer, alluvial		
82	Capaura placers	BO		Diamond	Diamond placer, alluvial	Cenozoic	Gravel
83	Uriman placers	BO	Río Caroní	Diamond	Placer, alluvial		Quartz gravel
84	Caura placers	BO		Diamond, gold	Diamond placer, alluvial		Gravel
85	Kamu placers	BO		Diamond, gold	Placer, alluvial		Gravel
86	Guacharaca	BO		Diamond	Alluvial		
87	Uraday	BO		Diamond	Placer, alluvial		
88	Parupa placers	BO	Río Caroní	Diamond, gold	Placer, alluvial		Quartz gravel
89	Kamarata	BO		Diamond, gold	Placer, alluvial	Cenozoic	Gravel
90	Gran Sabana	BO		Aluminum	Laterite, residual		
91	Maua	BO		Aluminum	Laterite		
92	Carapo	BO		Diamond	Alluvial, placer		
93	Kamoiran	BO		Bauxite	Laterite, residual	Cenozoic	Granite
94	Luepa	BO		Bauxite	Laterite		
95	Gran Sabana	BO		Bauxite	Laterite, residual		
96	Kavanayen	BO		Bauxite	Laterite, residual		
97	Gran Sabana	BO		Bauxite	Laterite, residual		
98	Río Chiguao placers	BO	Río Caroní	Diamond, gold	Placer, alluvial	Cenozoic	Quartz gravel
99	El Carmen	BO		Diamond	Alluvial, placer		
100	Guayaraca	BO		Diamond	Diamond placer, alluvial		
101	Cerro Impacto	BO		Nb, Th, rare earth elements, Ba, Fe, Mn, bauxite, Ce	Laterite, carbonatite	Precambrian or younger	Carbonatite
102	Larinal	BO		Diamond, gold	Placer, alluvial	Cenozoic	Gravel
103	Gallito	BO	San Salvador de Paúl	Diamond	Alluvial, placer	Holocene	Gravel
104	Barrialon placers	BO		Diamond, gold	Placer, alluvial	Cenozoic	Gravel
105	Bogarin mine	BO	San Salvador de Paúl	Diamond	Alluvial, placer	Holocene	Fluvial gravel
106	San Salvador de Paúl district	BO	San Salvador de Paúl	Diamond	Diamond placer, alluvial	Quaternary	Quartz and sandstone gravel
107	Serrania La Cerbutana	BO	Los Pijiguaos	Bauxite	Laterite, residual		
108	Cerro Arrendajo	BO		Gold	Vein	Proterozoic	Mafic flows, pillow lavas, not metamorphic
109	Unnamed diamond occurrence	BO	San Salvador de Paúl	Diamond	Alluvial, placer	Cenozoic	Gravel
110	Río Cuyuni-Río Uey	BO		Gold	Alluvial, veins		

111	San Juan	BO		Diamond	Diamond placer		
112	Río Suapure bauxite occurrence	BO	Los Pijiguaos	Bauxite	Laterite, residual		
113	Kilometro 88	BO		Bauxite	Laterite, residual		
114	Kilometro 88 kaolin deposits	BO	La Escalera	Kaolin	Residual kaolin	Cenozoic	Diorite, granite
115	Campo Grande	BO	Campo Grande	Diamond	Alluvial, placer	Quaternary	Gravel
116	El Pauji	BO		Gold	Lode		Schist
117	Manaima	BO		Gold	Placer, alluvial		
118	Salto Araguai	BO		Gold	Placer, alluvial		
119	Unnamed	BO	Venamo	Gold	Alluvial		
120	Guaicas	BO		Bauxite, iron, titanium	Laterite, residual	Cenozoic	Gabbro-diabase, metasedimentary rocks, late
121	Aguamena and Boquerons	BO		Sn, Nb, Ta, Ti, Zr, Fe, W	Placers	Cenozoic	Sediments
122	Leoncio	BO		Diamond	Diamond placer		
123	Cristina-Bizkaitarra	BO	Kilometro 88	Gold	Lode, vein		Schist
124	Kilometro 88-Las Claritas	BO		Gold	Lode, stockwork, placer	Proterozoic	Schist
125	Río Villacoa bauxite occurrence	BO	Los Pijiguaos	Bauxite	Laterite, residual		
126	Las Claritas de Uroy	BO	El Chivao	Gold	Quartz vein		Schist, metavolcanic
127	Río Suapure	BO		Diamond	Diamond placer, alluvial		
128	Unnamed	BO	El Chivao	Gold	Vein		
129	Serrania Parguaza	BO	Los Pijiguaos	Bauxite	Laterite, residual		
130	La Carabobo	BO		Gold	Placer, alluvial	Cenozoic	Alluvial sediments
131	Río Oris	BO		Diamond	Alluvial		
132	El Foco	BO		Gold	Vein		
133	Quebrada Cachanaca	BO		Gold	Alluvial, placer	Cenozoic	Alluvial sediments
134	Río Carrao placers	BO	Río Caroní	Diamond	Diamond placer, alluvial		Quartz gravel
135	Unnamed	BO	El Chivao	Gold	Alluvial		Sandstone, gravel, poorly consolidated
136	El Chivao placers	BO		Gold	Alluvial, weathered veins, residual		Tuffaceous metavolcanic rocks
137	Píston de Uroy	BO		Gold	Lode, vein, placer		Ultramafic; alluvial gravel
138	La Hoya	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
139	Campo Grande	BO		Diamond	Diamond placer		
140	Cepillito	BO	Quebrada Grande	Diamond	Placer, residual, alluvial	Cenozoic	Gravel, clay, laterite
141	El Toco	BO		Diamond	Placer diamond, alluvial, kimberlite	Cenozoic	Gravel and underlying weathered kimberlite
142	Matute	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
143	Uraima-Urutani	BO		Diamond	Placer, alluvial		
144	El Candado	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, laterite, clay
145	Cerbatana	BO	Guaniamo	Diamond	Kimberlite, gravel	Cenozoic-Proterozoic	Alluvial sediments, kimberlite
146	La Cuaimita	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
147	La Salvacíon	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, laterite, clay
148	Uraima-Urutani	BO		Diamond	Placer, alluvial		
149	Uraima-Urutani	BO		Diamond	Placer, alluvial		
150	La Cu-Ca	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, laterite, clay

Table 3. Mines, prospects, and mineral occurrences of the Venezuelan Guayana Shield—Continued.

Map No.	Site name	State	District or area	Commodity	Deposit type	Host rock	
						Age	Type
151	Tres Choques	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, laterite, clay
152	La Cuaima	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
153	Curao	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, laterite, clay
154	Río Caroní placers	BO	Río Caroní	Diamond	Diamond placers, alluvial		Quartz gravel
155	El Milagro	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
156	Serranía Los Pijiguaos	BO	Los Pijiguaos	Bauxite	Laterite, residual		
157	La Bicicleta	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
158	El Resbalon del Diablo	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, laterite, clay
159	Asa placers	BO	Río Caroní	Diamond	Diamond placers		Quartz gravel
160	Los Pijiguaos	BO		Bauxite, kaolin, gallium, germanium, titanium, iron	Laterite, residual	Cenozoic	Granite (two mica), laterite, clay,
161	El Caracolito	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
162	Quebrada Grande placers	BO	Guaniamo	Diamond	Placer, residual	Precambrian-Cenozoic	Gravel, clay, laterite; weathered kimberlite
163	El Casabe placers	BO	Río Caroní	Diamond, gold	Placer, alluvial	Cenozoic	Quartz gravel
164	El Caracol	BO	Quebrada Grande	Diamond	Placer, residual	Cenozoic	Gravel, clay, laterite
165	Río Nichare	BO		Titanium	Alluvial		
166	Caura	BO		Titanium, chromium, zirconium	Placer		
167	La Playita	BO	El Zulia Viejo-Verdun	Gold	Placer, alluvial		Gravel
168	Panamá	BO	El Zulia Viejo-Quebrada Verdun	Gold	Placer, alluvial		
169	Parapapoy	BO		Gold	Placer, alluvial	Cenozoic	Gravel
170	Dori	BO		Diamond	Alluvial		
171	Río Caroní (no. 18)	BO		Diamond	Alluvial		
172	Bocon placers	BO	Río Caroní	Diamond	Diamond placer, alluvial		Quartz gravel
173	Chicanan	BO	Upper Río Cuyuni	Diamond	Diamond placer		Gravel
174	Quebrada Mochila placer	BO		Gold	Placer, alluvial		
175	Unnamed bauxite occurrence	BO		Bauxite	Laterite, residual		
176	Aponwao	BO		Gold	Placer, alluvial		
177	La Estrella	BO		Gold	Vein or placer	Late Proterozoic-Cenozoic	Metavolcanic rock
178	La Lira	BO		Gold	Lode		
179	Corazon de Jesus	BO		Gold	Placer		
180	Paragua	BO		Diamond	Alluvial		
181	La Paragua	BO		Diamond	Alluvial		
182	Guariche	BO		Gold	Gold placer		Gravel
183	Unnamed gold occurrence	BO	Zulia Viejo-Quebrada Verdun	Gold	Alluvial, placer		
184	El Dorado	BO		Gold	Vein		
185	Guatuaima	BO		Gold	Alluvial, placer		Greenstone

186	La Camorra	BO		Gold	Lode, vein	Proterozoic	Greenschist, metatuff
187	Triunfo	BO		Gold			
188	Unnamed gold occurrence	BO	Zulia Viejo-Quebrada Verdun	Gold	Alluvial		
189	Anacoco placers	BO		Gold	Alluvial, placer		Alluvial sediments
190	El Placer	BO		Gold	Lode		
191	Canaima	BO		Gold	Vein	Proterozoic	Chloritized fragmented tuff
192	Payapal	BO		Gold	Quartz vein, alluvial, placer	Proterozoic	Mica schist, metagabbro in fault
193	San Miguel	BO		Gold	Vein	Proterozoic	
194	Veri	BO		Diamond	Alluvial		
195	Aza	BO		Diamond	Diamond placer, alluvial		
196	Macapa	BO		Gold, diamond	Placer, alluvial		
197	Unnamed gold occurrence	BO	Zulia Viejo-Quebrada Verdun	Gold	Alluvial		
198	El Carmon	BO	Roscio	Gold	Vein		
199	Rancho Verde	BO		Gold			
200	La Libertad	BO	Río Caroní	Diamond	Alluvial, placer	Cenozoic	Sediments
201	San Rafael	BO		Gold	Placer, vein, alluvial		
202	Yuruan	BO		Gold	Placer, alluvial	Cenozoic	Alluvial sediments
203	Unnamed gold occurrence	BO	Zulia Viejo-Quebrada Verdun	Gold	Alluvial		
204	Sua-Sua	BO		Gold	Lode	Proterozoic	
205	Sesina	BO		Gold	Alluvial, placer	Cenozoic?	Alluvial sediments
206	San Pedro de las Bocas placers	BO	Río Caroní	Diamond	Diamond placer, alluvial		Quartz gravel
207	Guaniamo district	BO	Guaniamo	Diamond	Diamond placer, diamond pipes		Gravel, kimberlite
208	Marwani-Los Caribes	BO		Gold	Lode		Mafic to felsic volcanic and volcaniclastic rocks
209	Carmen Rosa	BO		Gold	Placer, vein, alluvial		Alluvial sediments
210	Agua Negra	BO		Diamond, gold	Placer, alluvial		
211	Botanamo	BO	Tumeremo region; Botanamo	Gold, tungsten	Lode, vein	Early Proterozoic	Sericitic schist, chloritic schist
212	El Pao de La Fortuna placers	BO	Lower Río Caroní	Diamond	Diamond placer, alluvial	Cenozoic	Quartz gravel
213	Nuevo Callao	BO		Gold	Vein	Proterozoic	
214	Las Flores	BO		Gold, copper	Veins		
215	San Antonio	BO		Gold	Lode, vein	Proterozoic	Gneissoid granite, greenschist
216	Río Marwani	BO		Gold	Placer, alluvial		
217	Aveclica	BO		Gold	Alluvial		
218	Marhuanta	BO		Rare earth elements	Disseminated stratabound		
219	La Rosa	BO		Gold, copper	Vein, placer	Proterozoic	Metavolcanic and metasedimentary rocks
220	Vuelvan Caras	BO	Tumeremo region	Gold, copper	Lode	Precambrian	Metavolcanic and metasedimentary rocks

Table 3. Mines, prospects, and mineral occurrences of the Venezuelan Guayana Shield—Continued.

Map No.	Site name	State	District or area	Commodity	Deposit type	Host rock Age	Host rock Type
221	Marwani IV	BO		Gold	Lode		Weathered quartz-mica schist-phyllite
222	Mercedes	BO		Gold			
223	El Trueno	BO	San Isidro Iron Quadrilateral	Iron	Laterite, banded iron formation	Archean	Quartzite
224	La Estrella	BO		Gold	Lode, vein, placer	Precambrian	Flow rocks and metavolcanic rocks
225	Vuelvan Caras placers	BO		Gold	Placer, alluvial		
226	Marwani I	BO		Gold	Lode, vein		Mafic to felsic volcanic and volcaniclastic rocks
227	Cerro Etuna	BO		Iron	Banded iron formation	Archean	
228	Purgatorío	BO	Tumeremo region	Gold, copper	Vein	Proterozoic	Metavolcanic and metasedimentary rocks
229	Buena Esperanza placer	BO		Diamond (?)	Alluvial, placer		Alluvial sediments
230	La Reforma	BO	Tumeremo region	Gold	Vein	Proterozoic	Meta-andesite?
231	Río Aro	BO		Diamond	Diamond placer, alluvial		
232	Las Grullas	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Gneiss and granulite
233	Concordia	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
234	Mejico	BO	El Callao	Gold	Vein		
235	El Choco	BO	El Callao	Gold, tungsten, manganese	Vein	Proterozoic	Metavolcanic rocks
236	El Pagon placer	BO		Diamond (?)	Alluvial, placer	Cenozoic	Alluvial sediments
237	Potosi	BO	El Callao	Gold	Lode, veins	Proterozoic	Metavolcanic rocks
238	Nacupal	BO		Gold	Vein	Proterozoic	
239	Placoa	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Metavolcanic and metavolcaniclastic rocks
240	Los Barrancos I and II	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Quartzite
241	Las Pailas	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Quartzite
242	Cenicero	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
243	Eureka	BO	El Callao	Gold	Vein	Proterozoic	Metavolcanic rocks
244	Chile	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
245	Sosa Mendez-Union mine	BO	El Peru zone, El Callao	Gold, tungsten	Lode, shear zone, vein	Proterozoic	Metabasalt, meta-andesite
246	Mocupia	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
247	Peru	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
248	Ropeway and Refugio	BO	El Callao	Gold	Vein	Proterozoic	Metavolcanic rocks
249	San Felipe	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
250	Paviche	BO		Gold, diamond	Alluvial		

251	Cerro La Estrella	BO	Cerro Bolívar	Iron	Banded iron formation	Archean	Quartzite and gneiss
252	Laguna mine-Santa Rita	BO	El Callao	Gold, tungsten	Vein, eluvial	Precambrian	Meta-andesite, silicified schist
253	Mina Colombia	BO	El Callao	Gold, arsenic	Lode, vein	Proterozoic	Metabasalt and metavolcaniclastic rocks
254	Mina C	BO	Lo Increíble	Gold	Vein		
255	Río Aro	BO		Bauxite	Laterite	Cenozoic	
256	Lo Increíble district	BO	Lo Increíble	Gold	Veins	Proterozoic	Sheared quartz-mica schist
257	Iguana	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
258	Santa Barbara	BO		Iron	Banded iron formation	Archean	
259	El Callao district	BO	El Callao	Au, W, Cu, Zn, Cd, Hg, B, Ti, Pb, As	Vein/shear, placer	Early Proterozoic	Greenstone belt rocks, meta-andesite
260	Remington	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
261	Viejo Callao	BO	El Callao	Gold	Lode, vein	Proterozoic	Metavolcanic and metavolcaniclastic rocks
262	Ciudad Piar	BO		Diamond			
263	La Culebra	BO	El Callao	Gold	Vein	Proterozoic	
264	Cerro Las Adjuntas, Punta del Cerro	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Metavolcanic and metavolcaniclastic rocks
265	Real Corona	BO		Iron	Banded iron formation, laterite, residual	Archean	Quartzite
266	Experiencia	BO	Lo Increíble	Gold	Vein	Proterozoic	Metabasalt
267	Sofia	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
268	San Isidro	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Quartzite
269	Talismán Cova	BO	Lo Increíble	Gold	Vein	Proterozoic	Metavolcanic rocks
270	Talismán	BO	Lo Increíble	Gold	Lode, stockwork	Proterozoic	Greenschist, argillaceous schist
271	Mina Zenovia	BO	Lo Increíble	Gold	Vein	Proterozoic	Metalava
274	El Roble	BO	Lo Increíble	Gold	Vein	Proterozoic	Metavolcanic rocks, argillaceous schist
273	Pierina	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
272	La Cubanita	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
275	Union–1	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
276	La Armónica	BO	Lo Increíble	Gold	Vein	Proterozoic	Arenaceous schist
277	Te Esperaba	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
278	Macondo	BO	Lo Increíble	Gold	Vein, veinlets	Proterozoic	Greenschist facies rocks
279	Lo Increíble	BO	Lo Increíble	Gold	Lode, vein	Proterozoic	Greenschist (?)
280	Mina Calí	BO	Lo Increíble	Gold	Vein, veinlets	Proterozoic	Greenschist, argillaceous schist
281	Malave	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
283	Mi Venezuela	BO	Lo Increíble	Gold	Vein	Proterozoic	Metavolcanic rocks
282	El Valle	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
284	La Lapa–1	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
285	Las Tres Rosas–2	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist

Table 3. Mines, prospects, and mineral occurrences of the Venezuelan Guayana Shield—Continued.

Map No.	Site name	State	District or area	Commodity	Deposit type	Host rock	
						Age	Type
286	El Crucero	BO		Gold	Quartz vein	Late Proterozoic	Metabasalt, andesite
287	La Loca	BO	Lo Increíble	Gold	Vein	Proterozoic	Basalt
288	Mina Sonia	BO	Lo Increíble	Gold	Vein	Proterozoic	Metalava, schist
289	Yi Yi	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
290	La	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
291	Santa Inés	BO	Lo Increíble	Gold, zinc	Vein, veinlets	Proterozoic	Greenschist, argillaceous schist
292	Mina Corozo	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
293	Santa Barbara	BO	Lo Increíble	Gold	Vein	Proterozoic	
294	La Divina Pastora	BO	Lo Increíble	Gold	Vein	Proterozoic	Metavolcanic rocks
295	Mina Ortega	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
296	Las Morochas	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
297	La Foraleza	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
298	Union–2	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
299	Mina A	BO	Lo Increíble	Gold	Vein, alluvial	Proterozoic	Metavolcanic rocks, mainly felsic
300	La Lapa	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
301	La Plata	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
302	La Espanoa	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
303	La Foresta	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
304	Santa Ana	BO	Lo Increíble	Gold	Veins, stockwork	Proterozoic	Greenschist, argillaceous schist
305	San Isidro Iron Quadrilateral	BO	Imataca iron belt	Iron	Banded iron formation	Archean	Gneiss and amphibolite
306	San Joaquin	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Quartzite
307	El Grito	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
308	Santa Elena	BO	Lo Increíble	Gold	Vein	Proterozoic	Schist
309	Amparo	BO	Lo Increíble	Gold	Vein	Proterozoic	
310	Margarita	BO	Tumeremo region	Gold	Vein	Proterozoic	Metavolcanic rocks
311	Florinda	BO		Gold	Vein?		
312	Cerro La Pinto mine	BO		Gold, platinum-group elements	Vein		Metavolcanic greenstone, metasedimentary rocks
313	El Carmen	BO	Lo Increíble	Gold	Lode, vein	Proterozoic	Schist?
314	Cerro San Cristobal district	BO	Cerro San Cristobal	Manganese, iron, copper, lead, zinc	Laterite, residual	Precambrian-Cenozoic	Quartzite, phyllite, schist, siltstone
315	Cerro Bolívar	BO	Cerro Bolívar	Iron	Banded iron formation	Archean	Quartzite
316	Cerro Frontera	BO	Cerro Bolívar	Iron	Banded iron formation	Archean-Cenozoic	Quartzite, banded iron formation
317	El Grillero	BO		Gold			
318	El Manteco	BO		Gold			
319	Salva Le Peine	BO		Gold	Vein	Proterozoic	
320	Hueco Rico	BO	La Mina (La Esmeralda)	Gold	Vein, alluvial, placer		Porphyritic volcanic greenschist

321	Cerro Altamira	BO	Cerro Bolívar	Iron	Banded iron formation	Archean	Metavolcanic and metavolcaniclastic rocks
322	La Estrella	BO		Iron	Banded iron formation	Archean	Quartzite
323	Río Los Dos Pozos	BO		Diamond	Alluvial		
324	Cerro Redondo	BO	Cerro Bolívar	Iron	Banded iron formation	Archean	Quartzite and gneiss
325	La Esperanza	BO	Tumeremo region, Bochinche	Gold	Vein	Proterozoic	Metavolcanic rocks
326	Terecay	BO		Iron	Banded iron formation	Archean	Granulite facies rocks
327	Altamira 2	BO	Cerro Bolívar	Iron, gold	Banded iron formation	Archean	Metavolcanic and metavolcaniclastic rocks
328	Guasipati-La Pastora area phosphate	BO		Phosphrous	Residual weathering		Metasedimentary rocks?
329	Las Chichorras	BO	Tumeremo region	Gold	Vein	Proterozoic	Meta-andesite?
330	Sipao	BO		Gold, diamond	Placer, alluvial		
331	Cicapra zone	BO	Cicapara	Gold	Lode, placer	Precambrian	Schist
332	Cerro de La Esperanza	BO		Manganese, iron	Laterite, residual	Early Proterozoic-Cenozoic	Greenstone, quartzite
333	El Tigre	BO		Gold	Vein, placer	Proterozoic	
334	Bochinche	BO		Gold	Lode, placer	Early Proterozoic	Metatuff, volcaniclastic rocks
335	Placers of Bochinche	BO		Gold	Placer, alluvial		Mafic metavolcanic rocks
336	Mandingal	BO		Gold	Lode, vein	Early Proterozoic	Porphyritic granite
337	Quebrada de Oro	BO		Gold	Vein	Proterozoic	
338	Caicara	BO		Diamond	Alluvial		
339	Cerro Azul Valley placers	BO		Gold, silver, copper	Placer, alluvial	Cenozoic	Alluvial sediments
340	Cerro Toribio	BO	Cerro Bolívar	Iron	Banded iron formation	Archean	Quartzite, gneiss
341	Las Nieves	BO		Bauxite	Residual laterite		
342	Quartz mine	BO		Quartz	Unknown		
343	Cerro del Hormiguero	BO	Nuria	Bauxite	Laterite, residual		
344	El Tesoro	BO		Gold	Quartz vein		
345	Nuria Plateau	BO	Nuria	Bauxite	Laterite	Cenozoic	Gabbroid rocks
346	San Felipe	BO		Gold	Vein	Proterozoic	
347	Bochi	BO		Gold	Vein	Proterozoic	
348	Cerro Arimagua	BO		Iron	Banded iron formation	Archean	Quartzite
349	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial
350	Guacuripia area dolomite deposits	BO		Dolomite	Sedimentary	Precambrian	Dolomite
351	La Introduccion	BO		Gold	Vein, placer	Proterozoic-Cenozoic	
352	La Cayena	BO		Gold	Placer, alluvial		Alluvial sediments
353	Stone quarry	BO		Stone		Proterozoic	Gneiss
354	Río Suruma	BO		Gold	Placer, alluvial		
355	Corre Gente	BO		Gold	Placer, alluvial	Cenozoic	Alluvial sediments
356	Sand quarry	BO		Sand and gravel	Alluvial		Alluvial sediments
357	Maria Luisa	BO	San Isidro Iron Quadrilateral	Iron	Banded iron formation	Archean	Imataca D Formation
358	La Salvación	BO		Gold	Vein	Proterozoic	
359	La Salvacíon	BO		Gold	Placer, alluvial		Alluvial sediments
360	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments

Table 3. Mines, prospects, and mineral occurrences of the Venezuelan Guayana Shield—Continued.

Map No.	Site name	State	District or area	Commodity	Deposit type	Host rock Age	Host rock Type
361	Las Pavas	BO		Gold	Placer, alluvial		
362	Las Pavas	BO		Manganese			
363	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
364	El Merey placers	BO	Lower Río Caroní	Diamond	Diamond placers, alluvial	Cenozoic	Quartz gravel
365	Polvo De Oro	DE		Gold	Placer, alluvial		
366	Moitaco	BO		Bauxite			
367	Las Nieves	BO		Gold	Vein	Proterozoic	
368	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
369	Construction sand quarry	BO		Sand and gravel	Alluvial sediments		
370	El Manteco	BO		Manganese	Sedimentary		
371	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
372	La Horqueta	BO		Manganese	Sedimentary		
373	Sand quarry	BO		Sand and gravel	Alluvial		Alluvial sediments
374	Santa Rita	BO	Río Caroní	Kaolin	Residual kaolin	Cenozoic	Feldspathic gneiss
375	Construction sand quarry	BO		Sand and gravel	Alluvial		Alluvial sediments
376	Las Margaritas	BO	Río Caroní	Kaolin	Residual kaolin	Precambrian-Cenozoic	Feldspathic gneiss
377	Santa Maria deposit	BO		Manganese, iron	Residual?	Precambrian-Cenozoic	Gneiss, schist, quartzite, dolomite
378	Guacuripia	BO	Guacuripia	Manganese	Laterite, residual	Precambrian-Cenozoic	Quartzite, dolomite marble
379	San Lorenzo	BO		Manganese, iron	Residual?	Precambrian-Cenozoic	Gneiss, quartzite
380	Mundo Nuevo	BO	Río Caroní	Kaolin	Residual kaolin	Precambrian-Cenozoic	Feldspathic gneiss
381	Sand quarry	BO		Sand and gravel	Alluvial		Alluvial sediments
382	San Lorenzo	BO	Upata	Kaolin	Residual	Precambrian-Cenozoic	Gneiss; bauxite
383	Santa Rosa	BO		Iron, manganese		Archean	Schist, gneiss, quartzite
384	Monte Bello	BO		Iron		Archean	
385	Cerro Santa Rosa	BO	Upata	Kaolin	Residual	Precambrian-Cenozoic	Gneiss, bauxite
386	Cerro Monte Visto	BO		Iron	Banded iron formation	Archean	Quartzite (itabirite)
387	Sand quarry	BO		Sand and gravel	Alluvial		Alluvial sediments
388	Cerro Copeyal	BO	Upata	Kaolin	Residual	Precambrian-Cenozoic	Felsic granulitic gneiss, migmatite
389	El Manganeso	BO		Manganese		Precambrian	
390	Río Claro placers	BO	Lower Río Caroní	Diamond	Diamond placer, alluvial		Quartz gravel
391	El Pao	BO	Imataca iron belt	Iron, manganese	Banded iron formation	Archean	Ferruginous quartzite
392	El Chorro	BO	Upata	Bauxite	Laterite, residual	Cenozoic	Ferruginous quartzite
393	Copeyal	BO	Upata	Bauxite, kaolin	Laterite, residual	Cenozoic	Ferruginous quartzite
394	Los Guamos	BO	Upata	Bauxite	Laterite, residual	Cenozoic	
395	Cerro Once	BO	Upata	Bauxite, iron	Laterite, residual	Cenozoic	
396	Mesa de La Carata	BO	Upata	Bauxite	Laterite	Cenozoic	
397	El Baúl	BO	Upata	Bauxite	Laterite, residual	Cenozoic	
398	Cerro Gutierrez	BO	El Pao	Iron	Banded iron formation	Archean	Gneiss and granulite
399	Pila Blanca	BO		Diamond	Alluvial		
400	Playa Blanca placers	BO	Río Caroní	Diamond	Diamond placer		Quartz gravel

401	Dolomite quarry	BO		Dolomite	Metamorphic (?)	Proterozoic	Dolomite
402	Kaolin quarry	BO		Kaolin	Residual	Cenozoic	High-grade metamorphic rocks
403	Upata district	BO	Upata	Bauxite	Laterite	Cenozoic	Ferruginous quartzite, gneiss
404	Upata bauxite	BO		Aluminum, manganese	Laterite		
405	Ancho Caroní	BO		Diamond	Alluvial		
406	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
407	Ganges I	BO		Manganese, iron	Residual?	Precambrian-Cenozoic	Schist, gneiss, dolomite, marble
408	Ganges II	BO		Manganese, iron	Residual?	Precambrian-Cenozoic	Schist, quartzite, gneiss, dolomite
409	Ganges III	BO		Manganese, iron	Residual?	Precambrian-Cenozoic	Schist
410	Dimension stone quarry	BO		Dimension stone	Dimension stone, metamorphic	Proterozoic	Gneiss
411	Cerro Pando	BO		Manganese, iron	Residual?	Precambrian-Cenozoic	Gneiss, schist, quartzite, dolomite
412	Cerro Abanico	BO	Upata	Manganese	Residual?	Precambrian-Cenozoic	Gneiss, quartzite, dolomite
413	Delta	DE		Aluminum	Laterite, residual		Gabbroid rocks
414	Gavilan	BO		Bauxite	Residual		
415	Monte Romero	BO		Iron	Banded iron formation	Archean	
416	Cuyubini	DE		Iron	Banded iron formation	Archean	
417	Las Delicias	BO	Upata	Manganese, iron	Residual	Precambrian-Cenozoic	Gneiss, quartzite, dolomite
418	El Palmar	BO		Manganese, iron, aluminum	Residual?	Precambrian-Cenozoic	Schist and kaolinized gneiss
419	Río Acure	DE		Bauxite, clay	Sedimentary (?), alluvial, secondary		
420	Caruachi placers	BO	Río Caroní	Diamond	Diamond placers		Quartz gravel
421	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
422	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
423	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
424	Morocota	BO		Iron, manganese	Sedimentary iron-manganese	Precambrian	
425	Unnamed placer workings	BO		Gold	Alluvial, placer	Cenozoic	Alluvial sediments
426	Wausa	DE		Gold, bauxite	Alluvial, residual, laterite		
427	Polvo de Oro	DE		Iron	Laterite, banded iron formation	Archean-Cenozoic	
428	La Linea	DE		Iron	Banded iron formation	Archean	
429	Sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
430	San Felix placers	BO	Lower Río Caroní	Diamond	Diamond placers, alluvial		Quartz gravel
431	San Juan de Amacuro	DE		Iron	Banded iron formation	Archean	
432	Kaolin quarry	BO		Kaolin	Sedimentary	Cenozoic	Alluvial sediments
433	Manoa	DE	El Pao	Iron	Bedded, banded iron formation	Archean	Quartzite
434	Construction sand quarry	BO		Sand and gravel	Alluvial	Cenozoic	Alluvial sediments
435	Amacuro Delta region aluminum	DE		Bauxite	Laterite bauxite, residual		
436	Río Aroi	DE		Bauxite	Laterite, residual		
437	Santa Catalina	DE		Iron	Banded iron formation	Archean	
438	Imperial mine	DE	El Pao	Iron	Banded iron formation	Archean	Quartzite
439	Piacoa	DE		Iron	Banded iron formation	Archean	Granitic gneiss and granulite
440	Morocota	DE		Iron	Banded iron formation	Archean	

Table 3. Mines, prospects, and mineral occurrences of the Venezuelan Guayana Shield—Continued.

Map No.	Site name	State	District or area	Commodity	Deposit type	Host rock	
						Age	Type
441	Sacupana	DE		Iron	Banded iron formation	Archean	
442	Corocoro	BO		Gold	Alluvial, placer	Cenozoic	
	Apollo 8	BO	Lo Increíble	Gold	Vein, stockwork	Proterozoic	Greenschist
	Caño Aquamena	BO		Tin, niobium, tantalum			
	Cerro Toro	BO	Upata	Kaolin	Residual	Archean	Gneiss
	Colombia	BO	El Callao	Gold	Vein	Proterozoic	Metabasalt
	El Leon	BO	El Callao	Gold	Vein		
	Guaniamo I	BO		Gold, diamond	Placer		
	La Grulla	BO		Bauxite	Laterite, residual		
	La Patricia	BO		Gold	Vein	Proterozoic	
	Las Piñas	BO		Bauxite	Laterite, residual		
	Mina B	BO	Lo Increíble	Gold	Vein	Proterozoic	Greenschist
	Mina Ordaz	BO	Lo Increíble	Gold	Vein	Proterozoic	Greenschist
	Miribisi-Manarevaca	BO		Gold	Placer		
	Monte Cristo	BO	Upata	Kaolin	Residual	Archean	Gneiss
	Peña	BO	Lo Increíble	Gold	Vein, stockwork	Proterozoic	Greenschist
	Placo	BO		Iron, manganese	Banded iron formation	Archean	
	Salva La Patria	BO					
	Salvador	BO	Lo Increíble	Gold	Vein, stockwork	Proterozoic	Greenschist
	San Antonio	BO		Rare earth elements	Sedimentary		
	San Rafael	BO	Río Caroní	Kaolin	Residual	Archean	Gneiss
	Santeli	BO					
	Sierra El Lindero	BO		Manganese			
	Troya	BO	Lo Increíble	Gold	Vein	Proterozoic	Greenschist
	Unnamed gold vein	BO		Gold	Vein		

Table 4. Known low-sulfide gold-quartz vein deposits of the Venezuelan Guayana Shield.
[Shown by map number on plate 5; leader (–) indicates site is not shown on map. Y indicates production; N indicates no production; U indicates production status undetermined. Reserves are shown where known]

Site name	Map No.	Production	Reserves
Amparo	309	U	
Apollo 8	–	Y	
Bochi	347	U	
Bochinche	334	N	
Botanamo	211	136,665 t, 32.7 g/t Au (to 1968)	2,000 t, 12 g/t Au (1986)
Canaima	191	Y	
Cenicero	242	1,324 t, 14.46 g/t Au (to 1968)	
Cerro Arrendajo	108	Y	
Cerro La Pinto mine	312	N	
Chile	244	Y	
Cicapra zone	331	Y	
Colombia	–	U	
Concordia	233	Y	
Cristina-Bizkaitarra	123	Y	
El Callao district	259	123,962 kg Au (1829–1980)	
El Carmen	313	84.815 kg Au (to 1968)	
El Carmon	198	U	
El Choco	235	Y	
El Crucero	286	U	
El Dorado	184	Y	
El Foco	132	Y	
El Grito	307	Y	
El Leon	–	200 t, 13.0 g/t Au (1968)	
El Pauji	116	Y	
El Placer	190	1,165 t, 16.7 g/t Au (to 1968)	
El Roble	274	Y	
El Tesoro	344	N	
El Tigre	333	Y	
El Valle	282	Y	
Eureka	243	2,289 t, 8.5 g/t Au (to 1968)	
Experiencia	266	53,278 t, 10.6 g/t Au (to 1968)	
Florinda	311	U	
Hueco Rico	320	U	
Iguana	257	12,452 t, 8.6 g/t Au (to 1968)	
Kilometro 88-Las Claritas	124	Y	
La	290	Y	
La Armónica	276	Y	
La Camorra	186	4,218 t, 19.7 g/t Au (to 1968)	887,000 t, 19.06 g/t Au (1990)
La Cubanita	272	Y	
La Culebra	263	27,915 t, 10.2 g/t Au (to 1968)	
La Divina Pastora	294	Y	
La Espanoa	302	Y	
La Esperanza	325	Y	
La Estrella	177	U	
La Estrella	224	Y	
La Foraleza	297	Y	
La Foresta	303	Y	
La Introduccion	351	Y	
La Lapa	300	Y	
La Lapa–1	284	Y	
La Lira	178	52 t, 20 g/t Au (to 1968)	
La Loca	287	Y	
La Patricia	–	U	
La Plata	301	Y	
La Reforma	230	Y	
La Rosa	219	Y	

Table 4. Known low-sulfide gold-quartz vein deposits of the Venezuelan Guayana Shield—Continued.

Site name	Map No.	Production	Reserves
La Salvación	358	U	
Laguna mine-Santa Rita	252	1,385,220 t, 16.8 g/t Au (1989–1971)	
Las Chichorras	329	Y	
Las Claritas de Uroy	126	N	
Las Morochas	296	Y	
Las Nieves	367	663 t, 7.2 g/t Au (to 1968)	
Las Tres Rosas–2	285	Y	
Lo Increíble	279	Y	
Lo Increíble district	256	100,364 t, 13.2 g/t Au (to 1968)	
Macondo	278	Y	
Malave	281	Y	
Mandingal	336	Y	
Margarita	310	Y	
Marwani-Los Caribes	208	N	
Marwani I	226	N	
Marwani IV	221	Y	
Mejico	234	Y	
Mi Venezuela	283	Y	
Mina A	299	4,200 t, 80 g/t Au (1989)	
Mina B	–	Y	
Mina C	254	Y	
Mina Calí	280	Y	
Mina Colombia	253	429,442 t, 11.28 g/t Au (to 1968)	1,550,000 t, 9.2 g/t Au (1988)
Mina Corozo	292	Y	
Mina Morocha-Fortaleza	–	U	
Mina Nueva	19	Y	
Mina Ordaz	–	Y	
Mina Ortega	295	Y	
Mina Plataneal	20	Y	
Mina Sonia	288	Y	
Mina Zenovia	271	Y	
Mocupia	246	314,869 t, 16.5 g/t Au (1928–1946)	4,600,000 t, 1.35 g/t Au (1990)
Nacupal	238	Y	
Nuevo Callao	213	Y	
Payapal	192	Y	
Peña	–	Y	
Peru	247	20,568 t, 22.96 g/t Au (to 1968)	4,500,000 t, 4 g/t Au (1985)
Pierina	273	Y	
Píston de Uroy	137	N	
Potosi	237	23,898 t, 20.5 g/t Au (to 1968)	
Purgatorio	228	Y	
Quebrada de Oro	337	Y	
Remington	260	50,965 t, 17.7 g/t Au (to 1968)	
Río Cuyuni-Río Uey	110	Y	
Ropeway and Refugio	248	3,013 t, 10.4 g/t Au (to 1968)	
Salva le Peine	319	Y	
Salvador	–	Y	
San Antonio	215	5,262 t, 12.2 g/t Au (1866–1968	
San Felipe	249	30,752 t, 13.3 g/t Au (to 1968)	
San Felipe	346	Y	
San Miguel	193	120 t, 10.5 g/t Au (to 1968)	
Santa Ana	304	Y	
Santa Barbara	293	Y	
Santa Elena	308	Y	
Santa Inés	291	Y	
Sofia	267	Y	

Table 4. Known low-sulfide gold-quartz vein deposits of the Venezuelan Guayana Shield—Continued.

Site name	Map No.	Production	Reserves
Sosa Mendez-Union mine	245	27,650 t 7.0 g/t Au (to 1968)	2,000,000 t, 12 g/t Au (1969)
Sua-Sua	204	Y	
Talismán	270	1,745 t, 11.4 g/t Au (to 1968)	
Talismán Cova	269	Y	
Te Esperaba	277	Y	
Troya	–	15 t, 7.8 g/t Au (to 1968)	
Union–1	275	Y	
Union–2	298	Y	
Unnamed	128	Y	
Unnamed gold vein	–	U	
Viejo Callao	261	761,272 t, 68 g/t Au (to 1968)	
Vuelvan Caras	220	802,533 kg Au (to 1968)	
Yi Yi	289	Y	

Table 5. Known placer gold deposits of the Venezuelan Guayana Shield.
[Shown by map number on plate 5; leader (–) indicates site is not shown on map. Y indicates production; N indicates no production; U indicates production status undetermined. Where production value is given it is to 1968]

Site name	Map No.	Production	Site name	Map No.	Production
Agua Negra	210	Y	La Salvacíon	359	Y
Anacoco placers	189	Y	Larinal	102	Y
Aponwao	176	Y	Las Pavas	361	U
Avechica	217	Y	Macapa	196	Y
Barrialon placers	104	Y	Manaima	117	U
Bochinche	334	N	Maria Varela	67	Y
Caño Maraya	24	Y	Mina A	299	Y
Carmen Rosa	209	1,666 t, 19 g/t Au	Miribisi-Manarevaca	–	U
Cerro Azul Valley placers[1]	339	N	Panamá	168	U
Cerro Yapacana I	23	N	Pao	64	Y
Chiricayen placer	51	Y	Parapapoy	169	238.7 kg
Cicapra zone	331	Y	Parupa placers	88	Y
Cinco Ranchos placers	37	Y	Paviche	250	Y
Corazon de Jesus	179	U	Placers of Bochinche	335	Y
Corocoro	442	3,310 kg	Polvo de Oro	365	Y
Corre Gente	355	U	Pumpiri	28	Y
El Callao district	259	Y	Quebrada Cachanaca	133	Y
El Casabe placers	163	Y	Quebrada Mochila placer	174	Y
El Chivao placers	136	Y	Río Chiguao placers	98	Y
El Polaco placers	46	Y	Río Cuyuni-Río Uey	110	Y
El Tigre	333	Y	Río Marwani	216	Y
Guaniamo I	–	Y	Río Suruma	354	Y
Guariche	182	Y	Salto Araguai	118	Y
Guatuaima	185	N	San Luis placers	35	Y
Hacha placers	34	Y	San Rafael	201	Y
Hueco Rico	320	Y	Sesina	205	Y
Icabarú placers	32	Y	Sipao	330	N
Kamarata	89	Y	Unidentified placer workings	425	Y
Kamu placers	85	Y	Unnamed	119	Y
La Bandera placers	33	Y	Unnamed	135	Y
La Carabobo	130	2,041 kg	Unnamed gold occurrence	183	Y
La Cayena	352	Y	Unnamed gold occurrence	188	Y
La Estrella	177	U	Unnamed gold occurrence	197	Y
La Estrella	224	Y	Unnamed gold occurrence	203	N
La Faisca placer	50	Y	Unnamed in Gran Sabana placers	58	Y
La Hollada placers	42	Y	Unnamed in Gran Sabana placers	69	Y
La Introduccion	351	Y	Unnamed in Gran Sabana placers	79	Y
La Pena placer	48	Y	Vuelvan Caras placers	225	Y
La Playita	167	Y	Wausa	426	U
La Rosa	219	Y	Yuruán	202	Y

[1]Reserves 4,800,000 m^3, 0.14 g/m^3 (1970).

Table 6. Known diamond deposits of the Venezuelan Guayana Shield.
[Shown by map number on plate 5. Y indicates production; N indicates no production; U indicates production status undetermined]

Site name	Map No.	Production	Site name	Map No.	Production
Agua Colorada	30	Y	Guayaraca	100	Y
Alto Aponguao	77	U	La Bicicleta	157	Y
Alto Kukenan	56	U	La Cu-Ca	150	Y
Alto Orinoco	12	U	La Cuaima	152	Y
Alto Ventuari	61	U	La Cuaimita	146	Y
Alto Ventuari	63	U	La Hoya	138	Y
Alto Ventuari	71	U	La Libertad	200	Y
Ancho Caroní	405	Y	La Paragua	181	Y
Aparuren	73	U	La Paragua placers	65	25,590 carats (1975–1980)
Aponguao	55	U	La Sabanita placers	78	Y
Arabopo	70	U	La Salvacíon	147	Y
Asa placers	159	Y	Leoncio	122	Y
Avequi placers	80	Y	Los Caribes placers	29	Y
Avispa	2	U	Los Frijoles placers	72	Y
Aza	195	U	Maijia placers	31	Y
Bocon placers	172	Y	Matute	142	Y
Bogarin mine	105	Y	Mavaca-Casuquare	8	U
Buena Esperanza placer	229	Y	Paragua	180	Y
C.O.D.S.A.	49	Y	Paraitepuy placers	40	Y
Caicara	338	Y	Paramichi placers	26	Y
Campo Grande	139	Y	Pila Blanca	399	Y
Campo Grande	115	Y	Playa Blanca placers	400	Y
Capaura placers	82	8,880 carats (1978)	Quebrada Grande placers	162	7,500,000 carats (to 1968)
Carapo	92	Y	Río Antavari	76	Y
Cardona	1	U	Río Aponguau placers	53	Y
Caruachi placers	420	Y	Río Aro	231	Y
Caruay	68	Y	Río Caroní (no. 18)	171	Y
Cepillito	140	Y	Río Caroní placers	154	Y
Cerbatana	145	Y	Río Carrao placers	134	Y
Chicanan	173	Y	Río Claro placers	390	Y
Ciudad Piar	262	U	Río Los Dos Pozos	323	U
Curao	153	Y	Río Marevari	38	U
Dori	170	Y	Río Merevari	43	U
El Candado	144	Y	Río Oris	131	Y
El Caracol	164	Y	Río Suapure	127	Y
El Caracolito	161	Y	San Felix placers	430	Y
El Carmen	99	U	San Juan	111	Y
El Infierno	41	U	San Pedro de Las Bocas placers	206	300 carats (1977–1980)
El Loco placers	74	Y	San Salvador de Paúl district	106	823,920 carats (1975–1980)
El Merey placers	364	6,350 carats (1977–1980)	Santa Elena de Uairén placers	47	21,020 carats (1978–1980)
El Milagro	155	Y	Santa Teresa	45	U
El Pagon placer	236	Y	Solano	4	U
El Pao de La Fortuna placers	212	Y	Tres Choques	151	Y
El Resbalon del Diablo	158	Y	Unnamed diamond occurrence	109	Y
El Toco	141	Y	Uraday	87	U
Flora Blanca placers	60	Y	Uraima-Urutani	143	Y
Gallito	103	Y	Uraima-Urutani	148	Y
Gran Sabana	57	Y	Uraima-Urutani	149	Y
Gran Sabana	54	Y	Uriman placers	83	13,710 carats (1975–1980)
Gran Sabana	66	Y	Veri	194	Y
Guacharaca	86	Y	Yiguiripin placers	62	Y
Guacharaquito	81	Y			
Guaibal-El Mango	3	Y			
Guaniamo district	207	3,654,830 carats (1975–1980)			
Guaramoni	10	Y			

Table 7. Known iron and manganese deposits of the Venezuelan Guayana Shield.
[Shown by map number on plate 5. Y indicates production; N indicates no production; U indicates production status undetermined]

Site name	Map No.	Commodity	Production	Reserves
Altamira 2	327	Iron, gold	Y	2 Mt, 58 percent Fe (1970)
Cerro Abanico	412	Manganese	Y	
Cerro Altamira	321	Iron	Y	137 Mt, 63 percent Fe measured (1985)
Cerro Arimagua	348	Iron	Y	136 Mt, 63 percent Fe measured (1970)
Cerro Bolívar	315	Iron	287 Mt (to 1974)	216 Mt, 64 percent Fe (1981)
Cerro de la Esperanza	332	Manganese, iron	N	
Cerro Etuna	227	Iron	U	
Cerro Frontera	316	Iron	Y	1 Mt, 64 percent Fe (1970)
Cerro Gutierrez	398	Iron	Y	8 Mt (1986)
Cerro La Estrella	251	Iron	Y	44 Mt, 62 percent Fe (1986)
Cerro Las Adjuntas, Punta del Cerro	264	Iron	N	
Cerro Monte Cristo	386	Iron	N	
Cerro Pando	411	Manganese, iron	N	
Cerro Redondo	324	Iron	Y	90 Mt, 62 percent Fe (1986)
Cerro San Cristobal district	314	Mn, Fe, Cu, Pb, Zn	N	
Cerro Toribio	340	Iron	Y	18 Mt, 64 percent Fe (1986)
Cuyubini	416	Iron	U	
El Manganeso	389	Manganese	U	
El Manteco	370	Manganese	U	
El Padamo	18	Iron	U	
El Palmar	418	Mn, iron, aluminum	N	
El Pao	391	Iron, manganese	Y	97 Mt, 61 percent Fe measured (1970)
El Trueno	223	Iron	Y	110 Mt, 62 percent Fe (1986)
Ganges I	407	Manganese, iron	N	0.3 Mt, 20.91 percent Mn, 17.8 percent Fe (1967)
Ganges II	408	Manganese, iron	N	0.05 Mt, 34.11 percent Mn, 10.60 percent Fe (1967)
Ganges III	409	Manganese, iron	N	0.02 Mt, 19.89 percent Mn, 19.25 percent Fe (1967)
Guacuripia	378	Manganese	N	
Imperial mine	438	Iron	N	6 Mt, 58 percent Fe (1986)
La Estrella	322	Iron	N	44 Mt, 62 percent Fe (1986)
La Horqueta	372	Manganese	U	
La Linea	428	Iron	U	
Las Delicias	417	Manganese, iron	Y	
Las Grullas	232	Iron	Y	50 Mt, 50 percent Fe (1970)
Las Pailas	241	Iron	Y	80 Mt, 58 percent Fe (1970)
Las Pavas	362	Manganese	U	
Los Barrancos I and II	240	Iron	Y	232 Mt, 58 percent Fe measured (1970)
Manoa	433	Iron	Y	1.4 Mt, 68 percent Fe (1986)
Maria Luisa	357	Iron	N	258 Mt (1986)
Monte Bello	384	Iron	U	
Monte Romero	415	Iron	U	
Morocota	424	Iron, manganese	U	
Morocota	440	Iron	U	
Piacoa	439	Iron	N	181.12 Mt, <55 percent Fe (1986)
Placo	–	Iron, manganese	U	
Placoa	239	Iron	Y	125 Mt, 45 percent Fe (1970)
Polvo de Oro	427	Iron	U	
Real Corona	265	Iron	U	5 Mt, 45 percent Fe (1986)
Sacupana	441	Iron	U	
San Isidro	268	Iron	Y	394 Mt, 65 percent Fe (1986)
San Isidro Iron Quadrilateral	305	Iron	Y	677 Mt, 57 percent Fe measured (1970)
San Joaquin	306	Iron	Y	65 Mt, 62 percent Fe measured (1970)
San Juan de Amacuro	431	Iron	U	
San Lorenzo	379	Manganese, iron	Y	
Santa Barbara	258	Iron	N	
Santa Catalina	437	Iron	U	
Santa Maria deposit	377	Manganese, iron	N	
Santa Rosa	383	Iron, manganese	N	
Sierra El Lindero	–	Manganese	U	
Tamatama	13	Iron	U	
Terecay	326	Iron	N	3.510 Mt, 64 percent Fe (1986)

Table 8. Known bauxite deposits of the Venezuelan Guayana Shield.
[Shown by number on plate 5; leader (–) indicates site is not shown on map. Y indicates production; N indicates no production; U indicates production status undetermined]

Site name	Map No.	Production	Reserves
Amacuro Delta region aluminum	435	N	
Casiquiare	6	N	
Cerro del Hormiguero, Al_2O_3	343	N	27.5 Mt, 34.49 percent Al (1972)
Cerro Once	395	N	1.0 Mt (1961)
Copeyal	393	N	
Delta	413	U	
Divina Pastora	44	N	
El Baúl	397	N	0.79 Mt (1961)
El Chorro	392	N	1.26 Mt (1961)
El Paru	52	U	
Gavilan	414	N	
Gran Sabana	97	N	
Gran Sabana	95	N	
Gran Sabana	90	N	
Guaicas	120	N	
Kamoiran	93	N	20 Mt, 35.5 percent Al_2O_3 (1986)
Kavanayen	96	N	
Kilometro 88	113	U	
La Grulla	–	U	
Las Nieves	341	N	
Las Piñas	–	U	
Los Guamos	394	N	0.5 Mt (1961)
Los Pijiguaos	160	Y	500 Mt, 48 percent Al_2O_3 (1985)
Luepa	94	U	
Maua	91	U	
Mesa de La Carata	396	N	596 Mt (1961)
Moitaco	366	U	
Nuria Plateau	345	N	8 Mt, 30 percent Al_2O_3 (1986)
Platanal II	9	U	
Platanal I	11	U	
Río Acure	419	N	
Río Aro	255	U	
Río Aroi	436	N	
Río Suapure bauxite occurrence	112	N	
Río Villacoa bauxite occurrence	125	N	
Serranía La Cerbutana	107	N	
Serranía Los Pijiguaos	156	N	
Serranía Parguaza	129	N	
Unnamed bauxite occurrence	175	N	
Upata bauxite	404	N	4 Mt (1973)
Upata district	403	N	

Table 9. Alphabetical listing of mines, prospects, and mineral occurrences, Venezuelan Guayana Shield.
[Shown by map number on plate 5; leader (–) indicates site is not shown on map]

Mineral site	Map No.	Mineral site	Map No.
Agua Colorada	30	Cerro Azul Valley placers	339
Agua Negra	210	Cerro Bolívar	315
Aguamena and Boquerons	121	Cerro Copeyal	388
Altamira 2	327	Cerro de La Esperanza	332
Alto Aponguao	77	Cerro del Hormiguero	343
Alto Kukenan	56	Cerro Etuna	227
Alto Orinoco	12	Cerro Frontera	316
Alto Paragua	25	Cerro Gutierrez	398
Alto Ventuari	61	Cerro Impacto	101
Alto Ventuari	63	Cerro La Estrella	251
Alto Ventuari	71	Cerro La Pinto Mine	312
Amacuro Delta region aluminum	435	Cerro Las Adjuntas, Punta del Cerro	264
Amparo	309	Cerro Monte Cristo	386
Anacoco placers	189	Cerro Once	395
Ancho Caroní	405	Cerro Pando	411
Aparuren	73	Cerro Redondo	324
Apollo 8	–	Cerro San Cristobal district	314
Aponguao	55	Cerro Santa Rosa	385
Aponwao	176	Cerro Toribio	340
Arabopo	70	Cerro Toro	–
Asa placers	159	Cerro Yapacana I	23
Avechica	217	Chicanan	173
Avequi placers	80	Chile	244
Avispa	2	Chiricayen placer	51
Aza	195	Churuata	17
Barrialon placers	104	Cicapra zone	331
Bochi	347	Cinco Ranchos placers	37
Bochinche	334	Ciudad Piar	262
Bocon placers	172	Colombia	–
Bogarin mine	105	Concordia	233
Botanamo	211	Conoroto placers	59
Buena Esperanza placer	229	Construction sand quarry	369
C.O.D.S.A.	49	Construction sand quarry	375
Caicara	338	Construction sand quarry	434
Campo Grande	115	Copeyal	393
Campo Grande	139	Corazon de Jesus	179
Canaima	191	Corococo	442
Caño Aguamena	–	Corre Gente	355
Caño Maraya	24	Cristina-Bizkaitarra	123
Capaura placers	82	Cunucunuma	14
Carapo	92	Curao	153
Cardona	1	Cuyubini	416
Carmen Rosa	209	Delta	413
Caruachi placers	420	Dimension stone quarry	410
Caruay	68	Divina Pastora	44
Casiquiare	6	Dolomite quarry	401
Caura	166	Dori	170
Caura placers	84	El Baúl	397
Cenicero	242	El Callao district	259
Cepillito	140	El Candado	144
Cerbatana	145	El Caracol	164
Cerro Abanico	412	El Caracolito	161
Cerro Altamira	321	El Carmen	99
Cerro Arimagua	348	El Carmen	313
Cerro Arrendajo	108	El Carmon	198

Table 9. Alphabetical listing of mines, prospects, and mineral occurrences, Venezuelan Guayana Shield—Continued.

Mineral site	Map No.	Mineral site	Map No.
El Casabe placers	163	Guaramoni	10
El Chivao placers	136	Guariche	182
El Choco	235	Guasipati La Pastora area phosphate	328
El Chorro	392	Guatuaima	185
El Crucero	286	Guayaraca	100
El Dorado	184	Hacha placers	34
El Foco	132	Hueco Rico	320
El Grillero	317	Icabarú placers	32
El Grito	307	Iguana	257
El Infierno	41	Imperial mine	438
El Leon	–	Kamarata	89
El Loco placers	74	Kamoiran	93
El Manganeso	389	Kamu placers	85
El Manteco	318	Kaolin quarry	402
El Manteco	370	Kaolin quarry	432
El Merey placers	364	Kavanayen	96
El Milagro	155	Kilometro 88	113
El Padamo	18	Kilometro 88 kaolin deposits	114
El Pagon placer	236	Kilometro 88-Las Claritas	124
El Palmar	418	La	290
El Pao	391	La Armónica	276
El Pao de la Fortuna placers	212	La Bandera placers	33
El Paru	52	La Bicicleta	157
El Pauji	116	La Camorra	186
El Placer	190	La Carabobo	130
El Polaco placers	46	La Cayena	352
El Resbalon del Diablo	158	La Churuata uranuim anomaly	16
El Roble	274	La Cu-Ca	150
El Tesoro	344	La Cuaima	152
El Tigre	333	La Cuaimita	146
El Toco	141	La Cubanita	272
El Trueno	223	La Culebra	263
El Valle	282	La Divina Pastora	294
Eureka	243	La Espanoa	302
Experiencia	266	La Esperanza	325
Flora Blanca placers	60	La Estrella	177
Florinda	311	La Estrella	224
Gallito	103	La Estrella	322
Ganges I	407	La Faisca placer	50
Ganges II	408	La Foraleza	297
Ganges III	409	La Foresta	303
Gavilan	414	La Grulla	–
Gran Sabana	54	La Hollada placers	42
Gran Sabana	57	La Horqueta	372
Gran Sabana	66	La Hoya	138
Gran Sabana	90	La Introduccion	351
Gran Sabana	95	La Lapa	300
Gran Sabana	97	La Lapa–1	284
Guacharaquito	81	La Libertad	200
Guacuripia	378	La Linea	428
Guacuripia area dolomite deposits	350	La Lira	178
Guaibal-El Mango	3	La Loca	287
Guaicas	120	La Paragua	181
Guaniamo district	207	La Paragua placers	65
Guaniamo I	–	La Patricia	–

Table 9. Alphabetical listing of mines, prospects, and mineral occurrences, Venezuelan Guayana Shield—Continued.

Mineral site	Map No.	Mineral site	Map No.
La Pena placer	48	Mi Venezuela	283
La Plata	301	Mina A	299
La Playita	167	Mina B	–
La Reforma	230	Mina C	254
La Rosa	219	Mina Calí	280
La Sabanita placers	78	Mina Colombia	253
La Salvacíon	147	Mina Corozo	292
La Salvacíon	358	Mina Nueva	19
La Salvacíon	359	Mina Ordaz	–
Laguna mine-Santa Rita	252	Mina Ortega	295
Larinal	102	Mina Plataneal	20
Las Chichorras	329	Mina Sonia	288
Las Claritas de Uroy	126	Mina Zenovia	271
Las Delicias	417	Miribisi-Manarevaca	–
Las Flores	214	Mocupia	246
Las Grullas	232	Moitaco	366
Las Margaritas	376	Monte Bello	384
Las Morochas	296	Monte Cristo	–
Las Nieves	341	Monte Romero	415
Las Nieves	367	Morocota	424
Las Pailas	241	Morocota	440
Las Pavas	361	Mundo Nuevo	380
Las Pavas	362	Nacupal	238
Las Piñas	–	Nuevo Callao	213
Las Tres Rosas–2	285	Nuria Plateau	345
Leoncio	122	Panamá	168
Lo Increíble	279	Pao	64
Lo Increíble district	256	Paragua	180
Los Barrancos I and II	240	Paraitepuy placers	40
Los Caribes placers	29	Paramichi placers	26
Los Frijoles placers	72	Parapapoy	169
Los Guamos	394	Parupa placers	88
Los Pijiguaos	160	Paviche	250
Luepa	94	Payapal	192
Macapa	196	Peña	–
Macondo	278	Peru	247
Maijia placers	31	Piacoa	439
Malave	281	Pierina	273
Manaima	117	Pila Blanca	399
Mandingal	336	Píston de Uroy	137
Manoa	433	Placers of Bochinche	335
Margarita	310	Placo	–
Marhuanta	218	Placoa	239
Maria Luisa	357	Platanal I	11
Maria Varela	67	Platanal II	9
Marwani-Los Caribes	208	Playa Blanca placers	400
Marwani I	226	Polvo de Oro	365
Marwani IV	221	Polvo de Oro	427
Matute	142	Potosi	237
Maua	91	Pumpiri	28
Mavaca-Casuquare	8	Purgatorio	228
Mejico	234	Quartz mine	342
Mercedes	222	Quebrada Cachanaca	133
Merevari geochemical anomaly	27	Quebrada de Oro	337
Mesa de La Carata	396	Quebrada Grande placers	162

Table 9. Alphabetical listing of mines, prospects, and mineral occurrences, Venezuelan Guayana Shield—Continued.

Mineral site	Map No.	Mineral site	Map No.
Quebrada Mochila placer	174	Sand quarry	371
Rancho Verde	199	Sand quarry	373
Real Corona	265	Sand quarry	381
Remington	260	Sand quarry	387
Río Acure	419	Sand quarry	406
Río Antavari	76	Sand quarry	421
Río Aponguau placers	53	Sand quarry	422
Río Aro	231	Sand quarry	423
Río Aro	255	Sand quarry	429
Río Aroi	436	Santa Ana	304
Río Caroní (no. 18)	171	Santa Barbara	258
Río Caroní placers	154	Santa Barbara	293
Río Carrao placers	134	Santa Catalina	437
Río Chiguao placers	98	Santa Elena	308
Río Claro placers	390	Santa Elena de Uairén placers	47
Río Cuyuni-Río Uey	110	Santa Elena de Uairén anomalous radioactivity	75
Río Los Dos Pozos	323	Santa Inés	291
Río Marevari	38	Santa Maria deposit	377
Río Marwani	216	Santa Rita	374
Río Merevari	43	Santa Rosa	383
Río Nichare	165	Santa Teresa	45
Río Oris	131	Santeli	–
Río Suapure	127	Serranía La Cerbutana	107
Río Suapure bauxite occurrence	112	Serranía Los Pijiguaos	156
Río Suruma	354	Serranía Parguaza	129
Río Villacoa bauxite occurrence	125	Sesina	205
Ropeway and Refugio	248	Sierra El Lindero	–
Sacupana	441	Sipao	330
Salto Araguai	118	Sofia	267
Salva la Patria	–	Solano	4
Salva le Peine	319	Sosa Mendez-Union mine	245
Salvador	–	Stone quarry	353
San Antonio	215	Sua-Sua	204
San Antonio	–	Talismán	270
San Felipe	249	Talismán Cova	269
San Felipe	346	Tamatama	13
San Felix placers	430	Te Esperaba	277
San Isidro	268	Terecay	326
San Isidro Iron Quadrilateral	305	Tres Choques	151
San Joaquin	306	Triunfo	187
San Juan	111	Troya	–
San Juan de Amacuro	431	Uaiparu placers	36
San Lorenzo	379	Union–1	275
San Lorenzo	382	Union–2	298
San Luis placers	35	Unnamed	119
San Miguel	193	Unnamed	128
San Pedro de las Bocas placers	206	Unnamed	135
San Rafael	201	Unnamed bauxite occurrence	175
San Rafael	–	Unnamed diamond occurrence	109
San Salvador de Paúl district	106	Unnamed gold occurrence	5
Sand quarry	349	Unnamed gold occurrence	7
Sand quarry	356	Unnamed gold occurrence	15
Sand quarry	360	Unnamed gold occurrence	21
Sand quarry	363	Unnamed gold occurrence	22
Sand quarry	368	Unnamed gold occurrence	183

Table 9. Alphabetical listing of mines, prospects, and mineral occurrences, Venezuelan Guayana Shield—Continued.

Mineral site	Map No.	Mineral site	Map No.
Unnamed gold occurrence	188	Uraima-Urutani	143
Unnamed gold occurrence	197	Uraima-Urutani	148
Unnamed gold occurrence	203	Uraima-Urutani	149
Unnamed gold vein	–	Uriman placers	83
Unnamed in Gran Sabana placers	58	Veri	194
Unnamed in Gran Sabana placers	69	Viejo Callao	261
Unnamed in Gran Sabana placers	79	Vuelvan Caras	220
Unnamed placer workings	425	Vuelvan Caras placers	225
Uonan placers	39	Wausa	426
Upata bauxite	404	Yi Yi	289
	403		
Upata district		Yiguiripin placers	62
Uraday	87	Yuruán	202

Any assessment based on deposit models has the inherent weakness that resources in unknown or unrecognized models may be overlooked. Given this qualification, we believe that the assessment herein describes, in the most explicit manner possible, the mineral potential of the Venezuelan Precambrian shield.

For the purpose of this discussion, the term "deposit type" is defined as a model of a specific group of deposits (Cox and Singer, 1986; Orris and Bliss, 1991; Bliss, 1992a, b). The term "occurrence" describes a specific locality where geologic observations and other data indicate the presence of mineralized rock, and the term "deposit" refers to a mineral occurrence of sufficient size and grade that might be considered to have economic potential. The three-step process of Singer (1975) was first used as part of the mineral resource assessment of the Nabesna 1:250,000-scale quadrangle, Alaska (Richter and others, 1975), and has since been used to assess more than 170,000 km^2 in the United States at a scale of 1:250,000 and more than 2.2 million km^2 in North and South America at a scale of 1:1,000,000.

THREE-STEP ASSESSMENT PROCESS

DELINEATION OF DOMAIN BY DEPOSIT TYPE

Stratigraphic and tectonic information, lithologic descriptions, geologic environment, and the deposit type or types permissive in that environment (based on deposit types in similar geologic environments elsewhere) are factors taken into consideration when domains are delineated. The boundaries of the domains are first delineated using mapped or inferred geologic characteristics. They may then be redefined using the results of geochemical analysis of rock samples and (or) exploration history. Geophysical techniques, including gravity and aeromagnetic surveys, are used to identify buried rock units in areas of poor exposure. Deposit types are identified on the basis of host and associated rock types, contained metals, tonnage and grade, ore minerals, and geologic setting. An inventory of known mining activity in the area is also an important step in determining deposit type. Incomplete or inaccurate descriptions of known occurrences can make it difficult to identify the specific deposit type. Projection of deposits from adjacent areas is useful if a well-explored area is adjacent to a relatively unexplored area and if geologic conditions in the two areas appear similar (Menzie and Singer, 1990). If two types of deposits share a common association, the presence of one suggests the possibility of the presence of the other. Later steps in the delineation process serve to narrow the list. Once the deposit types are identified, limits are placed on what is permissible in a domain. The domain boundaries are then adjusted to account for areas where it can be demonstrated that a deposit type could not exist. For some deposit types extensive surface exploration might provide evidence to exclude areas from consideration, but for many deposit types only close-spaced drilling can be used to exclude areas.

TONNAGE AND GRADE MODELS

Estimated pre-mining tonnages and average grades for well-explored, well-documented, and well-characterized deposit types from throughout the world are used to construct tonnage and grade models. Tonnage and grade models can be used to help selectively classify known deposits in the area being assessed and to separate suspected deposits from mineral occurrences or other weak manifestations of ore-forming processes. Published tonnage and grade models of deposits in various settings worldwide (Cox and Singer, 1986) were used to estimate tonnages and grades of undiscovered deposits in similar geologic settings in Venezuela. The variation of tonnage and grade for deposits belonging to a specific deposit type tends to be small in comparison with the variation between deposit types.

ESTIMATES OF NUMBER OF UNDISCOVERED OCCURRENCES

The number of undiscovered deposits in Venezuela was estimated for selected deposit types in a probabilistic form in order to show a degree of certainty. A variety of factors, including geologic, geochemical (where available), and geophysical data and the extent of mineral exploration, were integrated to make the estimates. The amount, type, and nature of available geologic data variably influence the effectiveness with which these data reflect different types of deposits and therefore affect the certainty of the assessment exercise. Additionally, the density and spatial distribution of sampling associated with the survey affect the estimation of undiscovered deposits. For example, where exploration has been extremely thorough, estimates of undiscovered deposits may be confidently placed at zero. More commonly, however, exploration is less thorough, and the effect of previous exploration on estimates of undiscovered resource is variable. Singer and Mosier (1981) noted, in regard to the effect of previous exploration, that the larger deposits are commonly discovered by early efforts and the remaining, undiscovered deposits may be, on average, smaller than those already found. Estimates of the number of undiscovered deposits for selected deposit types in the delineated domains are made at the 90th, 50th, 10th, 5th, and 1st percentile values. For example, the 90th percentile value is that number of deposits for which there is a probability of 0.90 that the actual number of deposits equals or exceeds that number. Approximately half the estimated undiscovered deposits should have tonnages or grades greater than the median tonnage or grade for that deposit type. Documented mines and prospects considered to be discovered mineral deposits in Venezuela and listed previously (table 3) are not included in the estimated number of undiscovered deposits.

The delineation of domains and the identification of deposit types facilitate exploration because deposit types having similar physical, chemical, and mineralogical features tend to be present in similar geologic environments throughout the world. Thus, it is important to identify deposit types in Venezuela using what is known about geologic environments and deposit types elsewhere. This report includes exploration guides and recommendations as part of the discussion of selected domains. Future exploration programs in Venezuela should be based on the world economic outlook for specific commodities and should focus on those domains delineated for specific deposit types.

DEPOSITS IN DEEPLY ERODED TERRANES

The Imataca and Pastora-Supamo terranes contain mineral deposits that (1) were formed in the Archean and Early Proterozoic, infolded into their host rocks, and metamorphosed or (2) were formed during or soon after regional metamorphism associated with the Trans-Amazonian orogeny. These deposits were exposed in a later epoch by uplift and erosion. They include stratiform deposits of iron and manganese and deposits of gold in quartz veins, as well as undiscovered deposit types such as massive sulfide deposits and deposits of nickel-copper in mafic and ultramafic intrusive rocks.

Algoma- and Superior-Type Iron Deposits

By Dennis P. Cox, Norman J Page, *and* Floyd Gray

THE MODEL

Stratiform deposits of thinly laminated quartz and iron oxide minerals intercalated with marine felsic and intermediate volcanic and volcaniclastic rocks have been described by Gross (1970) and Goodwin (1973) and termed "Algoma iron deposits" by Cannon (1986a). The ores are believed to be of submarine volcanic exhalative origin. These deposits are mainly Archean in age and are widely distributed in Precambrian shields (James, 1983). Commonly, three facies of iron formation are present: an oxide facies, a sulfide facies, and a carbonate facies. In terms of tonnage, these deposits are similar to the Superior-type stratiform iron deposits, which are unrelated to volcanic processes. Superior-type iron ores are mainly of Early Proterozoic age and are commonly deposited in sequences of rocks that lie unconformably on older, stable Proterozoic or Archean basement rocks (Cannon, 1986b). Deposits formed distally from extrusive centers may be indistinguishable from Superior-type deposits. Repetition of ore horizons by faulting and folding, thickening at intersecting folds, and plastic flow toward axes may thicken iron formations and increase metallurgical quality.

Based on data from 66 deposits in 17 countries, Algoma- and Superior-type iron deposits have a median ore tonnage of 170 million tonnes (Mosier and Singer, 1986)(fig. 11*A*). Ninety percent of the deposits contain at least 11 million tonnes of ore, and ten percent contain more than 2.4 billion tonnes of ore. The grade of these deposits is strongly affected by enrichment of iron during weathering. Such enrichment produces residual hematite ore containing 60–65 percent Fe, as compared to 30–50 percent Fe for unweathered quartz-magnetite (taconite) ore. Both supergene-enriched and primary ores are included in the tonnage model resulting in a median grade of 53 percent Fe (figs. 11*A*, *B*).

EXAMPLES IN VENEZUELA

Iron deposits, believed to be Algoma or Superior type (Ruckmick, 1963; Dorr, 1973), are abundant in the Imataca terrane, but, because rocks of the Imataca terrane are highly deformed and metamorphosed to amphibolite and granulite facies, the environment of deposition of the iron ore is difficult to determine and assignment to the Algoma model is uncertain. A listing of known deposits within the study area is given in table 7.

These iron deposits are composed of alternating, fine layers of quartzite and iron oxide minerals (hematite and magnetite and minor goethite). Only minerals of the oxide facies have been recognized. The layers are 0.1–25 mm thick, but lenses of almost pure iron ore as thick as 30 m are known. Structurally below several of the main orebodies thin layers as thick as 2 m of iron-rich rock intercalated with lithic arkose and felsic gneiss suggest a cyclic repetition of depositional conditions prior to main deposition of iron formation (Ferencic, 1969). Zuloaga (1933), one of the first to describe deposits in the Imataca Complex, noted that the ore at El Pao is structurally overlain by hypersthene granulite, which he termed "norite." Ascanio (1985) recognized three types of ore based on grain size: (1) coarse grained (>1 mm); (2) medium grained (~1 mm); and (3) fine grained (<1 mm). The deposits of El Pao, Las Grullas, and Piacoa comprise coarse-grained ore, Maria Luisa medium-grained ore, and Cerro Bolívar, San Isidro, Los Barrancos I and II, and Altamira 2 fine-grained ore. The three groups of deposits are from geographically separate areas; the coarse-grained deposits are north and east of the El Pao fault, the medium-grained deposits are between the El Pao and Guri faults, and the fine-grained deposits are in the westernmost part of the Imataca terrane. The increase in grade of metamorphism from west to east in the Imataca terrane likely affected the grain size of both the underlying protore and the enriched ore because both decrease toward the west (Gruss, 1973). Mapping by Kalliokoski (1965b) and Martín (1975) suggests that the major rock types of the Imataca Complex are granitic gneiss and interlayered mafic granulite and basaltic amphibolite, iron formation, and other metasedimentary rocks. Intimate infolding of the iron ore with the metamorphic rocks at many stratigraphic horizons is characteristic of the more deformed deposits. Large, extensive blanket

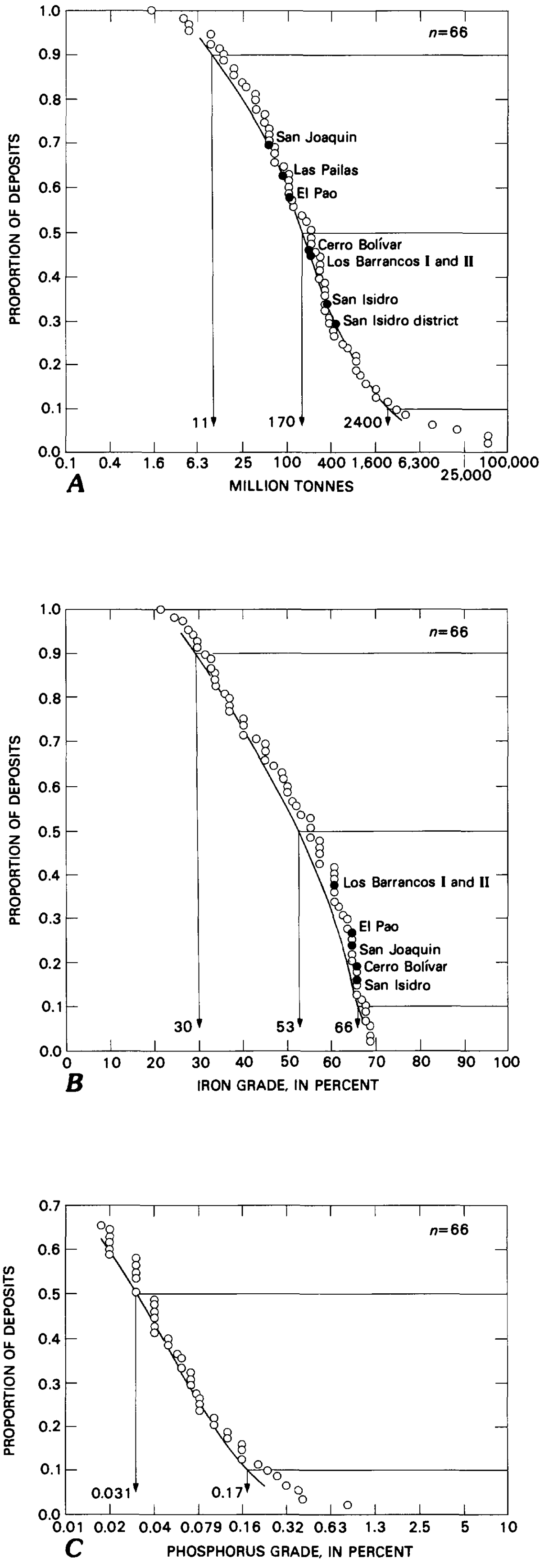


Figure 11 (facing column). Tonnage and grade diagrams for Algoma iron and Superior iron deposits. Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. Modified from Mosier and Singer (1986, figs. 172–174). *A*, Tonnages. Tonnages for selected deposits in Venezuela are also shown (solid circles). *B*, Iron grades. Grades for selected deposits in Venezuela are also shown (solid circles). *C*, Phosphorus grades.

iron formations common to other cratonic regions are not easily observed or interpreted to be present in Venezuela. Most of the Venezuelan deposits are aligned east-west following the dominant structural trend of the host complex. They form the tops of high-standing ridges comprising more resistant iron-rich material and typically 200 m or more above surrounding terrain.

The Cuadrilatero Ferrifero de San Isidro (San Isidro Iron Quadrilateral) represents the largest known iron reserves in Venezuela. It is in the southernmost part of the Imataca terrane near the Guri fault zone and consists of five orebodies: San Isidro, Los Pailas, San Joaquin, and Los Barrancos I and II (which are continuous). The district is associated with amphibole-pyroxene gneiss, granitic gneiss, and amphibolite. Ferencic (1969) concluded that the primary ore was deposited as a chemical precipitate of volcanic exhalative origin. The orebodies are in range tops between 430 and 800 m elevation and formed in the synclinal axes of folds. The average chemical composition of ore from the district is Fe, 61–68 percent; SiO_2, 0.5–4.05 percent; Al_2O_3, 0.6 percent; LOI, 3–4 percent; Mn, 3.5 percent; and P_2O_5, 0.01–0.45 percent (Ferencic, 1969, p. 293).

The El Pao deposit (fig. 12), described by Zuloaga (1933) and Kalliokoski (1965c), is overlain by hypersthene granulite. Three types of ore are present: siliceous ore (hematite gneiss), massive high-grade hard ore, and canga. The deposit is underlain by quartz-feldspar gneiss, and the enclosing rocks are deformed by at least two stages of intense folding that produced complexly intersecting, steeply plunging synclines and cup-shaped structural basins (Fernando Lopez, El Pao mine geologist, oral commun., 1991). Textural and isotopic evidence indicates that the deposit has undergone high-grade metamorphism to temperatures as high as 640°C (Kalliokoski, 1965c, p. 113). Massive coarse-grained ore and siliceous ore consist of lamellar hematite in which the crystals are oriented and strongly deformed. This metamorphism in the orebody may be related to the granulite facies metamorphism characteristic of the eastern Imataca terrane.

At the Cerro Bolívar deposit (Ruckmick, 1963), on a prominent ridge about 520 m above the surrounding savanna, weathered ferruginous laterite and friable ore were formed from typically very fine grained iron formation (fig. 13). Outcrops display thin, continuous, parallel laminations from 0.05 mm to 1–2 cm in thickness that are composed of layers alternately rich and poor in amounts

Figure 12. Steeply plunging recumbent limb of iron ore, El Pao deposit, Estado Bolívar. Blocks of hematite ore are in the foreground. Photograph by Floyd Gray.

of iron oxide and quartz. Locally, massive ore exhibits little or no interlayering or bedding features. Hematite, magnetite, and quartz are the main mineral constituents; however, Dougan (1977) identified local laminated calc-silicate quartzite associated with laminated quartz-magnetite and orthopyroxene-quartz-magnetite iron formation. Silicate minerals, principally sodic amphibole (magnesioriebeckite-crossite) and pyroxene (diopsidic acmite), are common phases in the iron formation. The Cerro Bolívar deposit represents a stratigraphically thick section of iron formation (220 m) repeated by tight folding along east-northeast–west-southwest axes and by imbricate reverse faulting. At least two generations of folding are present. Weathering, an important factor in the enrichment of the Cerro Bolívar orebody, has produced an almost pure iron oxide cap of ferruginous laterite composed of primary grains of hematite in a hard vuggy matrix of secondary goethite. The cap extends downward about 15.6 m, below which is the friable ore—mainly hematite and quartz—to a maximum depth of 28 m from the surface. Weathering of the deposit is thought to have begun in the Oligocene. Mixed ore from the mine yields an average grade of approximately 64 percent Fe, 1.3 percent SiO_2, 1.3 percent Al_2O_3, and minor amounts of phosphorous, titania, and manganese (Ruckmick, 1963, p. 219).

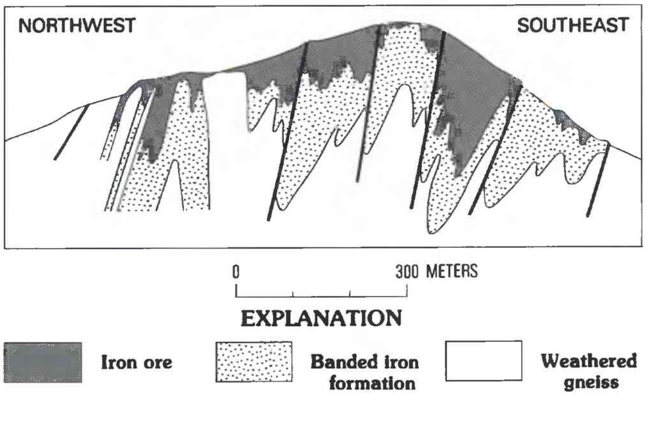


Figure 13. Cross section of iron orebodies of Cerro Bolívar, Venezuela. Modified from Ruckmick (1963); used with permission of Economic Geology.

Other ore exploited at the present time in the Imataca Complex has been enriched by weathering and leaching of silica. Unenriched (taconite type) ore is not being exploited and has been only partly explored.

PERMISSIVE DOMAIN

The domain permissive for Algoma and Superior iron deposits is coincident with the known extent of the Archean Imataca Complex and extends north and east under covering Cenozoic rocks except where the complex is cut off by faulting along the Río Orinoco. Domain Ia (pl. 7) contains the many prominent ridges underlain by iron formation and all of the known deposits. The west end of the Imataca Complex and outliers south of the Guri fault are considered to have a low probability of undiscovered deposits because of the absence of prominent ridges characteristically developed on iron formation and the lack of known deposits. These areas are labeled domain Ib (pl. 7). Other marine volcanic areas in the shield are excluded because they do not contain the characteristic lithologies of the model, they are Proterozoic, and they lack known occurrences of this type. The permissive domains also exclude granitic plutons within the Imataca Complex. Within domain Ia, there are 22 deposits for which a tonnage and grade have been published, of which 17 are consistent with the tonnage model of Mosier and Singer (1986). Approximately 10 deposits are known for which no tonnage data are available. Geologic mapping by Kalliokoski (1965b) shows approximately 125 ridges of iron formation within the complex.

UNDISCOVERED DEPOSITS

Based on these data we made the following estimate for domain Ia. In addition to the 22 deposits for which a tonnage and grade are known, there is a 90 percent chance of 9 or more undiscovered deposits consistent with the tonnage-grade model of Mosier and Singer (1986), a 50 percent chance of 26 or more deposits, and a 10 percent chance of 90 or more deposits. About half of these undiscovered deposits will be of the unenriched (taconite) type containing 25 percent Fe or less.

Sedimentary Manganese Deposits

By Floyd Gray *and* Norman J Page

THE MODEL

Shallow-marine (nonvolcanogenic) sedimentary manganese deposits that formed around rims of anoxic basins were termed "sedimentary manganese deposits" by Cannon

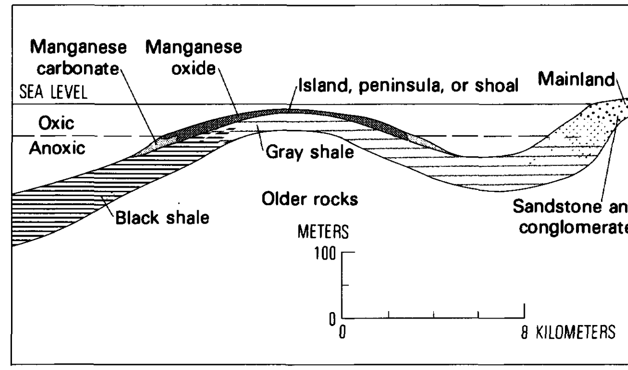


Figure 14. Schematic cross section showing relation between sedimentary facies and sedimentary manganese deposits. Modified from Cannon and Force (1986, fig. 175).

and Force (1986) and Force and Cannon (1988). These deposits form at depths of 50–300 m, commonly in sheltered sites around paleoislands, and are hosted in and associated with shallow-marine sedimentary rocks, commonly carbonates, clays, and glauconitic sand, typically with shellbeds, in transgressive sequences associated with anoxic basins (fig. 14). These large anoxic basins are in interior stable cratonic areas. Deposits formed mainly during anoxic events—narrow time periods within the early Paleozoic, Jurassic, and mid-Cretaceous—but may have formed with rocks of any age associated with anoxic basins. Manganese is present as oolites, pisolites, laminae, and shell replacements. A variety of manganese carbonate (mostly basinward) and oxide (mostly landward) minerals are present.

Based on data from 39 deposits, the median tonnage of this deposit type is 7.3 million tonnes; 90 percent of the deposits contain at least 190,000 tonnes and 10 percent as much as 280 million tonnes (fig. 15*A*). The median manganese grade is 31 percent, and the median phosphorus grade is 0.2 percent (figs. 15*B*, *C*).

EXAMPLES IN VENEZUELA

Secondarily enriched manganese deposits believed to be mainly sedimentary in origin are abundant in the Imataca terrane. Geologic details, however, do not permit us to conclusively assign these deposits to the sedimentary manganese model or to the similar volcanogenic-sedimentary deposit model (Roy, 1981; Koski, 1986).

A large cluster of these deposits is in the area of Upata-Guacuripia in a stratigraphic sequence approximately 500 m wide and 20 km long (Drovenik and others, 1967). The strike of the ore-bearing zone is east-northeast, parallel with the trend of the Santa Maria fault zone and the general trend of structure in the Imataca terrane. Manganese-rich beds are generally intercalated between overlying quartzite and underlying dolomitic marble

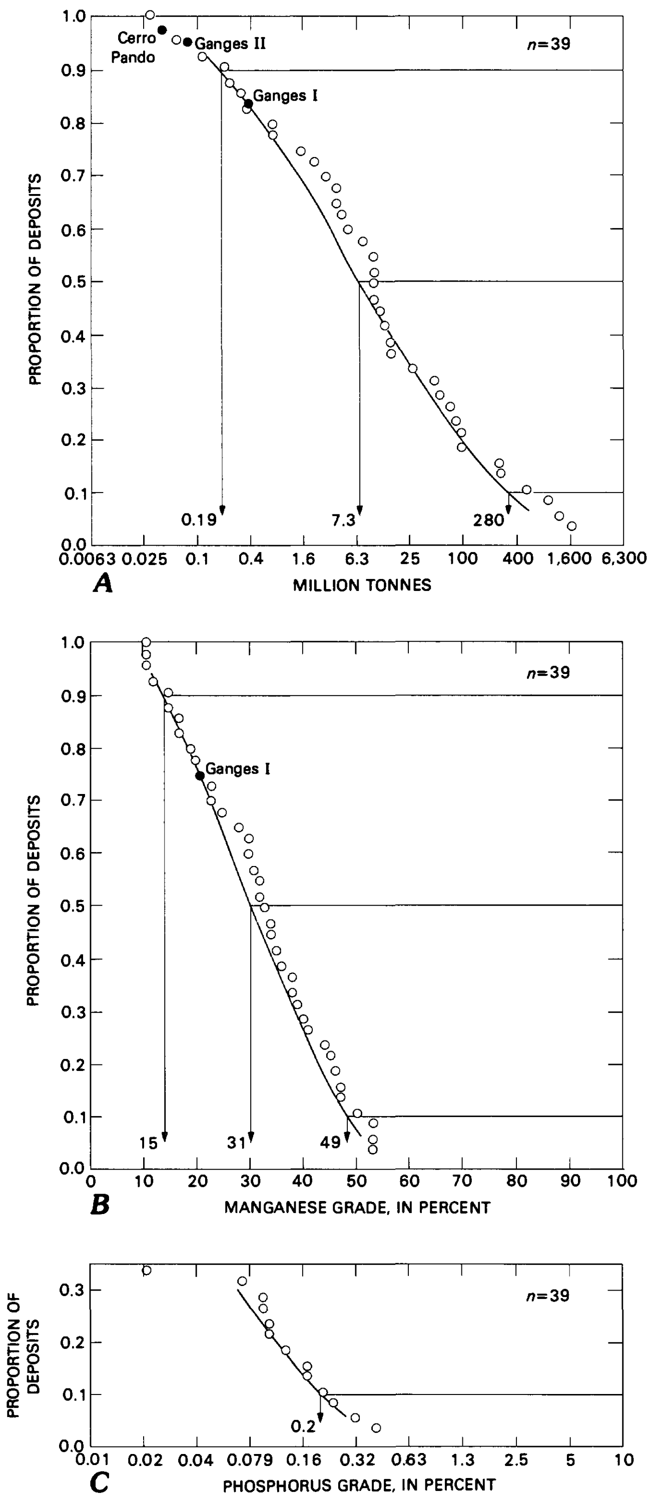


Figure 15. Tonnage and grade diagrams for sedimentary manganese deposits. Modified from Mosier (1986a, figs. 176, 177). *A*, Tonnages. Tonnages for selected deposits in Venezuela are also shown (solid circles). Tie lines to the curved plot represent intercepts for the 90th, 50th, and 10th percentiles. *B*, Manganese grades. Grade for Ganges I deposit in Venezuela is also shown (solid circle). Tie lines to the curved plot represent intercepts for the 90th, 50th, and 10th percentiles. *C*, Phosphorus grades. Tie line to the curved plot represents intercept for the 50th percentile.

horizons. The average thickness of the beds is less than 10 m. Manganese protore may contain 10–30 percent MnO_2 and is hosted in amphibolite schist, quartzite (ferruginous), quartz-biotite schist, spessartine-rhodonite-bearing schist, and forsterite-bearing dolomitic marble. A kaolinitic saprolite of unknown protolith is also present. Typical associated minerals are spessartine garnet, quartz, graphite, cordierite and sillimanite. Sulfide minerals such as pyrite, pyrrhotite, and chalcopyrite are present in gondite (Drovenik and others, 1967). The above mentioned host rocks intimately associated with manganese occurrences are not described from other locations in the Imataca Complex, and they may be part of a younger sequence of beds infolded into rocks of the complex. The variability in manganese to iron ratios in various prospects and occurrences indicates that the deposition of manganese is a product of the same processes that deposited the iron. Thus, part of the stratified manganese-bearing sequence at Upata may be intercalated or gradational to exhalative (volcanogenic) suites. The ore consists of manganese and iron oxide and hydroxide minerals. In fresh protore minerals such as cryptomelane, psilomelane, pyrolusite, goethite, and nsutite are associated with quartz and silicate minerals such as spessartine, mica, and clays. Minor amounts of hypogene minerals such as magnetite, manganese-rich magnetite, spessartine, rhodonite, braunite, and hausmannite are present. Drovenik and others (1967) described four types of ore at Upata: earthy, hard, pisolitic, and detrital. The first two types form beds containing relict protore minerals and textures.

The deposits at Upata contain from slightly less than 10,000 to 30,000 tonnes of ore and have a median grade of 23 percent MnO_2 (Drovenik and others, 1967). If these deposits are of the sedimentary manganese type, they have lower tonnages than the 750,000-metric-ton median of the tonnage model (Mosier, 1986a).

The Ganges group of deposits (Ganges I–III, table 3) in an east-northeast-trending zone between Guacuripia and El Palmar forms the largest reserves of secondarily enriched manganese deposits presently explored in Venezuela (Drovenik and others, 1967). The deposits are at elevations between 365 and 395 m above sea level. The deposits are uniformly deeply weathered but probably are associated with black argillaceous schist, underlie ferruginous quartzite, and are intercalated with kaolinitized gneiss. Ore is present on weathered surfaces as earthy and hard varieties, but the largest reserves are pisolitic ores cemented by earthy matrix.

The group of workings along the crest of Cerro Pando strikes east-west for a total length of 700 m (Drovenik and others, 1967). The deposits are between 303 and 430 m above sea level; most workings are at 350–365 m elevation. The area is underlain by manganiferous quartzite, black argillaceous schist, and dolomitic marble intercalated with kaolinitized gneiss. The largest occurrence, Pando IV, consists of cemented manganese-iron clastic material forming a 60-cm-thick cover overlying kaolinized gneiss intercalated with black earthy ore and argillaceous schist. This sequence is underlain by dolomitic marble. The Pando IV deposit is estimated to contain 11,900 tonnes. The percentage of manganese, iron, and SiO_2 in the ore is 22.58, 20.74, and 15.18, respectively (Drovenik and others, 1967). The combined occurrences at Cerro Pando are spatially close enough to be considered one deposit and have estimated reserves of as much as 38,000 tonnes.

PERMISSIVE DOMAIN

We were unable to make a quantitative estimate of manganese resources because of the uncertainty in assigning the deposits described above to a particular model or type; however, the Imataca terrane (pl. 7, domains Ia, Ib) is permissive for the occurrence of manganese deposits similar to those in the Upata area.

Low-Sulfide Gold-Quartz Veins

By U.S. Geological Survey *and* Corporación Venezolana de Guayana, Técnica Minera, C.A.

THE MODEL

Auriferous quartz-carbonate veins in faults and shear zones in metamorphic rocks and, less commonly, in and associated with intrusive rocks are termed "low-sulfide gold-quartz veins" (Berger, 1986); they have been described as mesothermal gold, shear-zone gold, orogenic gold, or Mother Lode gold deposits by other workers (Clark, 1970; Hotz, 1971; Barr, 1980). These veins differ from other auriferous veins in that they characteristically contain only a few percent sulfide minerals, commonly pyrite. Base-metal sulfide minerals and scheelite are present in small amounts. Most veins are in marine volcanic and volcaniclastic rocks metamorphosed to the greenschist facies of regional metamorphism. Generally, the deposits having significant tonnage and grade are in areas underlain by greenstone. In addition to volcanic rocks and graywacke, favorable host rocks are iron formation and intrusive rocks of various compositions, notably granite to diorite. The veins may occupy ductile, high-angle shear zones, and the largest deposits, such as those in the Mother Lode system in California, are along major geologic terrane boundaries of regional extent. Deposits in higher level, more brittle, sheared environments form stockwork and disseminated systems in and adjacent to plutonic bodies. Hydrothermal alteration near veins is marked by a lower silica content in wallrocks, the result of

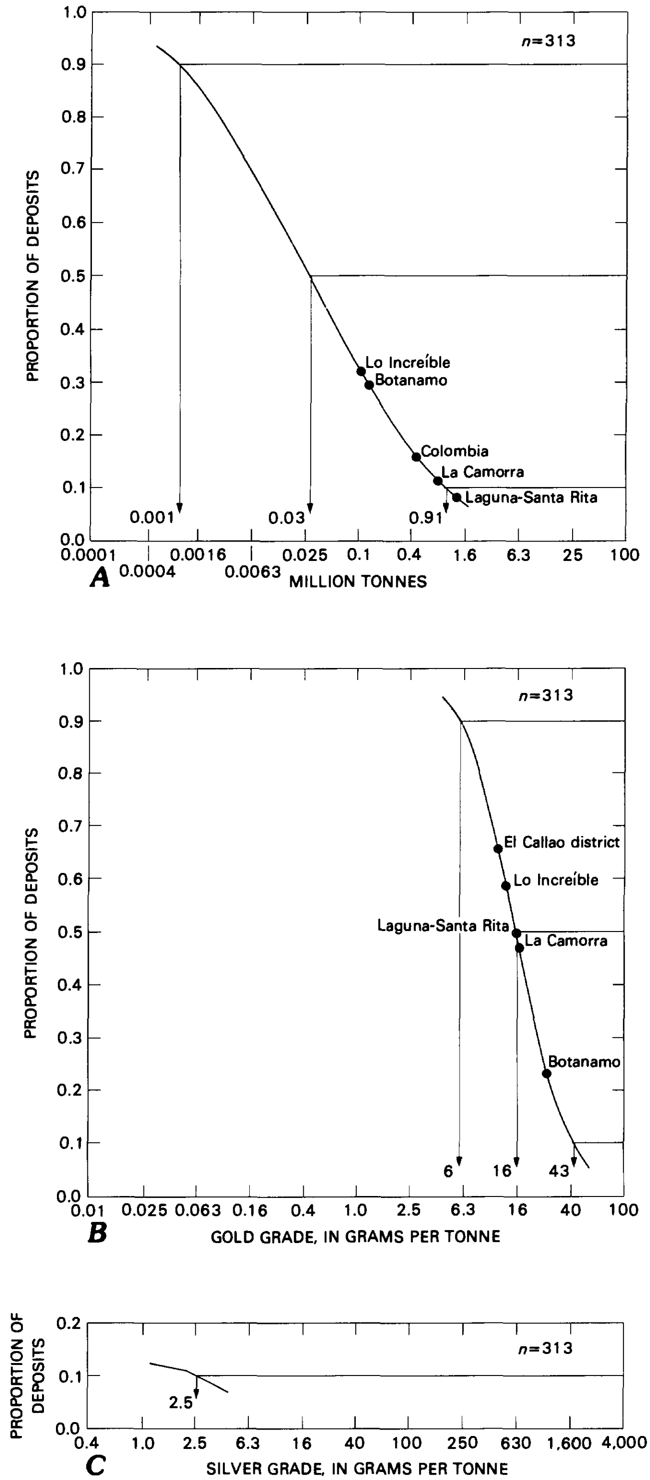


Figure 16. Tonnage and grade model curves for low-sulfide gold-quartz vein deposits. Modified from Bliss (1986, figs. 182, 183). A, Tonnages. Tonnages for selected deposits in Venezuela are also shown (solid circles). Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. *B*, Gold grades. Grades for selected deposits in Venezuela are also shown (solid circles). Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. *C*, Silver grades. Tie line to the curved plots represents intercept for the 10th percentile.

Figure 17. Colombia and Las Americas gold-vein systems, El Callao mine, Estado Bolívar. Photograph by Floyd Gray.

EXPLANATION

- Qal — **Alluvium**
- Xbc — **Tectonic breccia**
- Xgb — **Gabbro**
- Xid — **Diabase**

Pastora Supergroup—Divided into:

- Xc — **Caballape Formation**
- Xy — **Yuruari Formation**
- Xec, Xecb — **El Callao Formation of the Carichapo Group**—Includes volcanic breccia (unit Xecb)

- **Contact**—Approximately located; dashed where inferred
- **Fault**—Dashed where inferred; arrows show direction of movement. Bar and ball on downthrown side
- **Thrust fault**—Sawteeth on upper plate
- **Shear zone**
- **Syncline**—Dashed where inferred
- 40 **Strike and dip of foliation**
- 60 **Bearing and plunge of lineation**
- **Pillow lava showing younging direction**
- **Mine or prospect**
- **Paved road**
- **Unimproved road**
- **Town**
- **Lake**

reaction with reduced fluids rich in CO_2 and H_2S. Mafic rocks are converted to pyrite and ferroan dolomite, felsic rocks to albite and sericite. Tourmaline is locally abundant. Weathering produces auriferous laterite, gold-bearing saprolite, and extensive placer gold deposits.

The tonnage-grade model for this deposit type (Bliss, 1986) is based on 313 deposits in California, Alaska, Nova Scotia, eastern Australia, New Zealand, and other countries (fig. 16). In assembling the model, veins within 1.6 km of each other were considered to be one deposit and veins of less than 99 tonnes were not included. The median deposit contains 30,000 tonnes of ore; 90 percent of the deposits contain at least 1,000 tonnes, and 10 percent contain 910,000 tonnes or more. The median grade is 16 grams of gold per tonne; 90 percent of the deposits have a grade of 6 grams per tonne or more and 10 percent a grade of more than 43 grams per tonne. Only 10 percent of the deposits have a published silver grade, generally about 10 percent of the gold grade.

EXAMPLES IN VENEZUELA

Low-sulfide gold-quartz veins are abundant in the Precambrian shield of Venezuela in greenstone belts and in other areas of greenschist derived from volcanic and volcaniclastic rocks. Host rocks are metabasalt of the El Callao Formation and correlative units, as well as meta-andesite, metatuff of dacitic to rhyolitic composition, metagraywacke, gabbro, and ultramafic rocks. Almost all of the deposits are in rocks of greenschist facies. A notable exception is Píston de Uroy, where veins cut relatively unmetamorphosed gabbro (Wynn, Page, and others, in press). The gabbro was probably intruded shortly after the peak of greenschist facies metamorphism, and the quartz veins were probably emplaced a short time after the gabbro. Some deposits are in amphibolite facies metavolcanic rocks. This higher grade metamorphism is more widespread near the Guri fault and is probably related to post-Supamo movement on the fault that occurred considerably later than gold-quartz vein formation. Other distinctive deposits that may be of this type are in the Vuelvan Caras and Kilometro 88-Las Cristinas

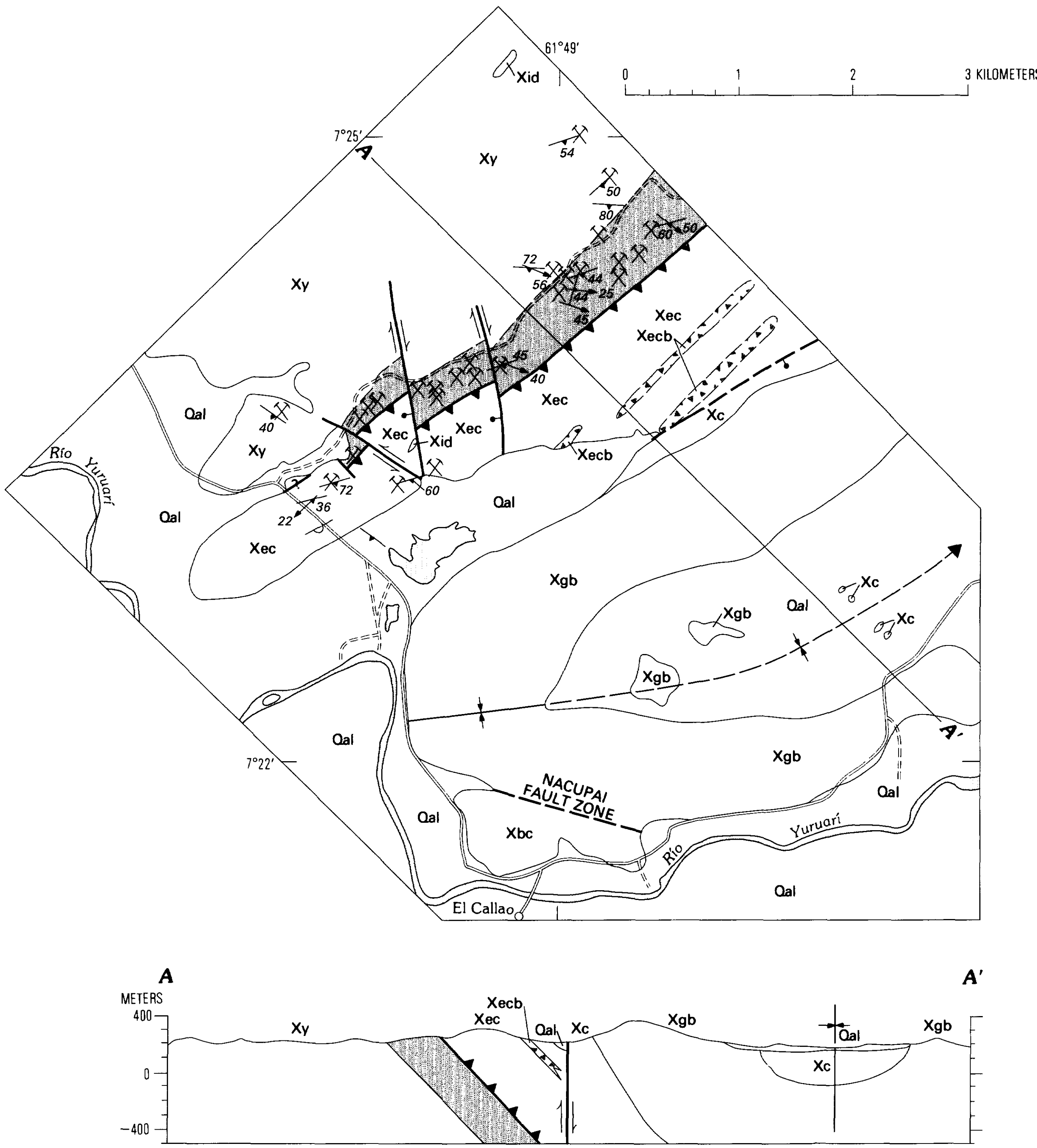


Figure 18 (above and facing page). Geologic map of area of Lo Increíble gold deposit, Estado Bolívar. Modified from Day and others (fig. 2, in press).

areas, where young granitic rocks intrude greenstone-belt rocks (Wynn and Sidder, 1991; Floyd Gray, written commun. to CGV–TECMIN, January 1992). The gold-quartz veins cut both the granitic stocks and the metavolcanic country rock and are in fractures associated with the regional high-level intrusive episode. This form of mineralization is relatively widely known in gold deposits of Guyana (Carter and Fernandez, 1969; Bertoni and others, 1991).

The Colombia vein in the El Callao district is the most completely explored deposit in the region. Estimated production to 1968 for this vein and the branching Las

Americas vein is 429,000 tonnes of ore containing 11.28 grams of gold per tonne (Rodríguez, 1986). The Colombia vein is 2–10 m wide and mined to a depth of 475 m (fig. 17). It has a zoned alteration envelope comprising an inner albite-quartz-carbonate assemblage and an outer zone in which the basalt is replaced mainly by ferroan dolomite. The vein strikes N. 70° E. and is on a mineralized structure extending at least 10 km toward the southwest that includes the Sosa Mendez-Union, Peru, Chile, Mejico, and other deposits. A parallel structure 2 km to the north hosts the Laguna and Santa Rita veins. The El Callao district contains at least 19 named deposits, all in metabasalt of the El Callao Formation.

The Lo Increíble district (Day and others, in press), north of El Callao, is made up of at least 24 closely spaced mines that are along a N. 75° E.-striking fault zone that is as long as 10 km (fig. 18). This fault separates metabasalt of the El Callao Formation on the southeast from schistose dacitic metatuff of the Yuruari Formation on the northwest. The fault is a zone of intense ductile deformation that contains mesoscopic kinematic indicators of right-lateral motion. Most of the deposits are in schist within or adjacent to the fault zone; a few deposits are in the El Callao Formation. This district is believed to have produced more than 100,000 tonnes of ore averaging 13 grams of gold per tonne (Locher, 1974; Rodríguez, 1986).

Another large deposit is Botanamo, 70 km south-southeast of El Callao. Mostly mined out by 1940, Botanamo produced more than 136,000 tonnes of oxidized ore containing 32.7 grams of gold per tonne (Rodríguez, 1986). The mica schist and chlorite schist that host this deposit belong to the calc-alkaline eugeosynclinal sequence of metavolcanic rocks that is distributed over a wide area in the northeastern part of the shield and that does not have the form or structure of a greenstone belt. Low-sulfide gold-quartz veins are equally as abundant in these rocks as in the greenstone belts.

In the Vuelvan Caras deposit, granitic rocks represent high-level intrusive bodies as indicated by the presence of mariolitic cavities (Benaim, 1972; Wynn and Sidder, 1991). Northwest-striking faults localize veins in both types of host rocks. Mining in the Vuelvan Caras vein produced 802.5 kg of gold between 1850 and 1968 from ore that reportedly averaged 63 grams of gold per tonne (Locher, 1974). High-grade ore in the oxidized zone assayed greater than 400 grams of gold per tonne. The grade of ore was noted to decrease with depth in the sulfide zone.

The Kilometro 88 district, 110 km south of Botanamo, is also in calc-alkaline eugeosynclinal rocks (fig. 19). Auriferous saprolite and placer deposits are mined in the district; however, values for tonnage and grade are not available. Present-day workings are concentrated in saprolite weathering horizons as thick as 23 m (Luis Guzman, CVG–TECMIN, unpub. data, 1991)). The district forms a northwest-trending elliptical zone approximately 7 km wide by 15 km long that in its central part shows a close spatial association between high cupolas of probable Late(?) Proterozoic granitic rocks and deformed metavolcanic tuff; peripheral mineralized rock is void of abundant granitic rocks and is a stockwork controlled by north-northwest- to north-northeast-trending shear systems (Luis Guzman, CVG–TECMIN, unpub. data, 1991; Floyd Gray, written commun. to CVG–TECMIN, January 1992). The central part of the district deviates from the typical low-sulfide gold-quartz vein model in that it represents groups of localized vein systems or stockworks related to the intrusive rocks rather than massive persistent veins. The newly proposed "plutonic porphyry gold deposit" model (Hollister, 1992; see also Rytuba and Cox, 1991) in part describes the preliminary findings from this area. Similar deposits have been described at Omai, Guyana (Bertoni and others, 1991), Dublin Gulch, Canada (Hollister, 1991a), Boddington(?), Australia (Monti, 1987), Porgera, Papua New Guinea (Handley and Bradshaw, 1986), and Fort Knox, Alaska (Hollister, 1991b).

The central part of the Kilometro 88 area, nominally described as Las Cristinas, is underlain predominantly by intensely weathered felsic to intermediate metavolcanic and metasedimentary rocks (volcanic-derived graywacke) that locally form schist. The rocks include strongly foliated massive pyroclastic deposits including debris flows, breccia, pumice-rich tuff, thinly bedded tuff, and volcanic sandstone. Foliation trends dominantly north-northwest and dips steeply 50° N. to 80° SW. The volcanic sequence is intruded by quartz diorite, granodiorite, and intermediate porphyry stocks that crosscut foliation. Margins of the stocks are commonly altered and brecciated and locally contain stockwork veining (mainly iron oxide minerals). The stocks occupy a north-northeast-trending zone approximately 850 m wide. Veins in the weathered meta volcanic rocks contain the gangue assemblage hematite (with or without goethite) and quartz (with or without free gold); less weathered impermeable granitic stocks exhibit various stages of sericitization, tourmalinization, and argillic alteration. Sulfide-bearing veins, mainly pyrite and chalcopyrite, extend below the saprolite zone. Outboard of the central zone, mineralized areas are characterized as shear-mylonite-controlled, north-northeast- to north-northwest-trending zones that may be exhalative in nature. Mineralized samples of sericite-quartz schist contain the assemblage pyrite, chalcopyrite, and scattered covellite; more quartz rich schist contains the assemblage pyrite and molybdenite, with or without chalcopyrite, in hand specimen. The lateral extent of this zone, as well as the trend of the overall district, is undefined. Unknown but probably large annual production from this district and other similar districts suggests that this type of deposit is one of the

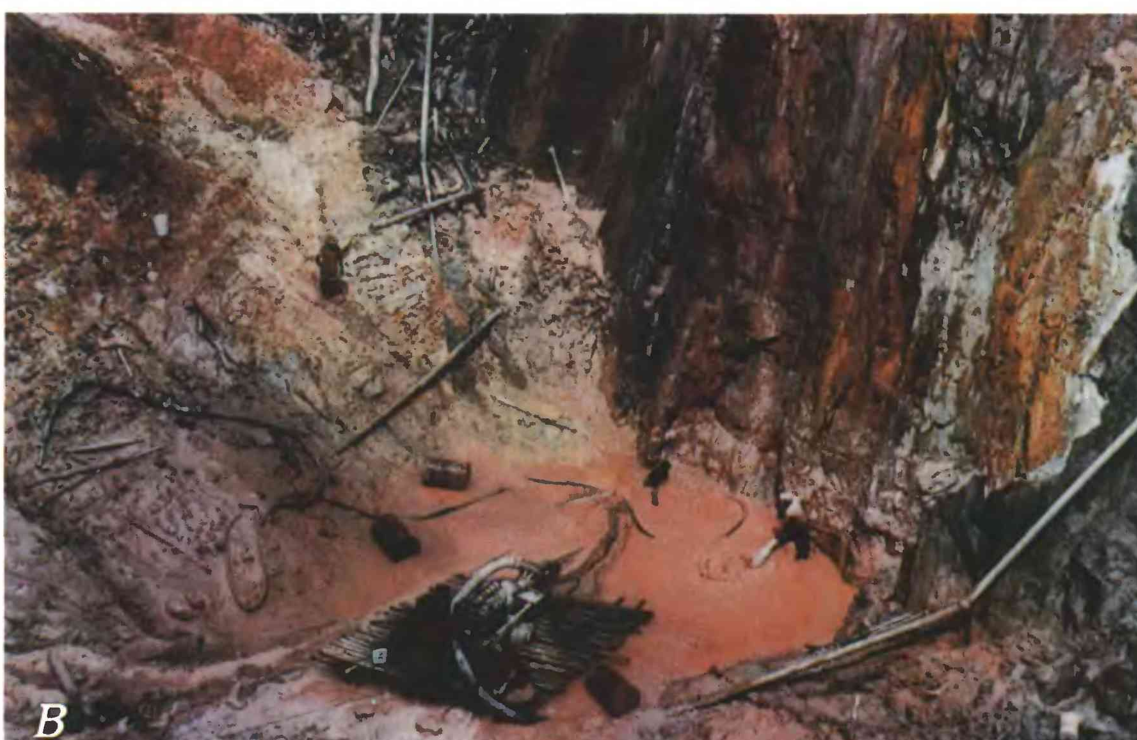


Figure 19. Saprolite-gold system, kaolinite-bearing surficial deposit, Kilometro 88, Estado Bolívar. *A*, Sidewall of prospect pit showing relict foliation in saprolitic metavolcanic sequence. Photograph by Floyd Gray. *B*, Kaolinite zones in gold prospect pit; lines are from hydraulic system used in mining saprolite-kaolinite. Photograph by Dennis Cox.

most important sources of gold in the Precambrian of Venezuela.

Table 4 lists 125 low-sulfide gold-quartz vein deposits, 28 of which have a tonnage and grade consistent with the model. The more than 45 mines in the Lo Increíble district are so closely spaced that they probably should be considered as no more than 3 deposits. Of the 19 deposits in the El Callao district for which there are tonnage and grade information, 14 have a tonnage and grade consistent with the model. Probably 9 deposits in this district are separated sufficiently from their neighbors to be counted as individual deposits. We estimate that there are at least 30 individual known deposits in the Precambrian shield of Venezuela that have a tonnage and grade consistent with the model.

PERMISSIVE DOMAIN

The area permissive (pl. 7, domain IIa) for low-sulfide gold-quartz veins is coextensive with greenstone belts (units Xm1, Xf1, Xs1, Xg1, and Xu1, pl. 2) and eugeosynclinal metavolcanic rocks (units Xm2, Xf2, Xs2, Xg2, and Xu2). Areas of amphibolite (unit Xa) are also included in the domain because in many areas amphibolite facies metamorphism probably postdated gold deposition. The total area of domain IIa is 13,175 km^2.

The area west and southwest of El Manteco (pl. 7, domain IIb) has a low probability of undiscovered deposits because of the absence of known gold occurrences despite levels of exploration similar to domain IIa. Rocks of the Imataca Complex are excluded because of their high grade of metamorphism. Areas of Cuchivero volcanic rocks, locally contact metamorphosed, are not included because of their subaerial origin. Areas of Supamo Complex are excluded mainly because of the absence of known deposits and because the complex is, for the most part, probably younger than the gold veins. In the southern part of Territorio Federal Amazonas, near Río Ugueto and the Sierra Parima, map unit Xmu (pl. 2) is assigned to domain IIa. No vein deposits have been identified in this region, but the area is permissive on the basis of placer gold occurrences and greenstone-belt rocks associated with Middle Proterozoic granitic rocks.

UNDISCOVERED DEPOSITS

Although the greatest economic return in the short term would be from developing extensions to known deposits, particularly mineralized wallrocks of veins, the possibility of undiscovered deposits is interesting from a long-term point of view.

The density of occurrence of low-sulfide gold-quartz vein deposits in California, eastern Australia, and Nova Scotia has been analyzed by Bliss and others (1987), who found that in these areas deposits have a remarkably constant density, between 4.3 and 5.4 deposits per 1,000 km^2. Assuming that deposits in domain IIa have a similar density, the domain should contain between 57 and 71 deposits. The domain is known to contain 30 deposits having known tonnage and grade. Thus, we estimate that 27–51 undiscovered deposits are present. These numbers are reasonable considering that 50 known occurrences in the domain are classified as undiscovered deposits because they lack tonnage and grade information. All or some of these could be classified as deposits if, based on future exploration, they were found to have a tonnage and grade consistent with the model. We estimate that domain IIa has a 90 percent probability of containing 20 or more undiscovered deposits consistent with the tonnage-grade model of Bliss (1986), a 50 percent chance of 40 or more, and a 10 percent chance of 50 or more.

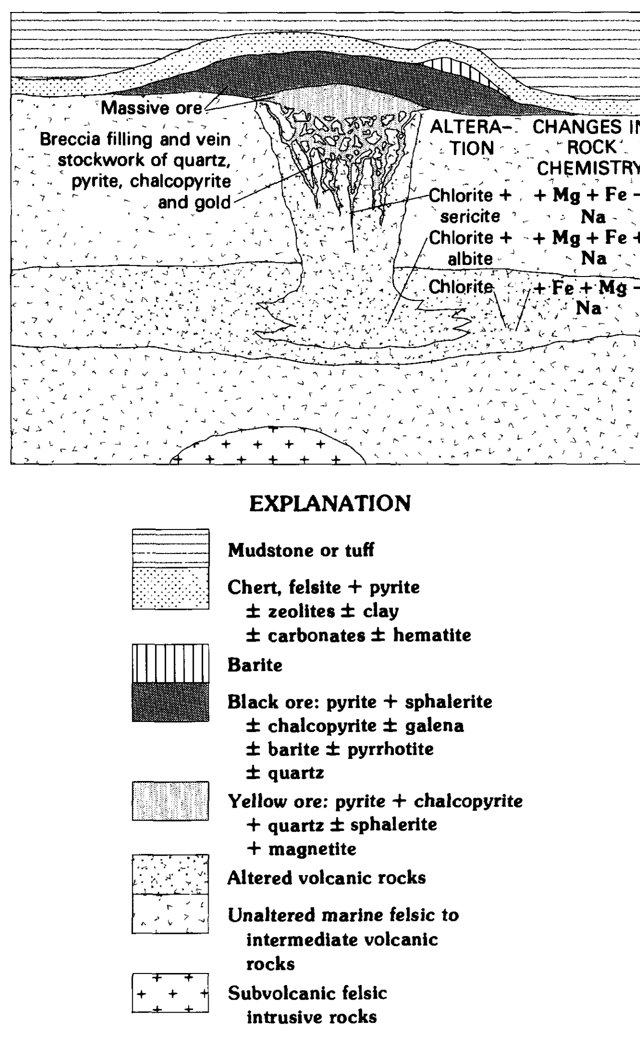


Figure 20. Schematic cross section of kuroko-type massive sulfide deposit. Modified from Franklin and others (1981).

Kuroko-Type Massive Sulfide Deposits

By Dennis P. Cox

THE MODEL

Copper- and zinc-bearing massive sulfide deposits in felsic to intermediate marine volcanic rocks were called "kuroko type" by Singer (1986a) and "Noranda type" by Franklin and others (1981)(fig. 20). Kuroko-type deposits are in marine flow rocks of andesitic to basaltic composition intercalated with submarine breccia and flow-dome complexes of dacitic to rhyolitic composition. The ore is commonly massive; that is, it contains more than 60 percent sulfide minerals and is composed of chiefly pyrite, chalcopyrite, sphalerite, and barite, subordinate galena, magnetite-hematite, and sulfosalt minerals, and traces of gold and silver minerals. Orebodies are lens shaped to stratiform. Deposits tend to be clustered around centers of felsic volcanism. They are syngenetic with respect to the surface on which they are deposited and are generally conformable with the bedding of underlying and overlying volcanic rocks. Underlying rocks commonly contain a mineralized breccia or stockwork that represents the feeder zone for the massive ore. This feeder zone is typically surrounded by a halo of magnesian chlorite alteration and an outer zone characterized by a potassic alteration assemblage. Transported ore recognized near some deposits consists of sedimentary beds of fine-grained sulfide minerals or breccia clasts composed of massive sulfide ore. Deposits are recognized by the appearance of iron-rich gossan formed during weathering and by geochemical anomalies in base- and precious-metals.

The tonnage-grade model was derived from a worldwide data set containing 432 deposits (Singer and Mosier, 1986a)(figs. 21, 22). The median deposit contains 1.5 million tonnes of ore; 90 percent of the deposits contain at least 120,000 tonnes, and 10 percent contain 18 million tonnes or more. The median copper grade is 1.3 percent, 90 percent of the deposits have a copper grade of at least 0.45 percent, and 10 percent have a copper grade of more than 3.5 percent. The median zinc grade is 2.0 percent, and 10 percent have a zinc grade of more than 8.7 percent. Only 50 percent of the deposits have a published gold

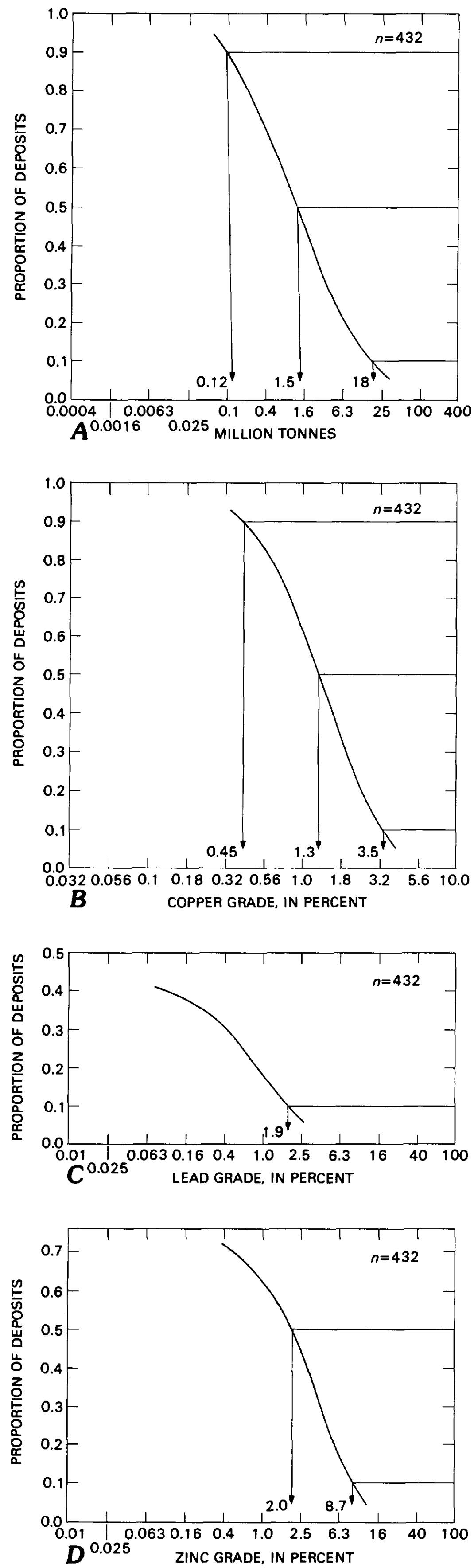


Figure 21 (facing column). Tonnage and grade model curves for kuroko-type massive sulfide deposits. Modified from Singer and Mosier (1986a, figs. 146–148). *A*, Tonnages. Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. *B*, Copper grades. Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. *C*, Lead grades. Tie line to the curved plot represents an intercept for the 10th percentile. *D*, Zinc grades. Tie lines to the curved plot represent intercepts for the 50th and 10th percentiles.

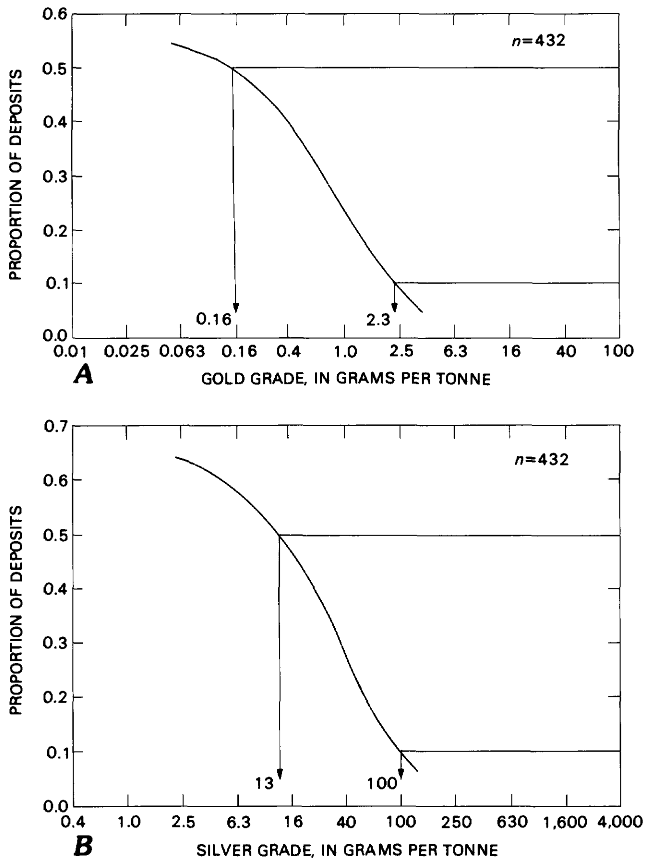


Figure 22. Precious-metal grades of kuroko-type massive sulfide deposits. Tie lines to the curved plots represent intercepts for the 90th and 10th percentiles. Modified from Singer and Mosier (1986, fig. 149). *A*, Gold. *B*, Silver.

grade; 10 percent have a grade of 2.3 grams of gold per tonne or more.

PERMISSIVE DOMAIN

No examples of kuroko-type deposits are known in the Precambrian shield of Venezuela; however, the geologic environment permissive for the deposits is widespread and their economic attractiveness makes their consideration worthwhile. The permissive domain (pl. 8, domain III) includes all of the marine volcanic and volcaniclastic rocks of the greenstone belts and other metavolcanic areas. The domain is the same as the permissive domain for low-sulfide gold-quartz veins, except that it excludes areas of gabbro and peridotite such as Sierra Verdún, areas of the Imataca terrane, and those areas considered permissive for Algoma iron deposits. Although both Algoma- and kuroko-type deposits are formed by submarine exhalative processes, the Imataca Complex contains a higher ratio of felsic to mafic rock than is characteristic of rocks that contain kuroko-type deposits.

UNDISCOVERED DEPOSITS

Massive sulfide deposits could exist in many places, undetected because of deep weathering and heavy forest cover. Ferruginous crusts derived from weathering of various types of iron-bearing rocks are widespread and easily confused with gossans derived from weathering of massive sulfide deposits. Mitigating against the existence of these deposits is the rarity of copper, lead, and zinc in the whole Guayana Shield. The low abundance of base metals may be an artifact of inadequate sampling or the result of leaching of near-surface rocks and soils in the tropical environment. Given these circumstances, we estimate that there is a 5 percent chance of one or more deposits consistent with the tonnage-grade model of Singer and Mosier (1986a).

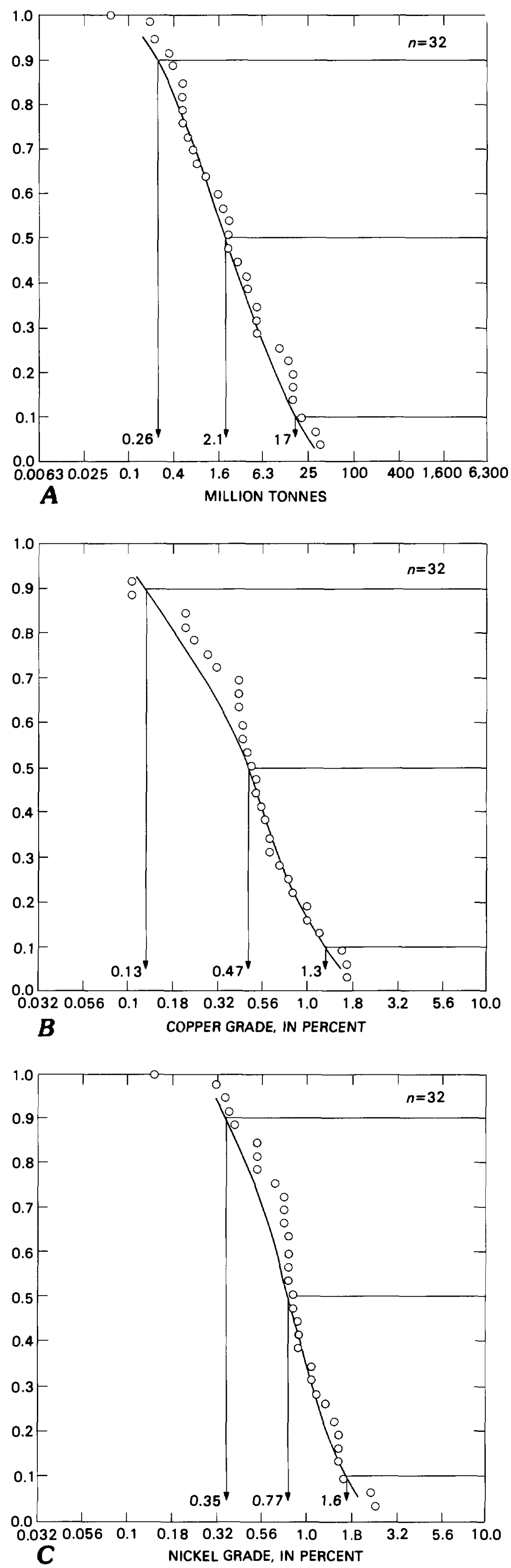
Synorogenic-Synvolcanic Nickel-Copper Deposits and Related Platinum Deposits

By Floyd Gray *and* Norman J Page

THE MODELS

Lenses of disseminated to massive iron-, nickel-, and copper-sulfide mineralization associated with gabbro intrusive rocks in greenstone belts are described as synorogenic-synvolcanic nickel-copper deposits by Page (1986) and as gabbroid class deposits by Ross and Travis (1981). They form in host rocks that range from gabbro to norite and include peridotite and anorthosite that have been intruded into tectonically active terranes. Host rocks are typically less magnesian than komatiitic rocks in Archean terranes. Chalcopyrite, pentlandite, pyrrhotite, and, less commonly, magnetite, ulvospinel, and chromite crystallized from an immiscible sulfide liquid and commonly are present as disseminations in spaces between the silicate crystals of rocks in the lower to basal parts of intrusive bodies.

A related model, Alaskan platinum-group element deposits (Page and Gray, 1986), describes the environment in which disseminated platinum-iron and osmium-iridium alloys are concentrated in zoned ultramafic and mafic rocks that intrude eugeosynclinal orogenic belts. The alloys are present with chromite or magnetite in clots or schlieren, in magmatic segregation layers, in cumulus-textured rocks, or in association with copper and (or) iron-nickel sulfide minerals. Placer platinum-group metal deposits are typically a result of weathering and are present near zoned igneous complexes.



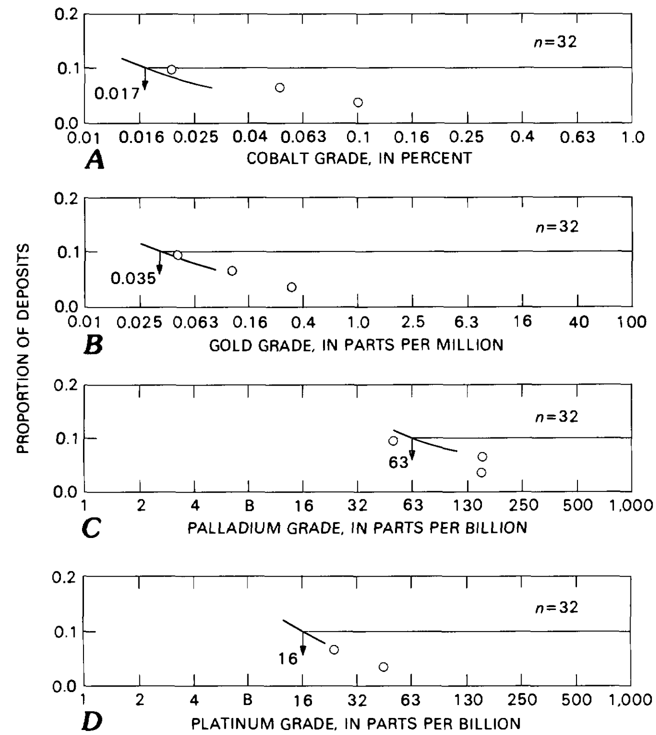


Figure 24. Byproduct grades of synorogenic-synvolcanic nickel-copper deposits. Tie lines to the curved plots represent intercepts for the 10th percentile. Modified from Singer, Page, and Menzie (1986, fig. 18). *A*, Cobalt. *B*, Gold. *C*, Palladium. *D*, Platinum.

Synorogenic-synvolcanic nickel-copper deposits are small as compared to other nickel-copper deposit types such as dunitic nickel-copper deposits; median tonnage deposits contain 2 million tonnes, and 10 percent of the deposits contain 17 million tonnes or more (fig. 23*A*). Median nickel and copper grades are 0.77 and 0.47 percent, respectively (figs. 23*B*, *C*). Ten percent of the deposits have published grades of cobalt, gold, platinum, and palladium (Singer, Page, and Menzie, 1986)(fig. 24). Tonnage-grade data are not available for the Alaskan-type deposits.

EXAMPLES IN VENEZUELA

No examples of these deposit types have been discovered in Venezuela, but permissive host environments are

Figure 23 (facing column). Tonnage and grade diagrams for synorogenic-synvolcanic nickel-copper deposits. Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. Modified from Singer, Page, and Menzie (1986, figs. 15–17). *A*, Tonnages. *B*, Copper grades. *C*, Nickel grades.

known and consist of cumulus-textured, clinopyroxene-rich, mafic to ultramafic intrusive rocks in some greenstone-belt terranes. These intrusive bodies crosscut metavolcanic and metasedimentary rocks and are present as multiphase plutons, sills, or dikes. The larger intrusive bodies, such as at Sierra Verdún and Cerro La Esperanza, locally contain hornfels in the contact zone, and all the intrusive rocks lack the strong penetrative deformation exhibited by nearby greenstone host rocks. Sulfide minerals are present in these intrusive rocks, most prominently at La Paragua, Píston de Uroy, and Sierra Verdún. The Paragua mafic-ultramafic intrusive body, in particular, contains abundant sulfide-bearing rock in discrete horizons (Jhonny Tapia, oral commun., 1990). Platinum-group-element geochemical anomalies have been identified in two areas, Píston de Uroy and La Flor Carapo.

Nickel laterite deposits associated with weathered areas of mafic-ultramafic rocks are unlikely in the Venezuelan Precambrian shield because of the lack of residual olivine-rich harzburgitic-dunitic rock that commonly underlies residual nickel deposits; the pyroxene-rich cumulus rocks that are abundant in the shield contain low concentrations of nickel.

PERMISSIVE DOMAIN

The domain permissive for this deposit type includes areas underlain by mafic and ultramafic intrusive rocks (units Xg1, Xg2, Xu1, and Xu2, pl. 2) in the Sierra Verdún, Píston de Uroy, Bochinche, Anacoco, and La Paragua areas (domain IV, pl. 8). Areas of intense mineral exploration in the El Callao district are excluded from the permissive domain.

UNDISCOVERED DEPOSITS

We estimate that there is a 1 percent chance of one or more deposits of nickel-copper-platinum group elements associated with pyroxenite and gabbroic intrusive rocks in the permissive domain.

Dolomite-Marble Deposits

By G.J. Orris

Dolomitic marble of the Guacuripia Formation (Morrison, 1953, 1956) of the Imataca Complex is disconformably overlain by schist and quartzite of the Imataca Complex. The Guacuripia Formation crops out in an east-northeast-trending range of hills that extends from the El Palmar area of Río Curipiaima to the area of Cerro Peluca. The dolomite is reported by Morrison and by Rodríguez (1986) to be uniformly bluish gray, crystalline, and fine to medium grained. At Cerro Hacha, near Salto Hacha, the formation is 85 m thick. The accessory minerals forsterite, tremolite-actinolite, muscovite, and phlogopite form about 3 percent of the rock. There is a spatial relationship between this unit and manganese deposits (see previous discussion on manganese). Dolomite mines in the Guacuripia Formation are reported to produce 30,000 tonnes of dolomite per year for the steel industry in Puerto Ordaz (Rodríguez, 1986). Other dolomite units within the Imataca Complex are not known, and resource potential is mostly limited to the identified deposits and their extensions within the known dolomite unit.

DEPOSITS FORMED IN SUPRACRUSTAL ROCKS AND EPIZONAL PLUTONS

Sedimentary rocks of the Roraima Group, volcanic rocks of the Cuchivero Group, and epizonal plutonic rocks that intrude rocks of the Cuchivero Group comprise a supracrustal terrane that is a potential host for deposits that formed near, or within a few kilometers of, the surface during the Early and Middle Proterozoic. These deposits include carbonatite and diamond pipes, as well as undiscovered deposit types such as tin greisen, porphyry copper, volcanic-hosted iron deposits, and polymetallic or epithermal veins. It is difficult to assess the potential of these undiscovered types primarily because deposits of these types are rarely found together in other parts of the world. For example, if tin greisen is abundant, then porphyry copper and the other deposit types are unlikely.

Carbonatite Deposits

By William E. Brooks, G.J. Orris, *and* Jeffrey C. Wynn

THE MODEL

Carbonatite is a carbonate-rich rock of magmatic origin that is present as intrusive bodies, flows, and pyroclastic rocks; it contains 4.0–55.4 weight percent CaO (Heinrich, 1966). Many carbonatite bodies are concentrically zoned. Structurally, carbonatite may be associated with alkaline intrusive complexes, with or without ring dikes, but not all carbonatite is associated with other alkaline rocks. Carbonatite may be of any age but is commonly intrusive into Precambrian shields and stable cratonic areas; geologically young carbonatite probably is related to rift environments (Guilbert and Park, 1985). Because carbonatite is emplaced within a few kilometers of the surface and pinches out at depth, it is commonly found in supracrustal rocks. Most, though not all, carbonatite bodies are cylindrical or pipelike in shape, and their commonly circular surface expression may be identifiable on radar images and may be further delineated by radiometric, magnetic, or gravity anomalies, depending on the composition of the carbonatite. Carbonatite may contain economic grades of phosphate, niobium, rare earth elements, uranium, thorium, titanium, iron, copper, zirconium, vermiculite, fluorite, and barite (Singer, 1986b).

The median tonnage of niobium- and rare earth element-bearing zones of carbonatite deposits is 60 million tonnes; 10 percent of the deposits contain 220 million tonnes or more of ore (fig. 25*A*). The median niobium grade is 0.58 percent Nb_2O_5; 10 percent of the deposits have a grade of 1.9 percent Nb_2O_5 or greater (Singer, 1986c) (fig. 25*B*). Ten percent of the deposits contain more than 0.35 percent rare earth element oxides (fig. 25*C*). Phosphate-bearing zones of carbonatite deposits may be coincident with, and similar in size to, niobium- and rare earth element-bearing zones. Preliminary models indicate a median phosphate grade of 18 percent P_2O_5. Ninety percent of reported barite-bearing zones have grades exceeding 20 percent barite (Orris, unpub. data, 1991).

EXAMPLES IN VENEZUELA

Cerro Impacto (6 km long by 2 km wide) is the central of three discontinuous north-trending ridges in Estado Bolívar that stand out within an irregularly shaped depression that has a maximum diameter of 20 km. This feature was first identified on radar imagery in 1971, and subsequent fieldwork and geochemistry identified the central ridge as carbonatite (Aarden and others, 1973). Tonalite, granodiorite, and granite showing signs of fenitization are adjacent to the carbonatite, and laterite in the area may be 200–300 m thick (Rodríguez, 1986; Woolley, 1987). The age of Cerro Impacto is unknown; however, it is intrusive into plutonic rocks of the Cuchivero Group and is therefore younger than about 1,900–1,800 Ma.

Geochemical analyses of samples from Cerro Impacto indicate significant contents (maximum value in weight percent oxide) of Ce (6.5), La (2.7), Nb (0.5), Th (0.4), Y (0.16), Nd (0.84), and Ba (57.8) (Rodríguez, 1986). North of the central carbonatite ridge near Río Impacto, Aarden and others (1973) sampled a 500 m by 800 m area having an average cerium content of 0.5 percent. The uranium to thorium ratio of the rocks at Cerro Impacto is 2:1 (Premoli and Kroonenberg, 1981); however, the uranium content is too low to be considered an economic target, although uranium is recovered as a byproduct at Palabora, South Africa (Premoli and Kroonenberg, 1981), and Araxa, Brazil (Young, 1984).

La Churuata is a deeply weathered, circular feature in Territorio Federal Amazonas that was identified in 1975 because of an airborne uranium anomaly. This circular feature, composed of several small hills visible on radar imagery, is an alkaline intrusive complex 3–4 km in diameter that intrudes rocks as young as the Roraima Group. No

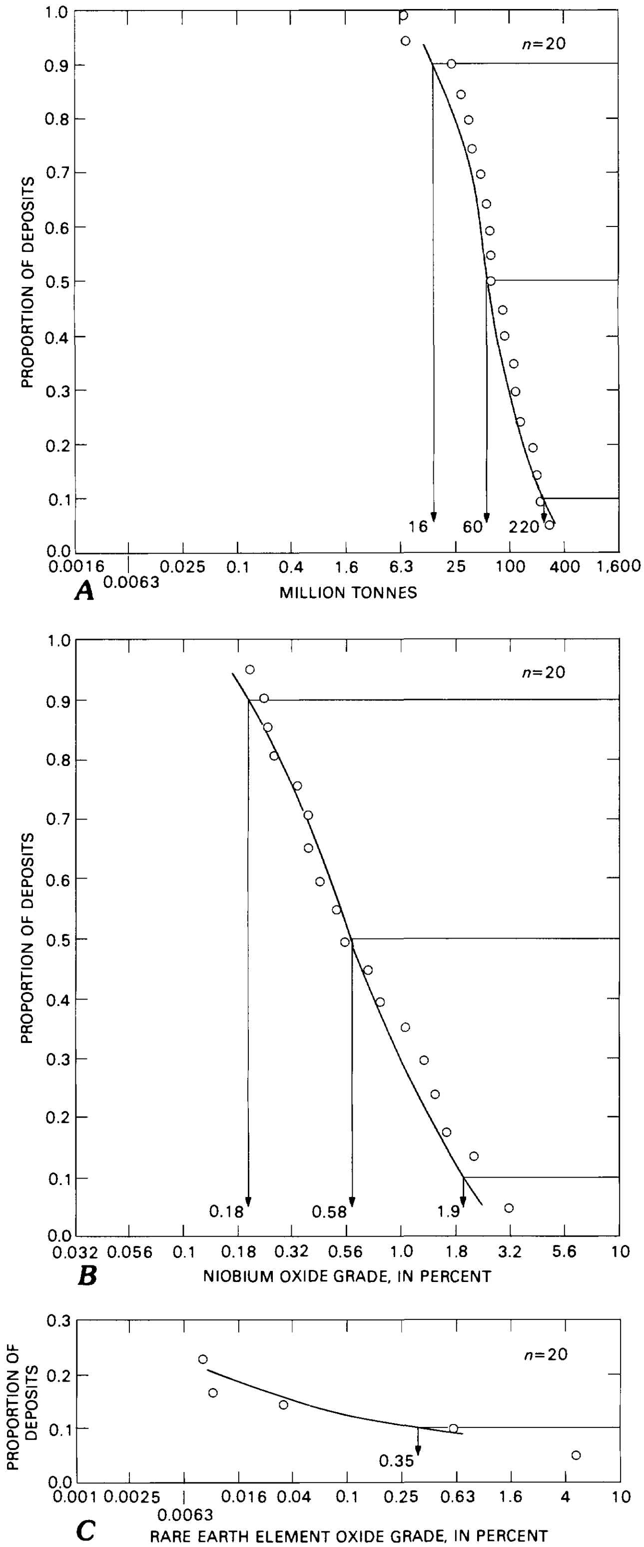


Figure 25. Tonnage and grade diagrams for carbonatite deposits. Modified from Singer (1986c, figs. 30, 31). *A*, Tonnages. Tie lines to the curved plot represent intercepts for the 90th, 50th, and 10th percentiles. *B*, Niobium grades. Tie lines to the curved plot represent intercepts for the 90th, 50th, and 10th percentiles. *C*, Rare earth element oxide grades. Tie line to the curved plot represents intercept for the 10th percentile.

carbonatite has been identified at La Churuata. Rock types include syenite, quartz syenite, and nepheline syenite. Aegirine, riebeckite, biotite, zircon, monazite, and bastnaesite are present in the syenite. Zirconium and lanthanum are present in altered rock, and Sn, La, Y, As, Pb, Zn, W, Zr, and Nb are present in stream sediments (Soares, 1985). The uranium content of the rocks in the area is low (10–160 ppm); however, Soares considered the La Churuata structure as favorable for uranium. Three Rb-Sr (whole-rock) and two K-Ar (nepheline, amphibole) ages from the intrusive rock give an average age of 1,300 Ma (Soares, 1985).

At least two alkaline rock bodies, Morro dos Seis Lagos (Brazil) and Kaituma (Guyana), are within 70 km of the Venezuelan border. Morro dos Seis Lagos in the Pico de Neblina area of the northern Amazonas of Brazil consists of three circular structures that represent lateritized carbonatite intruded into Precambrian granite and gneiss. The body was identified geochemically; the lateritic soil is characterized by total rare earth element contents of as much as 2.4 percent and by 0.15 percent Nb_2O_5, 4.5 percent ThO_2, and as much as 25 ppm U_3O_8. The deposit contains an estimated resource of 2,897 tonnes of niobium. Kaituma is a peralkaline quartz syenite intrusive body in a biotite granite. An age of 2,065+ Ma was obtained on aegirine-augite (K-Ar) (Snelling and McConnell, 1969). The radioactive minerals euxenite, samarskite, uranothorite, and titanium betafite have been identified.

PERMISSIVE DOMAIN

The area underlain by the Cuchivero Group is permissive for carbonatite deposits (pl. 8, domain V). Circular features have been noted because of the tendency of carbonatites to be associated with elliptical intrusive bodies and alkaline ring complexes as in Jacupiranga, southeastern Brazil (Melcher, 1965). The Imataca Complex, Supamo Complex, greenstone belts, and granitic rocks of the southern and western parts of Territorio Federal Amazonas are excluded because they probably are eroded too deeply for carbonatite deposits of Precambrian age to be preserved.

UNDISCOVERED DEPOSITS

Our estimate of undiscovered deposits is based on the number of circular features shown on radar imagery and inferred from aeromagnetic data, on the tendency of carbonatite deposits to cluster spatially, and on the presence of known deposits in the study area and northern Brazil. In addition to Cerro Impacto, we estimate that there is a 90 percent chance of two or more carbonatite deposits, a

50 percent chance of five or more, and a 10 percent chance of twelve or more. Approximately 80 percent of carbonatite deposits contain one or more commodities having subeconomic to economic potential.

Thorite-Rare Earth Element Veins

By Floyd Gray

THE MODEL

Thorium and rare earth element minerals, as described by Staatz (1983), Armbrustmacher (1988), and Staatz (1992), are present in quartz-potassium feldspar-iron oxide gangue in veins that are from about 1 m to more than 1 km in length and from less than 1 cm to about 16 m in thickness. Veins are generally fine grained and commonly stained with iron oxide minerals, with or without manganese oxide and hydroxide minerals. Principal ore minerals in most deposits are thorite and monazite. Possible associated minerals are brockite, allanite, bastnaesite, and xenotime. The veins are typically associated with variable suites of alkaline rocks and (or) carbonatite generally in a circular zone outboard of the alkaline rocks (fig. 26). Host rocks are mainly Precambrian in age and may include quartzite, gneiss, granite, and hornblende schist; Late Cretaceous and Tertiary host rocks are also known. Veins occupy brittle fractures and joints within 20 km of source magmas. Hydrothermal alteration near the veins is in the form of thin selvages of fenitized rock; iron-bearing minerals are altered typically to goethite and commonly to lepidocrocite and hematite.

The tonnage-grade model for this deposit type (Bliss, 1992a) is based on 32 deposits, most of which are in the continental United States (fig. 27). The median deposit contains 180,000 tonnes of ore; 90 percent of the deposits contain at least 7,000 tonnes, and 10 percent contain 4.4 million tonnes or more. The median grade of thorium oxide is 0.39 percent; 90 percent of the deposits contain at least 0.13 percent thorium oxide and 10 percent more than 1.2 percent. The rare earth element grade, where known, is as much as 0.5 percent in 10 percent of the deposits.

EXAMPLES IN VENEZUELA

No deposits have yet been identified in Venezuela as thorite-rare earth element veins. Placer accumulations of thorite, rare earth element minerals, and other heavy minerals in the Caño Aguamena-Cerro Boquerones area may have been derived, however, from unidentified sources of this deposit type.

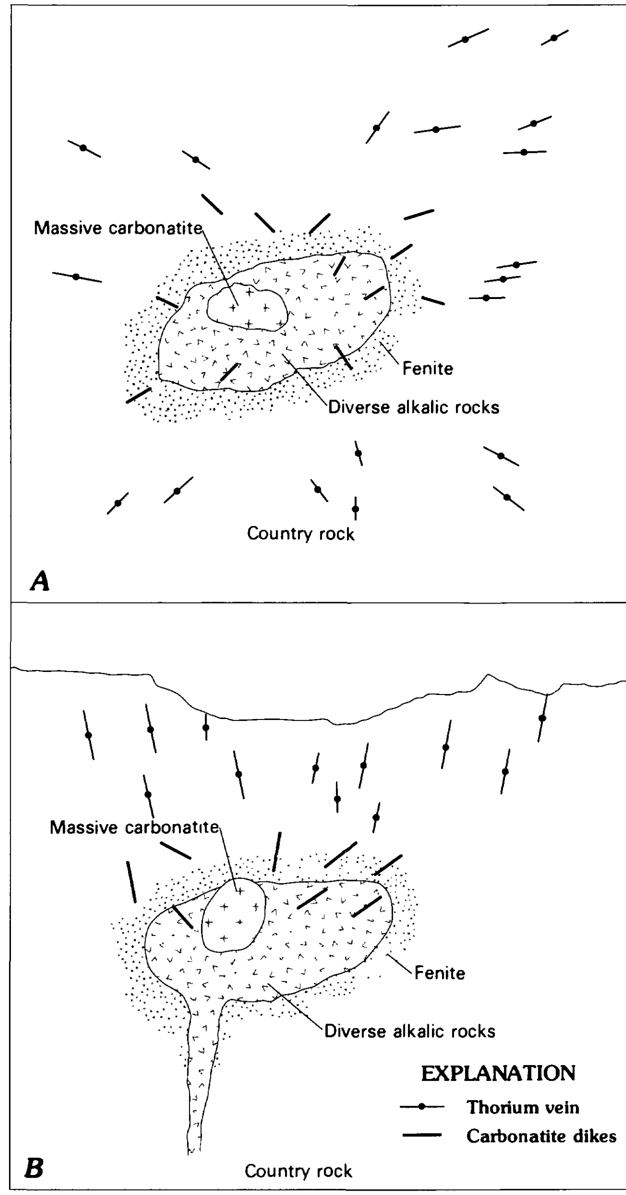


Figure 26. Idealized model showing relations between thorium-rare earth element veins and alkalic rocks and carbonatite. Modified from Staatz (1992, fig. 1). *A*, Plan view. *B*, Cross section.

Diamond-Bearing Kimberlite Pipes

By Floyd Gray

THE MODEL

Diamond pipes or kimberlite diatremes and other alkaline mafic rocks containing irregularly distributed diamonds are the major source of gem- and industrial-grade diamonds (Cox, 1986a; Michalski and Modreski, 1991). The rocks are believed to be hybrid ultramafic rocks of

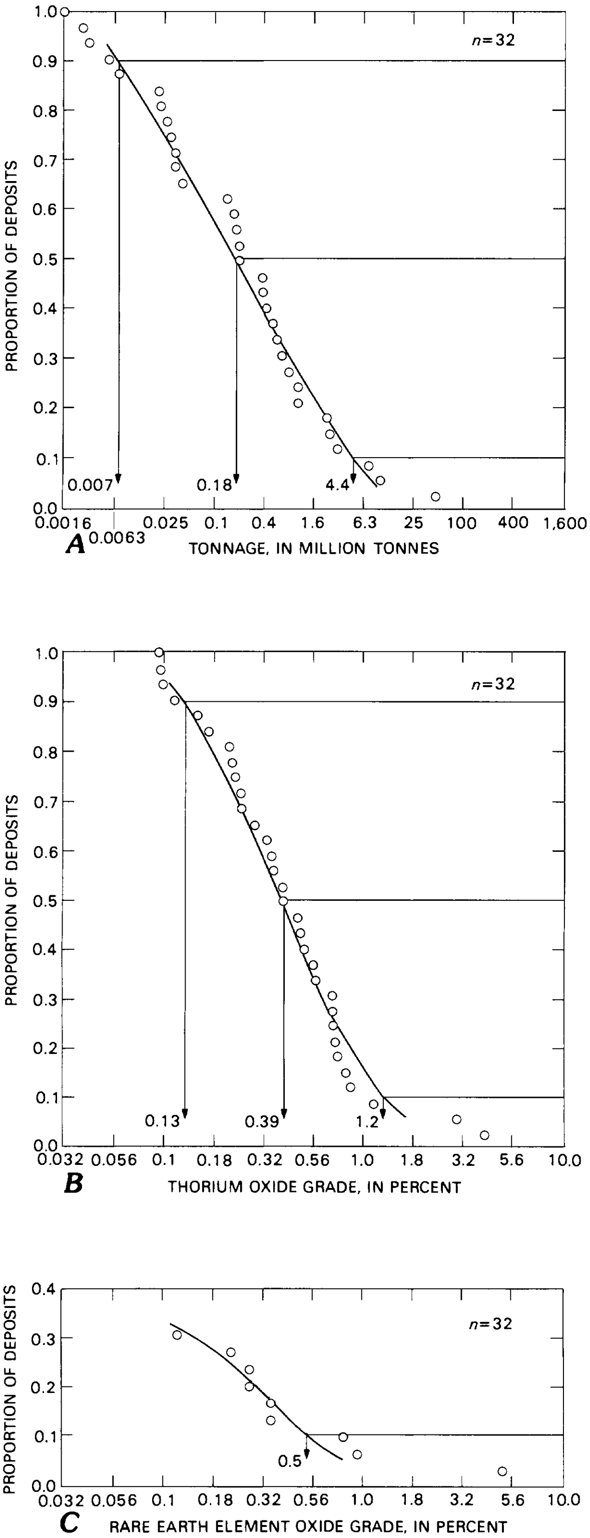


Figure 27. Tonnage and grade diagrams for thorium-rare earth element vein deposits. Modified from Bliss (1992a, figs. 2–4). *A*, Tonnages. Tie lines to the curved plot represent intercepts for the 90th, 50th, and 10th percentiles. *B*, Thorium oxide grades. Tie lines to the curved plot represent intercepts for the 90th, 50th, and 10th percentiles. *C*, Rare earth element oxide grades. Tie line to the curved plot represent intercepts for the 10th percentile.

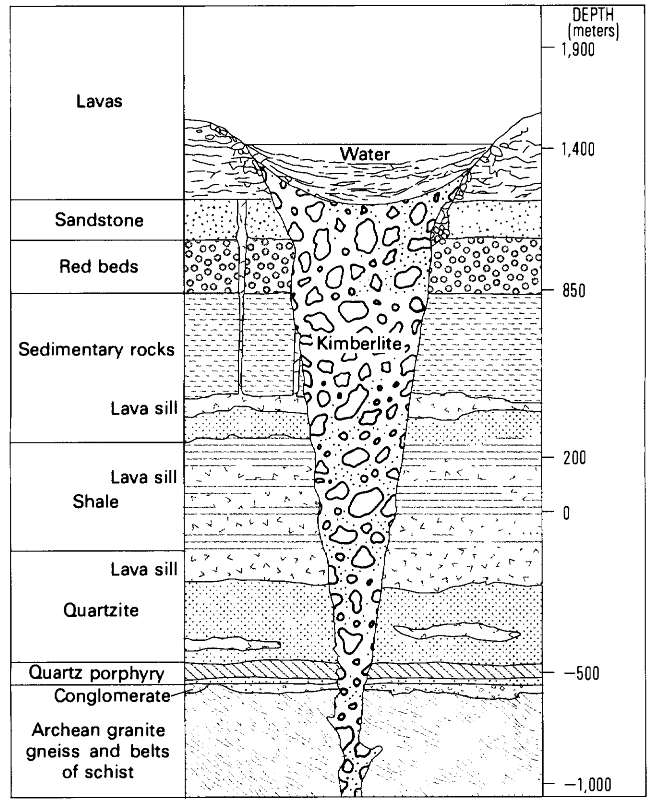


Figure 28. Cross section of a typical kimberlite pipe. Modified from Cox (1978, fig. 3).

upper mantle origin in areas of epeirogenic warping or doming and along major basement fracture zones (fig. 28). It is generally assumed that most kimberlite pipes erupted on the Earth's surface, although in most known kimberlite provinces surface features are rarely preserved. The deposits are hosted in rocks ranging in age from 2.5 Ga to 30 Ma in crudely outlined clusters of 5–15 occurrences. The pipes weather rapidly to form topographic depressions. Their geochemical signature consists of nickel and niobium and the heavy minerals pyrope garnet, phlogopite, and magnesian ilmenite; trace amounts of chromium, titanium, manganese, cobalt, and platinum-group elements are also present.

Based on data from 20 known deposits in several countries these deposits have a median tonnage of 26 million tonnes and a median diamond grade of 0.25 carats per tonne (fig. 29). Ninety percent of the deposits contain at least 2.5 million tonnes of material, and 10 percent contain more than 226 million tonnes. Ninety percent of the deposits have a diamond grade of at least 0.072 carats per tonne, and 10 percent have a grade greater than 0.83 carats per tonne (Bliss, 1992b).

Most pipes consists of several pipe- or dike-like columns of kimberlitic material, each of which has a different grade of diamonds. The economic viability of a given pipe is commonly determined not only by diamond grade

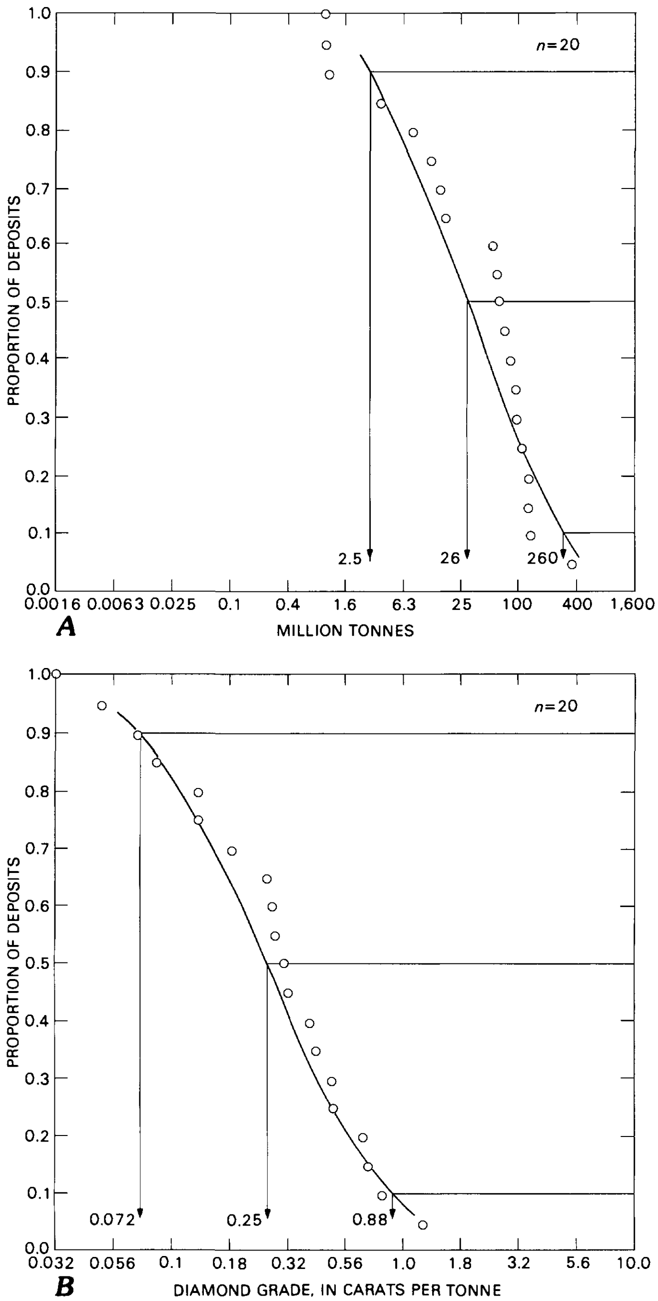


Figure 29. Tonnage and grade diagrams for diamond kimberlite pipe deposits. Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. Modified from Bliss (1992b, figs. 2, 3). *A*, Tonnages. *B*, Diamond grades.

but also by the ratio of gem- to industrial-grade diamonds and by the size, shape, clarity, and color of the gemstones. The ratio of gem- to industrial-grade diamonds in most economic deposits is about 1:4 (Michalski and Modreski, 1991).

EXAMPLES IN VENEZUELA

Diamond-bearing kimberlite has been identified in the Guaniamo district of Estado Bolívar along a stream known as Quebrada Grande. It is present as dikes and sills discontinuously exposed for a strike length of 7 km (Nixon and others, 1989); however, the main tributary and small creeks that feed from this area are diamondiferous for a distance of at least 40 km. The rocks consist mainly of yellow-green smectite and grains of ulvospinel-magnetite. Macrocrysts consist of lilac to green garnet that has kelyphitic (reaction) rims, chromite, diamond, and titanium-rich phlogopite. Yimengite is present in Venezuelan kimberlitic intrusions associated with spinel (Nixon and Condliffe, 1989). Yimengite alteration may be considered evidence for potassium-rare earth element metasomatism at the base of the craton in Venezuela, during or prior to emplacement of the kimberlitic rocks in the Early Proterozoic. Strontium whole-rock geochronology defines a poorly constrained Early Proterozoic age of 1,900±200 Ma. Neodymium model ages yield a similar Early Proterozoic age of 2,060±1,950 Ma. Micaceous lamprophyric dikes containing pyrope garnet are associated with the kimberlite, and mica from the dikes has been dated by the $^{40}Ar/^{39}Ar$ method at 850 Ma. The kimberlitic intrusive rocks in the Guaniamo area are present in a north-northwest-trending zone of faults and possible cratonal rifting (Nixon and others, 1989).

PERMISSIVE DOMAIN

The domain permissive for kimberlite intrusive rocks is virtually identical to that for carbonatite intrusive rocks. Domain V (pl. 8) includes the Cuchivero Group and sedimentary rocks of the Roraima Group. Areas of the Imataca Complex, the Supamo Complex and greenstone belts, and the granitic rocks of the southern and western parts of Territorio Federal Amazonas are excluded because they are eroded too deeply for kimberlite to be preserved, assuming that the most extensive erosion in the shield occurred from late Mesozoic through Tertiary time. Two types of areas within the permissive domain have a higher probability for undiscovered deposits of kimberlite and carbonatite. One type of area consists of crudely circular areas defined by radar imagery, aeromagnetic anomalies, residual gravity anomalies, and the association of some diamond prospects not associated with detritus of the Roraima Group. The other type of area is defined by a riftlike feature described in the section on geophysics. Many known kimberlite deposits are clustered in areas of crustal weakness or rifting.

Tin Greisen Deposits

By Dennis P. Cox *and* William E. Brooks

THE MODEL

Tin greisen deposits have been described by Taylor (1979) and Reed (1986a) as disseminated cassiterite and cassiterite veinlets in stockworks, lenses, pipes, and breccias associated with greisenized granite. Greisen alteration consists of a coarse-grained assemblage of muscovite, quartz, tourmaline, and fluorite or topaz that developed in granite during late magmatic or deuteric stages of crystallization. Granite that contains tin greisen deposits typically is mesozonal and has a high silica content (about 70 percent SiO_2). It contains anomalous amounts of F, Rb, Li, Be, W, Mo, Pb, Nb, Ta, Cs, Hf, U, and Th and is commonly depleted in Ca, Ti, Mg, Fe, Cu, Ni, V, Sc, Sr, La, and Ba. The tin greisen deposits tend to be near the apical parts of granite plutons. Placer tin deposits are typically closely associated with tin greisens.

The median tonnage of tin greisen deposits (Menzie and Reed, 1986) is 7.2 million tonnes; 10 percent of the deposits contain 65 million tonnes or more. The median grade is 0.28 percent Sn; 10 percent of the deposits have a grade of 0.47 percent Sn or higher.

EXAMPLES IN THE GUAYANA SHIELD

There are no known tin greisen deposits in Venezuela; however, in northern Brazil, less than 400 km south of its border with Venezuela, is the Pitinga deposit (lat 0°45′ S., long 60°00′ W.), perhaps the largest tin greisen deposit in the world with anticipated 1988 production of 34,000 tonnes of tin (Jones and others, 1986; Thorman and Drew, 1988). The Pitinga deposit, in the Mapuera mining district, is underlain by a suite of rhyolitic ash-flow and air-fall tuff intruded by younger granite. The intrusive rocks at Pitinga include an older biotite granite suite (1,700 Ma), a biotite-rapakivi granite (1,500 Ma), and a younger series of mafic-ultramafic dikes and sills. The Pitinga deposit is in the younger granitic rocks. Thorman and Drew (1988) indicated that the geologic setting of the Mapuera district may extend northward into Venezuela.

PERMISSIVE DOMAIN

The Cuchivero Group and related granitic rocks are similar in age and geologic setting to the rocks described in the Pitinga area and are considered permissive for tin greisen deposits (domain VI, pl. 7). Recently described circular structures, 10–12 km in diameter, in the Cuchivero terrane (García and Lugo, 1991) may indicate tin greisen targets that are structurally similar to ring features described by Thorman and Drew (1988) in the Rondonia mining district in Brazil. The Parguaza Granite terrane is also included in the permissive domain because of its approximately similar age (1,550 Ma; Gaudette and others, 1978), the rapakivi texture of the granite, and the presence of tin placers derived from pegmatite (Rodríguez and Pérez, 1982). A period of intrusion of rapakivi granite closely preceded intrusion of tin-bearing granite in the Pitinga, Xingu, and Rondonia tin districts in Brazil (Jones and others, 1986).

UNDISCOVERED DEPOSITS

No estimate of undiscovered deposits was made because of the lack of geochemical data with which to characterize granitic rocks in the permissive domain. Specifically, fluorine, rubidium, beryllium, and lithium contents would be useful in evaluating tin greisen potential.

Rhyolite-Hosted Tin Deposits

By Dennis P. Cox

THE MODEL

Rhyolite-hosted tin deposits (Reed and others, 1986) contain discontinuous veinlets of cassiterite and wood tin in rhyolitic flow-dome complexes. Specular hematite, fluorite, chalcedony, and adularia are accessory minerals in the veinlets. Stream-sediment samples from near these deposits typically contain 1,000 ppm Sn and show anomalies of the same elements found in tin granite associated with tin greisen deposits. Tin placer deposits are commonly associated with rhyolite-hosted tin.

These deposits are small and of low grade and rarely amenable to any but small, nonmechanized mining operations. Median tonnage is 1,000 tonnes, and median grade is 0.38 percent Sn. Ten percent of the deposits contain 1.1 percent Sn or more (Singer and Mosier, 1986b).

PERMISSIVE DOMAIN

Areas underlain by the Cuchivero Group are permissive for rhyolite-hosted tin deposits (see pl. 2 for areas of Cuchivero Group). No deposits are known, but their presence is suggested by small amounts of cassiterite in rhyolite, stream sediments, and panned concentrates in streams that drain into the upper Río Paragua (Sidder, 1990). Lacking other evidence regarding the distribution of tin in the Cuchivero Group, a quantitative estimate for this deposit type cannot be made.

Porphyry Copper Deposits

By Dennis P. Cox

THE MODEL

Porphyry copper deposits (Titley, 1982; Cox, 1986b) are large irregular masses of intrusive porphyry or country rock that contain chalcopyrite in stockworks and disseminations. The deposits form in felsic hypabyssal intrusive rocks emplaced at depths of 1–3 km. These intrusive rocks have a characteristic texture of small, closely spaced quartz and feldspar phenocrysts in a microaplitic groundmass. Chalcopyrite and pyrite, with or without molybdenite, are associated with pervasive characteristic alteration. Fine-grained sericitic or argillic alteration is present in the higher parts of the intrusions, and biotite and potassium feldspar are present at deeper levels. The deeper alteration produces hard, well-crystallized rocks that appear unaltered on first inspection. Two important porphyry copper subtypes are known; one contains magnetite in place of pyrite and commonly contains as much as 1 gram of gold per tonne and another contains pyrite and important byproduct molybdenite. Tropical weathering of the pyrite-rich deposits leaches copper and other metals, leaving behind clay-rich zones and no geochemical indications of a deposit. Weathering of magnetite-rich deposits can result in the deposition of copper carbonate minerals in rocks near the surface, as well as residual gold anomalies in soils.

Porphyry copper deposits are typically large (2–5 km diameter). Their median tonnage is 140 million tonnes of ore and their median grade is 0.53 percent Cu (Singer, Mosier, and Cox, 1986).

PERMISSIVE DOMAIN

Porphyry copper deposits may be present in two domains: areas underlain by felsic volcanic rocks of the Cuchivero Group and associated intrusive rocks and areas underlain by eugeosynclinal metavolcanic rocks, such as Botanamo, Anacoco, and Kilometro 88 (pl. 2). No porphyry-style mineralized rocks are documented in these areas. Porphyry having characteristic aplitic groundmass but lacking mineralization or alteration has been observed in granitic rocks of the Cuchivero Group near the village of Canaracuni. Pedro Lira (Ministerio de Energía y Minas, oral commun., 1991) reported disseminated chalcopyrite mineralization in intrusive rock encountered during drilling in the Kilometro 88 area. There is insufficient information to make an estimate of undiscovered porphyry copper deposits.

Veins of Plutonic and Volcanic Association

By Dennis P. Cox

THE MODEL

Polymetallic veins are associated with high-level plutons and porphyry and skarn base-metal deposits. Epithermal veins are associated with volcanic centers and, in some areas, with resurgent intrusions in calderas. Polymetallic veins form within 1 km of the surface, and epithermal veins form at even shallower levels. Deposits are exploited mainly for their gold and silver contents, but many contain abundant base-metal sulfide minerals.

PERMISSIVE DOMAIN

No examples of polymetallic or epithermal veins have been recognized in the Precambrian shield of Venezuela. The area underlain by volcanic rocks of the Cuchivero Group is permissive for these deposits (pl. 7, domain VIII), and their possible occurrence is supported by low-level Au, Ag, Bi, Mo, As, and W anomalies in Cuchivero rocks (Sidder and Martínez, 1990), by the presence of porphyry-copper-type intrusive rocks, and by the presence of possible caldera structures. The probability of undiscovered vein deposits cannot be assessed in this study due to the lack of geologic detail in regions potentially permissive for this deposit type.

Volcanic-Hosted Magnetite Deposits

By Dennis P. Cox

THE MODEL

Lens-shaped bodies of massive magnetite and subordinate apatite in volcanic rocks have been described in a poorly constrained descriptive model by Cox (1986c). Some deposits making up the model were formed by replacement of their host volcanic rocks and are surrounded by alteration zones containing diopside, garnet, and scapolite (Anhui Province, China). Other deposits may have been emplaced as iron-rich magmas (Kirunavaara, Sweden). Deposits may be of any geologic age; Pea Ridge, Missouri, is an example of an Middle Proterozoic deposit (1.46 Ga; Nuelle and others, 1992).

Median tonnage of these deposits is 40 million tonnes, and median grade is 58 percent Fe (Mosier, 1986b).

Volcanic-hosted magnetite deposits are similar to Olympic Dam-type deposits in terms of iron content and environment of formation. Olympic Dam in South Australia, the only known deposit of its type, is a 2-billion-tonne deposit of hematite, subordinate chalcocite, bornite, and uranium, and minor native gold and rare earth element minerals in a graben in an Early Proterozoic granitic basement. It is contemporaneous with felsic volcanism of about 1.59 Ga and is covered by more than 335 m of Late

Proterozoic and Phanerozoic sedimentary rocks. The possibility of a deposit of this type in rocks of the Cuchivero Group is difficult to evaluate because of uncertainties in the model.

PERMISSIVE DOMAIN

Areas underlain by Cuchivero Group are considered permissive for volcanic-hosted magnetite deposits because of the similarity of this environment to that of Pea Ridge, Missouri (domain VIII, pl. 7). The Parguaza Granite is similar tectonically, chemically, and in age to the Olympic Dam deposit (G.B. Sidder, oral commun., 1993). Because of uncertainties inherent in the model and the lack of known occurrences, an estimate of undiscovered deposits was not made.

Unconformity Uranium-Gold Deposits

By William E. Brooks

THE MODEL

Unconformity uranium-gold deposits, or veinlike uranium deposits, have been described by Dahlkamp and Adams (1981) and Grauch and Mosier (1986) as fracture- and breccia-filling associated with Early to Middle Proterozoic unconformities. These deposits are below, above, or across unconformities that separate Early and Middle Proterozoic rocks. Several subtypes of this deposit type exists. In Canada, uranium was originally deposited, along with sediments, on Archean basement; these sedimentary rocks were metamorphosed about 1,900–1,700 Ma and then weathered; the resulting erosion surface was then covered by Middle Proterozoic sandstone about 1,600–900 Ma (Dahlkamp and Adams, 1981).

Deposits are formed at and along the unconformity interface by mixing of reduced fluids from carbonaceous metasedimentary rocks and uranium-bearing oxidized fluids in overlying sandstone. Locally, Au, Ag, Te, Ni, Pd, Re, Mo, Hg, rare earth elements, Y, and Rb may be present. According to Mosier (1986c), median tonnage for these deposits is 260,000 tonnes, and median grade is 0.49 percent U_3O_8.

Deposits are, in some cases, difficult to detect using geophysical methods. An airborne radiometric survey at Jabiluka, Australia, failed to record any anomaly, and the ground radiometric anomaly was only slightly more than twice background (Dahlkamp and Adams, 1981).

DISCUSSION

There are no known unconformity uranium-gold deposits in Venezuela; however, the geologic setting and age of pre-Roraima sedimentary rocks in many parts of Venezuela, including the Cinaruco Formation (McCandless, 1962), the Esmeralda Formation (Sellier de Civirieux, 1966), the Los Caribes Formation (Benaim, 1972), and pre-Roraima sediments described by Briceño (1982), indicate the possibility that these types of deposits might be present. Pre-Roraima sediments were deposited on Early Proterozoic basement complex in Territorio Federal Amazonas and on Cuchivero Group and Early Proterozoic schist in the central part of Estado Bolívar (pl. 2); pre-Roraima rocks include quartzite, schist, and conglomerate. The pre-Roraima rocks have been intruded by the Parguaza Granite (McCandless, 1962), deformed into tight isoclinal and chevron folds (Ghosh, 1977), and then deeply eroded and overlain by the Roraima Group (Ghosh, 1977). The minimum age of the Roraima Group is 1,600 Ma (Priem and others, 1973); therefore, pre-Roraima sediments are inferred to be older than 1,600 Ma.

Despite the similarity in age and tectonic environment of the pre-Roraima Group unconformity and unconformities hosting major deposits in Canada and Australia, no evidence for the necessary reducing environment or for a carbonaceous component has been found in the pre-Roraima sediments. Therefore, the probability of unconformity uranium-gold deposits in the Venezuelan Guayana Shield is considered to be small.

Quartz-Pebble Conglomerate Gold-Uranium Deposits

By William E. Brooks

THE MODEL

Gold and uranium deposits associated with ancient quartz-pebble conglomerate have been described by Pretorius (1981) and reviewed by Cox (1986d). The world's most important source of gold is 2,800–2,200-million-year-old conglomerate in the Witwatersrand Basin in South Africa. Economic occurrences of this type contain 15 percent of known uranium reserves in the world (Young, 1984). These deposits are in mature monolithologic conglomerate within a thick sequence of less mature conglomerate and sandstone deposited on Archean granite-greenstone terrane. Basal volcanic rocks are present locally. Ore may be concentrated at the base of mature conglomerate in a sedimentary environment that includes braided stream channels, alluvial fans, trough crossbedding, and current- or wave-winnowed bedding surfaces (Minter and others, 1986).

DISCUSSION

The Tarkwa quartz-pebble conglomerate gold deposit in Ghana was affected by an orogeny dated at 2,100–2,000 Ma and is probably younger than the Witwatersrand deposits (Milési and others, 1991). The Tarkwa conglomerate contains no uranium in the gold mining area. A possible explanation for this lack of uranium is that by 1,645 Ma, minimum age of the Tarkwa conglomerate (Holmes and Cahen, 1955), an oxygen-rich atmosphere had developed that prevented formation of uraninite placers (Vogel, 1987). Milési and others (1991) presented arguments, however, that gold mineralization at Tarkwa is more closely associated with structures related to deformation than with features of detrital origin. Thus, Tarkwa may not properly belong to the quartz-pebble conglomerate gold model.

Gold deposits are present in French Guiana in the Orapu Series, a metasedimentary sequence that includes quartzose conglomerate. These deposits are suggestive of the quartz-pebble gold type but probably should not be included in that model. Unpublished reports by E. Manier, and P. Ledru (Milési and others, 1991) indicate that gold and polymetallic sulfide minerals are present in shear zones adjacent to the auriferous metaconglomerate of the Orapu Series.

No tonnage-grade model has been prepared for quartz-pebble conglomerate gold deposits, but data from Witwatersrand presented by Pretorius (1986) show tonnages of 10^7 and 10^8 tonnes and average grades of 5–30 grams of gold per tonne.

The basal formation of the Roraima Group is 850 m thick and comprises conglomerate, gravel, and pebbly sandstone (Reid and Bisque, 1975). The pebbles (10 cm) in the conglomerate beds (30 cm–1 m thick) are well rounded and consist of quartz, quartz porphyry, and quartzite (Wyant and others, 1953). Unmetamorphosed Cuchivero granitic and volcanic terrane is unconformable to conformable beneath the Roraima Group. A radiometric anomaly may be present in the basal Roraima (Reid and Bisque, 1975), and placer gold is commonly associated with the basal Roraima near Santa Elena de Uairén.

The Roraima Group is Middle Proterozoic (1,600 Ma; Priem and others, 1973) in age, younger than the deposits used to construct the model. Reconnaissance study of sandstone and conglomerate above the Roraima-Cuchivero contact near Santa Elena indicates only 1–9 ppm U (Brooks and Nuñez, 1991). Of the deposits in the model, the Tarkwa deposit in Ghana is a uranium-free end member of the population and younger than most other quartz-pebble conglomerate gold-uranium deposits. Vogel (1987) hypothesized that by 1,900 Ma (the age of the Tarkwa conglomerates) an oxygenic atmosphere had developed that prevented formation of economic uraninite placers but had no effect on formation of gold placers. Any deposits in the Roraima Group will more likely resemble Tarkwa rather than the uranium-enriched deposits of the model.

DEPOSITS FORMED BY SURFICIAL PROCESSES

Erosion and uplift of the Venezuelan Precambrian shield, from Mesozoic until late Cenozoic time, has produced many environments for mineral deposits. Deposits formed by leaching and residual enrichment of metals include bauxite, iron (discussed above), saprolite gold, and possibly nickel laterite. Transport and deposition of metals and minerals has produced placer deposits of gold, diamonds, titanium, and tin. Some deposit types, such as sedimentary kaolin, are produced by a combination of these surficial processes. In the northern part of the shield, most placers probably formed during the Miocene, during the period of maximum uplift (Olmore and Garcia, 1990; Olmore and others, 1990).

Laterite-Type Bauxite Deposits

By Floyd Gray

THE MODEL

Laterite-type bauxite deposits consist of residual material resulting from extreme chemical weathering of aluminous silicate rocks (Patterson, 1986). They have pisolitic, massive, nodular, or earthy textures and consist mainly of gibbsite and mixtures of gibbsite and boehmite, together with hematite, goethite, anatase, quartz, and volcanic ash. Deposits formed as a result of surficial weathering on well-drained plateaus in regions having warm to hot and wet climates. Locally, deposits may form in poorly drained areas and contain only small amounts of iron because of its removal by organic complexing. Structural and topographic features such as joints, fractures, and steepness of slope control the enrichment of Al_2O_3 and the depletion of SiO_2 (Moreno and Bertani, 1985). Laterite-type bauxite deposits are an end member of a range of similarly formed lateritic material found in tropical regions. These end members can be described in the following groups: (1) lateritic bauxite, in which the percentages of aluminum and iron are approximately equal or the percentage of aluminum is higher; if aluminum is much greater than iron, it is called bauxite; (2) lateritic iron, in which the percentage of iron is greater than that of aluminum; and (3) nickel laterite, derived from ultramafic rocks.

Based on data from 122 deposits and 32 countries, laterite-type bauxite deposits have a median ore tonnage of 25 million tonnes (Mosier, 1986d) (fig. 30*A*). Ninety percent of the deposits contain at least 870,000 tonnes of ore and 10 percent more than 730 million tonnes. Ninety percent of the deposits have ore that consists of more than 35 percent Al_2O_3, and 10 percent of the deposits exceed 55 percent Al_2O_3 (fig. 30*B*). The median grade of bauxite ore in the tonnage-grade model is 45 percent Al_2O_3.

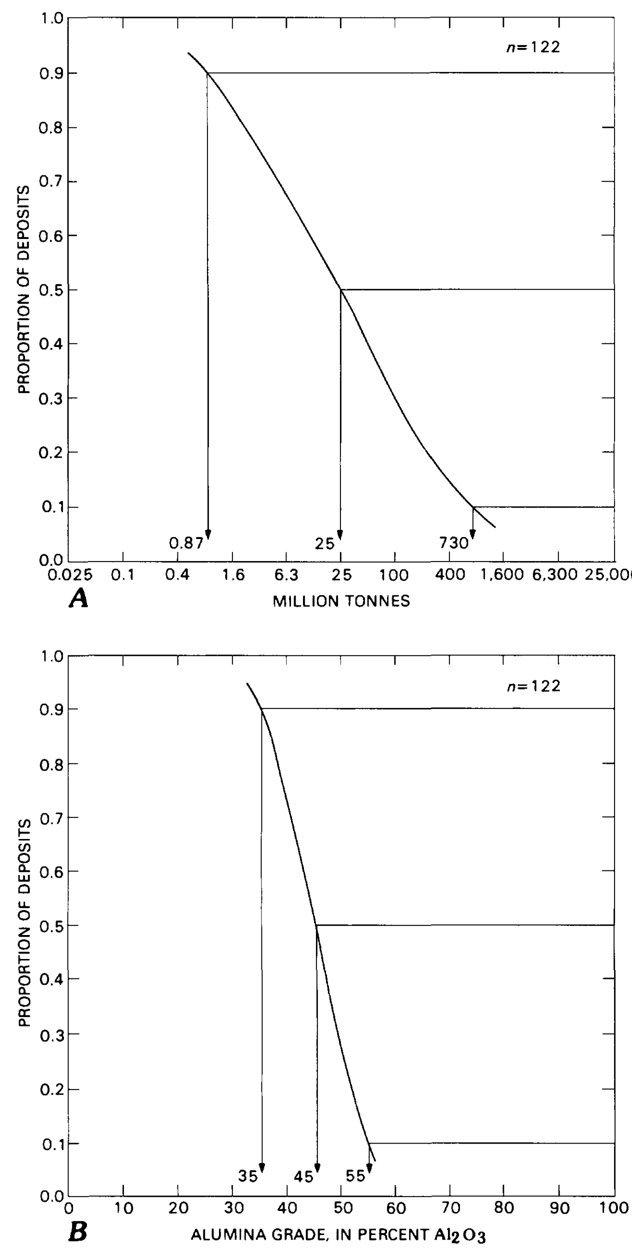


Figure 30. Tonnage and grade model curves for laterite-type bauxite deposits. Tie lines to the curved plots represent intercepts for the 90th, 50th, and 10th percentiles. Modified from Mosier (1986, figs. 191, 192). *A*, Tonnages. *B*, Alumina grades.

Table 10. Topographic surfaces of the Guayana Shield.
[Modified from Menéndez and Sarmentero (1984)]

Surface	Elevation (meters)	Age	Examples of deposits
Orinoco alluvial plain	1–50	Recent	–
Los Llanos	80–150	Pliocene-Pleistocene	Laterite.
Middle Caroní	200–350	Middle Tertiary	–
Intermediate level	400–500	Middle Tertiary	Ferruginous laterite between Ciudad Piar and La Paragua, western part of Los Pijiguaos.
Nuria	600–700	Late Cretaceous-Early Tertiary	Nuria Plateau, Los Guaicas Mountains, Los Pijiguaos, El Pao, and Cerro Bolívar iron deposits.
Kamarata	900–1,000	Jurassic or older	Roraima (Gran Sabana), southern Los Pijiguaos.

EXAMPLES IN VENEZUELA

Laterite-type bauxite deposits in Venezuela can be grouped into two categories, as suggested by Bellizzia, Pimentel de Bellizzia, and Rodríguez (1981): (1) deposits derived from mafic rocks such as diabase and gabbro-diorite complexes that intrude the Roraima Group and the Supamo Complex, respectively, and (2) deposits derived from the weathering of areas underlain by granitic rocks such as the Parguaza Granite. The differences between deposits in these two categories stems mainly from the size of source rock exposure and from the chemical composition of the source rocks. Deposits of lateritic bauxite from the first category are generally of smaller tonnage; iron is a significant component in the composition of the ore and the percentage of iron may exceed that of aluminum. Deposits in the second category, on the other hand, are of larger tonnage and have a higher proportion of aluminum with respect to iron.

Several topographic surfaces, interpreted by some workers as remnants of ancient erosional surfaces, have been identified in the Guayana Shield (table 10). Many of these surfaces are covered by laterite and lateritic bauxite deposits (Short and Steenken, 1962; Menéndez and Sarmentero, 1984, 1985).

The Los Pijiguaos deposit (fig. 31) is by far the most important bauxite deposit in the Venezuelan Precambrian shield. It formed at between 400 and 1,000 m elevation. The deposit is 7–8 m thick and is in the upper part of the weathering profile, which is about 50 m thick and developed in situ on the Middle Proterozoic Parguaza rapakivi granite (Moreno and Bertani, 1985). The granitic protolith contains 65–73 percent SiO_2 and 13.5–15 percent Al_2O_3. The area was initially discovered on the basis of geological, geomorphological, and vegetation density criteria, guided by correlation of these criteria with other known deposits elsewhere in the Guayana Shield. The total area of the surface remnants mapped in the Los Pijiguaos Mountains and vicinity is 550 km^2. The average thickness of the bauxitic mantle is 7.6 m and there is almost no overburden.

At Los Pijiguaos, the vertical profile of the deposit consists of an upper concretionary zone, underlain successively by a mottled zone, a pallid zone, weathered rock, and fresh granite. The concretionary zone has a cellular, pisolitic, or spongy texture and is composed of 60–90 percent gibbsite, 5–10 percent quartz, 5–10 percent hematite, less than 5 percent goethite, and traces of kaolinite and boehmite. The most accessible part of this bauxite deposit has proven mineable reserves of 176.5 million tonnes of bauxite having an average grade of 49.5 percent Al_2O_3 and an average thickness of 7.6 m. The ore also averages 16.6 percent Fe_2O_3, 1.2 percent TiO_2, and 9.3 percent total SiO_2.

In the Upata district at least thirteen deposits of bauxite have been identified, of which five are considered possibly economic (Candiales, 1961). These are El Chorro, La Mesa de la Carata, El Baul, Los Guamos, and Cerro Once. El Chorro has reserves of 1,259,250 tonnes and the other four together a total of 2,904,666 tonnes. The grade of bauxite varies from 39 to 67 percent Al_2O_3 and the grades of Fe_2O_3 and SiO_2 from 3 to 29 percent and from less than 1 to 23 percent, respectively. The ore is apparently a weathering product of gabbro or amphibolite.

Nuria is a high plateau that forms an amphitheater comprising a flat center and an elevated ringlike perimeter. The hills are 600–700 m in elevation. Granitic gneiss comprises the central part of the structure, and diabase (or possibly gabbro) forms the peripheral hills. Intense chemical weathering has enriched the mafic rocks in alumina and has formed a low-grade ore deposit. Total measured, indicated, and inferred reserves are 50 million tonnes of 37.5 percent Al_2O_3, 28.9 percent Fe_2O_3, and 8.7 percent SiO_2 (Candiales, 1961; Bellizzia, Pimentel de Bellizzia, and Rodríguez, 1981).

Deposits of aluminum-rich laterite and locally bauxite at Los Guaicas and in the Gran Sabana are weathering products of Middle Proterozoic and possibly Mesozoic diabasic intrusive rocks (Bellizzia, Pimentel de Bellizzia, and Rodríguez, 1981; Rodríguez, 1986). These deposits are relatively low grade (about 35 percent Al_2O_3, 30–40 percent Fe_2O_3, and 3–9 percent SiO_2) and generally small

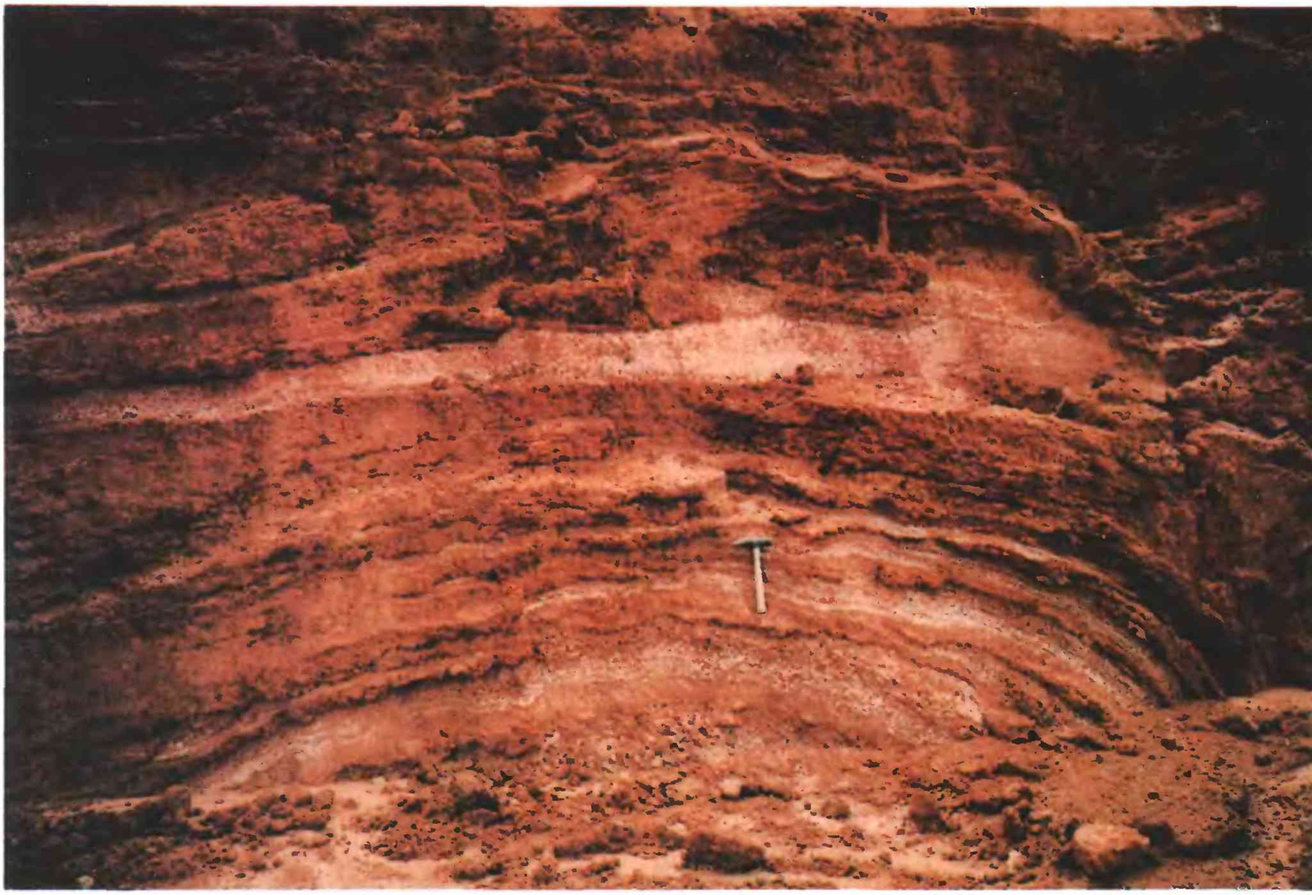


Figure 31. Los Pijiguaos bauxite deposit, Estado Bolívar. Road cut north of main mine in laterite. Photograph by Jeffrey C. Wynn.

(less than 100 million tonnes). The deposit at Los Guaicas contains 3.1 percent TiO_2 (Bellizzia, Pimentel de Bellizzia, and Rodríguez, 1981). The surface in the Gran Sabana area is between 990 and 1,100 m elevation and is called the Kamarata Surface. Minor lateritic-type bauxitic occurrences are in Estado Delta Amacuro. Occurrences in the Río Ibaruma region are thin lateritic-saprolitic surfaces in or above the Aibe Formation. Exploitable resources are small and of poor quality.

PERMISSIVE DOMAIN

The topographic surfaces and geologic characteristics of the known bauxite and lateritic deposits are keys to determining the permissive domains of laterite-type bauxite. The areas underlain by rocks containing abundant aluminum silicate minerals at elevations between 400 and 1,000 m are considered permissive for these deposits; however, because detailed topography is unavailable for large parts of the shield, no permissive domain was identified.

Residual Kaolin Deposits

By G.J. Orris *and* Floyd Gray

THE MODEL

The term "residual kaolin" refers to deposits of kaolinite-halloysite that are typically underlain by older granite, gneiss, or arkose and overlain by sedimentary strata, commonly marine. These deposits, also called saprolite or high-alumina kaolin, form in tropical to subtropical climates in areas of well-drained plains and plateaus where feldspathic source rocks can be katamorphically altered. Intense weathering leads to hydration of the anhydrous aluminous silicate minerals by acidic meteoric water to form kaolinite, potash, and silica. Further weathering leads to removal of the silica and alkalies and to the formation of laterite and local areas of gibbsitic bauxite in the overlying parts of the weathered horizon. The ratio of kaolinite to halloysite is determined by the amount of mica in the source rock; there is a positive correlation between mica content of the source rock and the kaolinite to halloysite ratio of the weathered residuum. Impurities in the kaolin include quartz, iron oxide minerals, gibbsite, ilmenite, and muscovite.

EXAMPLES IN VENEZUELA

Residual kaolin deposits in Venezuela are generally associated with alteration of planation surfaces in feldspathic gneiss of the Imataca Complex or with alteration of felsic granitic gneiss; residual deposits also may form in acidic to intermediate igneous rocks such as those in the Kilometro 88 area (Rodíguez, 1985). Kaolin deposits in granitic gneiss and gneiss complexes are spatially associated with bauxite typically underlying lateritic bauxite, for example, at Los Pijiguaos; less frequently, manganese-enriched zones are associated with these deposits.

The Kilometro 88 area may have the largest known reserves of kaolin in Estado Bolívar. The deposits, some as thick as 30 m, are associated with lateritic weathering horizons in granitic or dioritic sequences associated with post-Supamo intrusions and are partly covered by young sediments of the Río Cuyuní (Rodríguez, 1986). Estimated tonnage in the area may be in excess of 25 million tonnes of kaolin. Large deposits of kaolin are associated with gold occurrences in the Las Cristinas area; in this area normal tropical weathering of the country rocks has been enhanced by acidic decomposition of pyrite-enriched zones.

The deposits of the Upata area, although small, have been extensively mined. The principal deposits of Cerro Copeyal and San Lorenzo are in weathered zones in felsic granulitic gneiss of the Imataca Complex. Silicification of bauxitic material has resulted in the formation of some deposits (Rodríguez, 1986).

Minor deposits west of the Río Caroní are products of alteration of feldspathic gneiss of the Imataca Complex (Juan Acosta, CVG, oral commun., 1977). The deposit at Las Margaritas is 2.5 km from Río Orocopiche. The kaolin body trends N. 70° E. and is about 2 km long and about 2 m thick. Many small deposits of similar quality are being exploited in the area.

PERMISSIVE DOMAIN

Permissive areas for residual kaolin deposits are mostly the same as those for bauxite deposits. The permissive domain for these deposit types is more dependent on geomorphic and timing constraints than on rock type, and it was not possible to delineate the domain.

UNDISCOVERED DEPOSITS

No estimates of undiscovered deposits were made because we could not adequately define the permissive domains.

Sedimentary Kaolin Deposits

By G.J. Orris

THE MODEL

Sedimentary kaolin, also referred to as high-alumina clay or china clay, forms deposits that are typically underlain by much older crystalline rocks and overlain by sedimentary strata, commonly marine. The deposits form in tropical to subtropical climates where crystalline source rocks can be katamorphically altered. The resultant alteration products are transported and deposited in deltaic or tidal-flat environments where they form clay lenses within layers that are predominantly sand. Overlying deposits locally contain lignite. Postdepositional weathering and leaching result in recrystallization of the kaolinite and the formation of local areas of gibbsitic bauxite. Impurities in the kaolin commonly include quartz, iron oxide minerals, gibbsite, ilmenite, and (or) muscovite.

EXAMPLES IN VENEZUELA

Kaolin occurrences of probable sedimentary origin are present in the Tertiary Mesa Formation, which is postulated to be of mostly deltaic origin but also has alluvial and elluvial components (Hedberg and Pyre, 1944; Royo y Gomez, 1956). These occurrences are at predictable elevations in the terraces along the Río Orinoco. At least one mine is operational, and the product is used in the manufacture of ceramic tile. The kaolin likely is a mix of kaolinite, quartz, and minor iron oxide minerals. At least two kaolin-bearing units are present. The upper unit has a quartz sand content that commonly exceeds 40 percent. The upper kaolin unit is separated from the lower kaolin unit by a layer of bright-orange iron-stained sand. The lower kaolin unit is a mixture of kaolinite and small amounts of iron oxide minerals without visible quartz sand and is the part of the deposit currently being exploited.

PERMISSIVE DOMAIN

Within the study area, the Tertiary Mesa Formation is considered permissive for the discovery of additional sedimentary kaolin deposits (domain VII, pl. 8). A report that the Mesa Formation extends to the west and to the east of its current mapped outcrop could not be confirmed, and the delineated domain is therefore limited to the known outcrop area.

UNDISCOVERED DEPOSITS

An estimate of numbers of undiscovered deposits cannot be made because of a lack of geologic data on the Mesa Formation. Although the clay-bearing beds are extensive, variations in depositional facies within the formation control the quality (grade) of the kaolin. Data on these facies variations are not available.

Placer Gold

By G.J. Orris

THE MODEL

The placer gold model used in this study is that of Yeend (1986) and includes elemental gold grains and nuggets mechanically concentrated in sand, silt, and clay of alluvial, eolian, and beach deposits. This model also includes consolidated equivalents of these units, although deposits older than Tertiary are rarely preserved. In placer deposits, gold is concentrated at the base of the gravel deposits where it was trapped by stream or river riffles, fractured bedrock, bedding planes, foliation, or other structures perpendicular to the direction of water flow. Locally, gold may be concentrated above clay horizons that prevent its downward migration. In some cases, reworking or longer transport distances may increase gold concentration, average nugget size, and (or) fineness. There is a strong association between gold and quartz clasts in some placer systems, especially those related to low-sulfide gold-quartz vein deposits.

Placer gold deposits are commonly spatially associated with known gold-bearing lode. Large placer gold systems are also known that have no relation to economic gold-bearing lode deposits but instead formed from reworking of sediments originating from black shale, felsic tuff, or other rocks of generally low metamorphic grade and having low ambient gold contents. Other deposit types spatially associated with placer gold include diamond, ilmenite-magnetite, zircon, and (or) monazite placer deposits.

EXAMPLES IN VENEZUELA

Eighty-one placer gold deposits have been reported in a large part of the study area (table 5) and are mostly worked by small-scale mining techniques. A few of these deposits may actually be weathered low-sulfide gold-quartz vein deposits that are being mined by placer methods. The Carabobo placer deposits produced more than 2 tonnes of gold prior to 1968. The Corocoro placers produced more than 3.3 tonnes during the same time period. Other large placer areas are known, but production amounts have not been reported.

PERMISSIVE DOMAIN

Permissive areas for the occurrence of placer gold include areas downstream from known placer gold deposits and known lode gold deposits. In addition, placer gold deposits may be present downstream of areas of greenstone rocks and areas of Cuchivero Group rocks permissive for epithermal gold deposits. All areas downstream of Roraima Group and pre-Roraima rocks are also considered to be permissive for gold placers because of reported gold in the basal conglomerates. Despite the long history of small-scale placer mining within the study area, the mining methods used have been relatively inefficient, and deposits of very fine sized gold may have been overlooked.

UNDISCOVERED DEPOSITS

Grades and tonnages of placer gold deposits were modeled by Bliss and Orris (1986). These deposits have a median tonnage of 1.1 million tonnes and a median grade of 0.2 grams of gold per tonne. The extensive permissive area and the wide range of placer gold grades and tonnages make it difficult to estimate the potential number of undiscovered deposits, but their number and the amount of probable contained gold are thought to be significant.

Placer Diamond

By Floyd Gray *and* G.J. Orris

THE MODEL

Diamonds transported from weathered source rocks and deposited in alluvial and beach sediments, sandstone, and conglomerate are termed "placer diamonds" (Lampietti and Sutherland, 1978; Cox, 1986e). Deposits are in coarse, clastic-textured sedimentary sequences and are typically Tertiary and Quaternary in age. Diamonds are concentrated with other heavy minerals in the low-energy parts of stream systems and typically decrease in size and increase in quality with distance from their source. Streams draining areas of kimberlite pipes or diamond concentrations (paleoplacers) in sedimentary or metamorphic rocks form the principal environment of deposition; however, alluvial diamond deposits may be as far as 1,000 km from their source. Where kimberlite or lamproite form the source rocks, geochemically anomalous Cr, Ti, Mn, Ni, Co, platinum-group elements, and Ba may be a signature of the deposits. Anomalous nickel and niobium, together with the heavy minerals pyrope garnet, chrome diopside, magnesian ilmenite, and phlogopite, indicate nearby kimberlite pipes.

EXAMPLES IN VENEZUELA

Diamonds are in alluvial and residual deposits within the Guayana Shield of Venezuela. Production in 1986 totalled 212,000 carats of about 20 percent gem quality and 80 percent industrial quality and decreased in 1987 to about 113,000 carats of about 36 percent and 64 percent gem and industrial quality, respectively (Newman, 1988). Peak production of 1,248,979 carats was in 1974, and total production between 1913 and 1987 was 13,570,917 carats and about 25 percent gem quality (Anez, 1985; Baptista and Parra, 1985; Newman, 1988).

The source of the diamonds has been variously ascribed to the conglomerates of the basal Roraima Group (unit YXr, pl. 2) or pre-Roraima rocks (unit Xpr), to kimberlite deposits of West Africa, or to local weathered kimberlite (Quebrada Grande, Guaniamo district, see discussion on kimberlite). Although no occurrences of diamonds within the Roraima Group have been documented, there is a pronounced spatial association between alluvial diamond deposits and outcrops of the Roraima Group. With the major exception of the Quebrada Grande area workings, most known diamond placer deposits are either within areas of mapped Roraima Group or in areas downstream from this unit.

Although the lack of documented diamond finds within the Roraima Group has led some authors to postulate that the source of the diamond placers is kimberlite deposits of west-central Africa (Reid, 1974; Briceño, 1984), most West African kimberlites are younger the Roraima. Briceño (1984) stated that the conglomerates in the Uairén Formation were themselves paleoplacers and were the source for diamond-bearing gravels deposited about 8,000 years ago at San Salvador de Paúl. These Holocene paleoplacers probably are the source of diamonds in some deposits in currently active drainages.

Alluvial diamond deposits of the Guaniamo district are the most important diamond placers in Venezuela and have produced an estimated 12 million carats of diamonds during the last 20 years (Baxter-Brown and Baker, 1990). The area, discovered in 1968, accounts for approximately 85 percent of Venezuela's total reported historical diamond production (Fairbairn, 1971; Anez, 1985). The main area of production is along Quebrada Grande, a tributary of Río Guaniamo. Río Guaniamo flows into Río Cuchivero, which in turn enters the Río Orinoco several kilometers east of Caicara. Quebrada Grande and its tributaries are diamondiferous for 40 km or more.

A generalized stratigraphic profile of the Guaniamo area consists of a basement of igneous rocks, typically diabase, as at La Salvación, or a weathered granite that is essentially ferromagnesian or kimberlitic (Baptista and Svisero, 1978; Nixon, 1988; Baxter-Brown and Baker, 1990). Basal material is typically thoroughly altered and forms an irregular depositional surface. A coarse diamond-bearing angular to subangular gravel unit directly overlying the basal material forms a relatively thin (3 m thick or less) horizon consisting of quartz, microcline, chalcedony, chert, and lithic fragments of igneous rock in a clay-rich matrix. Pebbles 25–50 mm in size in a poorly sorted matrix indicate torrential-like high-energy deposition. The upper part of the section consists of fine-grained sedimentary rocks such as fine-grained, crossbed-stratified sandstone, mudstone, and organic-rich claystone. Minerals such as pyrope garnet, magnesian ilmenite, chrome diopside, olivine, and sphene in the coarse gravels also indicate a kimberlitic origin.

Diamond placer deposits associated with rocks of the Roraima Group form the second major group of occurrences in the Venezuelan Guayana Shield. These deposits are in the basins of Ríos Caroní, Paragua, and Icabarú and their tributaries below the high cliffs of the Roraima Group in the southeastern part of the country. The most prominent locale of this group is the San Salvador de Paúl area. Although records are poor, overall production in the San Salvador area exceeds 2 million carats; production is estimated at 2,000 carats per month (Briceño, 1984). Distribution of stone quality is approximately 49.17 percent gem, 36.2 percent industrial, and 14.63 percent bort (Maziarek, 1975). The high percentage of gem-grade diamonds and the absence of other minerals of kimberlitic association that are less resistant to transportation suggest either a distal kimberlitic source or more than one cycle of sedimentation or both (Briceño, 1984). The pattern of sedimentation observed in diamond-bearing unconsolidated sediments is fairly systematic (Briceño, 1984); basal diamond-bearing gravels rest on either iron-rich laterite or deeply weathered pre-Roraima rocks. These gravels are poorly sorted and clay rich and consist of extremely angular fragments of milky vein quartz and clear quartz crystals showing little wear mixed with coarse to very coarse sand that is well rounded. Iron concretions and silicified sandstone fragments may be present in the matrix. At least one area, Urimán, contains jasper-rich detrital material that fines upward into medium- and fine-grained sands commonly characterized by an organic-rich interval. The organic-rich horizon is overlain by either fluvial or windblown sediments extending to the surface.

The general mechanism of diamond deposition in unconsolidated sediment is interpreted as follows. (1) Diamonds were released by weathering, then (2) trapped and concentrated in the thick tropical soil profile. (3) With the initiation of drying climatic conditions about 9,000–8,000 years B.P. (representing savannalike conditions), diamonds and associated detritus were transported and deposited by high-energy streams (Briceño, 1984). (4) Continued dry conditions decreased the transporting capacity of streams, generating the finer grained upper profile of the sedimentary section. The upper section has been dated by carbon-14 methods at 6,470±340 years B.P. (5) Present-day conditions are that of a very humid tropical forest environment.

PERMISSIVE DOMAIN

The domain permissive for diamond placers is coincident with that outlined for diamond-bearing kimberlite pipes and also includes lowlands (about 400 m elevation) draining areas of the lower part of the Roraima Group, pre-Roraima rocks, and outliers of these formations. Extensions of this domain include the total length of basin-alluvial deposits of all major rivers and streams draining the above mentioned sequences. The large area east of Río Caura and south of the Río Supamo-Río Yuruaní basins and including major drainages such as the Caroní and Paragua that drain the Roraima and associated formations is considered to have a lower probability for undiscovered high-grade deposits because of the absence of kimberlitic source rocks (known or suspected) and the lack of known deposits. It must be noted, however, that the seasonal high-energy load capacity of rivers such as the Caroní carries diamond-enriched gravel-size material long distances from Roraima sources. The well-rounded diamond-bearing pebble conglomerate and modern-day river sediments southwest of Puerto Ordaz represent distal deposits.

Tin-(Rare Earth Element, Niobium-Tantalum) Placers

By William E. Brooks *and* Floyd Gray

THE MODEL

Placer tin deposits (secondary deposits) form the major source of tin for the world's markets. These deposits are loosely classified as eluvial (that is, residual, saprolitic), colluvial, stream-beach sand, eolian, and so forth (Jenkins, 1970; Daily, 1973; Taylor, 1979). Precambrian tin provinces are commonly characterized by regions of tin-bearing pegmatite and closely associated quartz-cassiterite veins. Alluvial deposits are usually linked with the unroofing of lode-tin-bearing formations and are present in both modern and fossil streambeds. Cassiterite and associated heavy minerals may be concentrated in streams as silt- to cobble-size nuggets near the source. Ilmenite, zircon, and monazite, as well as columbite-tantalite, may be present if the gravels are derived from cassiterite-bearing pegmatite. The deposits are commonly within a few kilometers (<8 km) of the source, and the minerals may concentrate in riffles and other structures transverse to stream flow. Anomalous amounts of Sn, As, B, F, W, Be, Cu, Pb, and Zn may be present. Deposits may be any age but are usually Tertiary or younger (Reed, 1986b).

Placer and residual deposits are significant sources for niobium, tantalum, and rare earth elements. These deposits are commonly associated with tin- and titanium-bearing placers and share model characteristics with them; however, source rocks such as carbonatite, the primary host rock for niobium-rare earth element deposits, are commonly tin and titanium poor. Deposits in general are small but may be sufficiently numerous in a local area to constitute an economically important district (Parker and Adams, 1973). Local radioactive anomalies caused by thorite and monazite commonly characterize these heavy-mineral accumulations.

EXAMPLES IN VENEZUELA

In the Caño Aguamena-Cerro Boquerones area, 45 km north of Puerto Ayacucho and east of the town of Puerto Paez, cassiterite, tantalite-columbite, and rutile have been reported in stream sediments (Rodríguez and Pérez, 1982; Rodríguez, 1986). Heavy-mineral concentrations of from 13 g/m^3 to 11 kg/m^3 are a few kilometers downslope from source pegmatites and associated quartz veins in the Parguaza Granite (Pérez and others, 1985).

Areas in which heavy-mineral concentrations are less quantifiable, such as the upper Río Paragua and the region of the upper Río Orinoco near Sierra Parima, suggest the occurrence of low-grade (subeconomic) alluvial tin. These areas were identified during regional exploration.

There are no known placer niobium-tantalum or rare earth element deposits in Venezuela; however, neither regional geochemical data nor information from prospects and occurrences were available from frontier areas of Venezuela at the time of this study.

PERMISSIVE DOMAIN

The domain permissive for alluvial placer tin-niobium-tantalum deposits includes drainages underlain by the Parguaza Granite, drainages of other areas considered permissive for tin greisen deposits, and drainages within a minimum 8-km-wide band outward from the contact between the Parguaza Granite and older rocks. A secondary boundary for tin-niobium-tantalum deposits includes areas underlain by other young anorogenic granites including rapakivi-textured calc-alkaline granite (unit Xg, pl. 2), late granite (unit Ylg), and small alkaline complexes.

Permissive areas of niobium-tantalum, rare earth element deposits exclusive of tin-bearing areas include areas immediately adjacent to suspected carbonatite deposits.

Placer Titanium and Other Heavy Minerals

By Jeffrey C. Wynn

THE MODEL

Ilmenite, minor rutile and zircon, and other heavy minerals are generally weathered from rocks containing primary titanium-rich deposits such as alkalic igneous rocks, gabbro, anorthosite, syenitic veins and pegmatites, granite, and high-grade metamorphic rocks and are concentrated by fluvial processes in river and stream channels and along their margins (see Force, 1986, for a related ocean-shoreline model). These heavy-mineral sands are in fluvial areas draining continental cratons, along present-day beaches and in deltas and along streams where they settle from the slower moving water. Some placer deposits are derived from older detrital deposits. These are medium- to fine-grained, well-sorted black sands in modern drainages or in river beach deposits; ilmenite is the primary titanium-bearing mineral. The black sands, chiefly ilmenite and (or) magnetite, are normally interlayered with low-feldspar to nonfeldspathic quartz sand. Garnet, zircon, rutile, sillimanite, cassiterite, or monazite may also be sufficiently abundant to be economically important. On river shorelines the heavy minerals are concentrated in dark layers on beaches and in high-water deposits, and in rivers the heavy minerals tend to collect in potholes and deep channels that are parallel with the current flow. Other producing titanium mineral deposits may form as a result of the winnowing of titanium-bearing saprolite by modern streams (Herz and others, 1970)

EXAMPLES IN VENEZUELA

Rodríguez and Pérez (1982) and Pérez and others (1985) reported titanium (in the form of rutile)-, tin-, niobium-, and tantalum-bearing alluvium in the area of Cerro Boquerones near the confluence of the Ríos Orinoco and Meta. These deposits directly overlie the 1,545-Ma Parguaza Granite. Samples taken from laterite-derived sediments ranging in size from clay to coarse-grained sand have concentrations of heavy minerals ranging from 13 g/m^3 to 11 kg/m^3. The heavy fraction of these samples contains 0–0.77 percent Sn, 0.01–0.23 percent Nb, 1.8–29.1 percent Ti, and 0.5–11.0 percent Zr (Pérez and others, 1985). These alluvial deposits apparently were derived from the weathering of pegmatite and mineralized quartz veins in the Parguaza Granite to the east and southeast. The titanium-bearing ore minerals are staniferous rutile and columbiferous rutile (Rodríguez and Pérez, 1982).

Candiales and Anez (1972) reported heavy-mineral concentrates in sediments in the Río Chicanan containing an average of 71 kg/m^3 ilmenite; some concentrates contain as much as 200 kg/m^3 ilmenite. Ilmenite makes up about 86 percent of the heavy minerals; 5 percent chromite and 1.5 percent zircon are present. The percentage of ilmenite increases as the sediments become finer grained. Amounts of gold vary from 2 to 5 g/m^3 in dredged river gravels (Candiales and Anez, 1972).

At least two feasibility studies have been conducted in the lower Río Caroní drainage (Amelinck, 1974; Charles McCallester, oral commun., 1989), as well as some limited exploitation of naturally concentrated black sands. The sands in this area contain as much as 55 percent ilmenite, as well as minor rutile, magnetite, staurolite, and zircon (Andrew Grosz, oral. commun., 1989). Locally, the sands contain gold and diamonds. These sands may also contain monazite and platinum-group elements. Gold miners in the Río Caroní use these sands to guide their dredging operations. The Río Aro west of Ciudad Bolívar apparently has significant quantities of black sands in beach deposits (conversations with local miners, 1990).

PERMISSIVE DOMAIN

The Ríos Aro, Caroní, Chicanan, Caura, and Paragua, as well as smaller drainages deriving from the Imataca Complex, are permissive for the occurrence of black sands containing ilmenite and other heavy minerals. Rivers in Territorio Federal Amazonas that drain the San Carlos metamorphic plutonic terrane (unit Xmp, pl. 2) and the igneous-metamorphic basement complex (unit Xbc) may also be permissive areas. Rocks of the Supamo Complex, the Cuchivero Group, and the Roraima Group can probably be excluded because of their metamorphic grade. The Río Cuyuní drainage, which contains ilmenite from an unknown source, may also be permissive.

Creeks and rivers draining the Parguaza batholith or cutting into alluvial fans produced over the batholith must be considered as permissive areas for quartz-vein- and pegmatite-derived titanium (in the form of rutile), tin, tantalum, and niobium (Rodríguez and Pérez, 1982; Pérez and others, 1985).

UNDISCOVERED DEPOSITS

Data are insufficient to allow quantitative estimates of number of undiscovered deposits of placer titanium and heavy minerals (other than gold) in Venezuela.

CONCLUSION

The major objective of this mineral resource assessment was to identify the various permissive domains controlling the distribution of mineral deposits and to define and classify the deposit types present or potentially present in the Precambrian Venezuela Guayana Shield. Thirteen deposit types are present, and nine deposit types may be present. Of these twenty-two deposit types, estimates of undiscovered deposits were made for five (table 11).

We were unable to make quantitative estimates for the other deposit types because of a lack of reconnaissance geochemical maps showing the distribution of Cu, Pb, Zn, Ag, Mo, Be, Nb, Ba, Li, rare earth elements, and other elements and a lack of regional geophysical data in the northwestern part of the shield. A lack of regional topographic maps hampered our analysis of residual deposits.

As more geologic information is developed and interpreted in view of modern mineral deposit models and well-documented grade-tonnage characteristics, the geologic community can build on this comprehensive study and further evaluate the quality of mineral resources in the Venezuelan Guayana Shield.

Table 11. Estimates of undiscovered deposit types, Venezuelan Guayana Shield.

Deposit type	Chance of occurrence				
	90 percent	50 percent	10 percent	5 percent	1 percent
Algoma iron	9 or more	26 or more	90 or more		
Low-sulfide gold-quartz veins	20 or more	40 or more	50 or more		
Carbonatite	2 or more	5 or more	12 or more		
Kuroko-type massive sulfide				1 or more	
Synorogenic-synvolcanic nickel-copper					1 or more

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APPENDIX—COMMODITY DEPOSITS INDEX FOR THE PRECAMBRIAN SHIELD OF NORTH-EASTERN SOUTH AMERICA INCLUDING VENEZUELA, GUYANA, SURINAME, AND NORTHERN BRAZIL

A mineral occurrence map for northeastern South America (pl. 6) was prepared from a Mineral Resources Data System (MRDS) file. A listing of the unedited MRDS data is given in this appendix. Inquiries about information stored in MRDS may be obtained from the regional MRDS representative at the U.S. Geological Survey, Minerals Information Office, Corbett Building, 340 North 6th Avenue, Tucson, Arizona 85705–8325, or at the U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, Virginia 22092.

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC30113	GARIMPO AMANA	BR	PARA	05-20-00S	057-37-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30112	IGARAPE PACU	BR	PARA	05-17-00S	058-11-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30111	RIO AMANA	BR	PARA	05-16-00S	057-26-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30110	RIO MAUES-IGARAPE PA	BR	AMAZONAS	04-37-00S	057-49-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30109	TERRA PRETA, PANEIRO	BR	AMAZONAS	07-45-00S	058-47-00W	CU BA	STRATAFORM		LIMESTONE, DOLOMITE,	M PROT
TC30108	RIO SUCUNDURIZINHO	BR	PARA	07-25-00S	058-48-00W	MN	STRATIFORM, SEDIMENT		QUARTZITE	M PROT
TC30107	MANUELZINHO, PARCEIR	BR	PARA	07-24-00S	054-48-00W	AU DIA	PLACER		GRAVEL	CEN
TC30106	IGAAPE BAU	BR	PARA	07-24-00S	054-48-00W	SN	PLACER		GRAVEL	CEN
TC30105	RIO MAPURA	BR	PARA	07-22-00S	057-11-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30104	VELHO GUILHERME	BR	PARA	06-48-00S	051-10-00W	SN	PLACER		GRAVEL	CEN
TC30103	TRIUFO	BR	PARA	06-33-00S	053-03-00W	SN	PLACER		GRAVEL	CEN
TC30358	CARAJAS SERRA NORTE	BR	PARA	06-02-00S	050-12-00W	FE			IRON FORMATION.	ARCH
TC30102	RIO BRANCO	BR	PARA	06-58-00S	051-00-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30357	CARAJAS SERRA SUL	BR	PARA	06-18-00S	050-27-00W	FE	IRON FORMATION,SEDIM		IRON FORMATION	ARCH
TC30101	ANTONIO VICENTE, PAR	BR	PARA	06-16-00S	052-14-00W	SN	PLACER		GRAVEL	CEN
TC30100	BOM DESTINO	BR	PARA	08-06-00S	053-32-00W	SN	PLACER		GRAVEL	CEN
TC30356	SERRA DE SAO FELIX	BR	PARA	06-23-00S	051-50-00W	FE AU	IRON FORMATION, STRA		IRON FORMATION	ARCH
TC30355	CARAJAS SERRA LESTE	BR	PARA	05-55-00S	049-40-00W	FE	IRON FORMATION, SEDI		IRON FORMATION	ARCH
TC30099	ANANA	BR	PARA	07-25-00S	052-57-00W	SN	PLACER		GRAVEL	CEN
TC30098	SERRA DOS GRADAUS	BR	PARA	07-32-00S	050-50-00W	SN	PLACER		GRAVEL	CEN
TC30097	SAO FRANCISCO	BR	PARA	07-00-00S	052-17-00W	SN	PLACER		GRAVEL	CEN
TC30096	MOCAMBO	BR	PARA	06-51-00S	051-59-00W	SN	PLACER		GRAVEL	CEN
TC30095	IGARAPE MAGUARI, SAO	BR	PARA	06-36-00S	051-47-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30094	CARRAPANA	BR	PARA	06-35-00S	051-13-00W	NI	LATERITE	LATERITIC NICKEL	LATERITE ON SERPENTI	ARCH
TC30093	SERRA ARQUEADA	BR	PARA	06-30-00S	050-41-00W	FE	STRATAFORM, IRON FOR		IRON FORMATION, ITAB	ARCH
TC30092	PIUM, SERRA DO PIUM	BR	PARA	06-27-00S	050-26-00W	FE	STRATAFORM, IRON FOR		IRON FORMATION, ULTR	ARCH
TC30091	SERRA DO RABO	BR	PARA	06-34-00S	049-45-00W	FE	STRATIFORM, IRON FOR		IRON FORMATION, ITAB	ARCH
TC30090	RIO VERMELHO	BR	PARA	06-34-00S	049-50-00W	NI	LATERITE, RESIDUAL		LATERITE ON SERPENTI	ARCH
TC30089	PUMA	BR	PARA	08-23-00S	050-58-00W	NI	LATERITE, RESIDUAL	LATERITIC NICKEL	LATERITE ON SERPENTI	ARCH
TC30088	SAO SEBASTIAO	BR	PARA	06-10-00S	051-58-00W	NI	LATERITE, RESIDUAL	LATERITIC NICKEL	LATERITE ON SERPENTI	ARCH
TC30087	BAHIA	BR	PARA	06-02-00S	050-30-00W	CU AU AG	DISSEMINATED, STRATA		SANDSTONE, GRAYWLKE,	EPROT
TC30086	SERRA NORTE-N5	BR	PARA	05-58-00S	050-01-00W	AL1	LATERITE, RESIDUAL	LATERITE-TYPE BAUXITE	LATERITE ON METABASA	ARCH
TC30085	POUJUCA	BR	PARA	05-54-00S	050-26-00W	CU ZN AU AG	STRATIFORM, DISSEMIN		AMPHIBOLITE	ARCH
TC30084	SERRA PELADA	BR	PARA	05-54-00S	049-42-00W	AU PD	DISSEMINATED, PLACER		LOW GRADE MUDSTONE,	EPROT
TC30083	SERRA DO SERENO	BR	PARA	05-52-00S	049-33-00W	MN	STRATIFORM		QUARTZITES, MICA SCH	ARCH
TC30082	SALOBO 3A	BR	PARA	05-45-00S	050-27-00W	CU AU AG FE MO	STRATAFORM, VEINS, D		AMPHIBOLITE SCHIST A	ARCH
TC30081	SERRA DE BURITIRAMA	BR	PARA	05-30-00S	050-13-00W	MN	STRATAFORM, LATERITE		QUARIZITE, MICA SCHI	ARCH
TC30080	RIO TOCANTINS	BR	PARA	05-17-00S	048-52-00W	DIA AU	PLACER		GRAVEL	QUAT-HOLO
TC30079	ILHA DAS POCAS, CANA	BR	BAHIA	04-51-00S	049-19-00W	DIA AU	PLACER		GRAVEL	CEN
TC30078	VOTORANTIM	BR	PARA	04-48-00S	048-29-00W	AL1	LATERITE	LATERITE-TYPE BAUXITE	SEDIMENTS	CEN
TC30077	VILA BELA	BR	PARA	04-37-00S	049-22-00W	DIA AU	PLACER		GRAVEL	CEN
TC30076	CERRO CAPITARI, SAUD	BR	PARA	04-30-00S	049-30-00W	DIA AU	PLACER		GRAVEL	CEN
TC30075	RIO IRIRI	BR	PARA	04-27-00S	053-43-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	QUAT-HOLO
TC30074	ANUERA	BR	PARA	04-10-00S	049-37-00W	DIA AU	PLACER		GRAVEL	CEN
TC30073	SERRA DA TOCANDERA	BR	PARA	06-52-00S	051-04-00W	FE	STRATAFORM BEDDED		IRON FORMATION, ITAB	ARCH
TC30072	SERRA DO ANTONHAO	BR	PARA	06-50-00S	051-45-00W	FE	STRATAFORM BEDDED		IRON FORMATION, ITAB	ARCH
TC30070	RIO UATUMA (2)	BR	AMAZONAS	01-18-00S	060-05-00W	SN	PLACER		GRAVEL	CEN
TC30069	SERRA DE ABONARI	BR	AMAZONAS	01-16-00S	060-19-00W	SN	PLACER		GRAVEL	CEN
TC30325	SERRA DO ARACA	BR	AMAZONAS	00-30-00N	063-03-00W	DIA	PLACER		GRAVELS	CEN
TC30068	RIO VATUMAI	BR	AMAZONAS	01-36-00S	060-01-00W	SN	PLACER		GRAVEL	CEN
TC30067	RIO PARDO	BR	AMAZONAS	01-42-00S	060-23-00W	SN AU	PLACER		GRAVEL	CEN
TC30066	IGARARE SANTO ANTONI	BR	AMAZONAS	01-29-00S	060-01-00W	SN	PLACERS		GRAVEL	CEN
TC30065	IGARAPE ITABOCA	BR	AMAZONAS	01-29-00S	060-18-00W	AU SN	PLACER		GRAVEL	CEN
TC30064	UNMAMED PROSPECT	BR	PARA	01-49-00S	054-37-00W	PB ZN CU	STRATIFORM		LIMESTONE AND DOLOMI	CARB-PERM
TC30063	SERRA DO JAMARI	BR	PARA	01-45-00S	056-35-00W	AL1	LATERITE	LATERITE-TYPE BAUXITE	SHALES AND SILTSTONE	TERT
TC30062	IGARAPE SAPUCUA	BR	PARA	01-41-00S	056-28-00W	AL1	LATERITE	LATERITE-TYPE BAUXITE	SHALES AND SILTSTONE	TERT
TC30061	RIO JATAPU	BR	AMAZONAS	01-32-00S	058-28-00W	FE	STRATAFORM, BEDDED		SANDSTONE	DEV
TC30060	RIO JATAPU	BR	AMAZONAS	01-32-00S	058-35-00W	AL1	LATERITE	LATERITE-TYPE	SANDSTONE	DEV

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC30059	BAHIA, SAO FRANCISCO	BR	PARA	00-51-00S	054-55-00W	SN	PLACER		GRAVEL	CEN
TC30056	SERRA SETE DE SETEMB	BR	PARA	00-36-00S	056-51-00W	CU PB ZN	STRATIFORM		ANDESITE	M PROT
TC30057	SERRA DO MAICURU	BR	PARA	00-26-00S	054-13-00W	TI	DISSEMINATED, MAGMAT		ALKALINE ROCKS	M PROT
TC30056	AGUA BRANCA	BR	AMAZONAS	00-28-00S	059-56-00W	SN	PLACER		GRAVEL	CEN
TC30055	SERRA DO CACHORRO	BR	PARA	00-20-00S	057-33-00W	SN	PLACER		GRAVELS	CEN
TC30054	E. OF AVEIRO	BR	PARA	03-49-00S	055-03-00W	DIA	PLACER		GRAVELS	CEN
TC30053	E. OF NHAMUNDA	BR	AMAZONAS	02-13-00S	056-56-00W	AL1	LATERITE	LATERITE-TYPE BAUXITE	SHALES AND SILTSTONE	TERT
TC30052	SERRA BERENICE, SERR	BR	PARA	01-22-00S	052-35-00W	AL1	LATERITE		SEDIMENTS	TERT
TC30051	RODOVIA PA-22	BR	PARA	01-00-00S	048-06-00W	CLY	STRATAFORM, BEDDED			TERT
TC30050	PAU DA ANDORINHA	BR	PARA	01-53-00S	048-45-00W	CLY	STRATIFORM			TERT
TC30049	ACAPUZAL	BR	AMAPA	00-59-00S	052-15-00W	AL1	LATERITE, RESIDUAL	LATERITE-TYPE BAUXITE		TERT
TC30046	MORRO DO FILIPE	BR	AMAPA	00-30-00S	052-22-00W	CLY3	STRATIFORM, BEDDED			TERT
TC30047	SERRA MARACANAI	BR	PARA	00-34-00S	053-21-00W	TI	LATERITE		ALKALINE ROCKS WITH	MPROT
TC30046	RIO CARECURU	BR	PARA	00-08-00S	053-00-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	PLEIST HOL
TC30045	RIO XINGU	BR	PARN	03-32-00S	051-45-00W	SN AU	PLACERS		GRAVELS	CEN
TC30044	JUTAI	BR	AMAZONAS	01-30-00S	052-59-00W	AL1	LATERITE	LATERITE-TYPE BAUXITE	CLAYS	QUAT, HOLO
TC30043	SAO GABRIEL DA CACHO	BR	AMAZONAS	00-19-00N	066-41-00W	REE TH NB V BE ZN	MAGMATIC, DISSEMINAT		CARBONATITE	CRET
TC30042	RIO CAUABURI	BR	AMAZONAS	00-36-00N	066-09-00W	AU	PLACER		GRAVELS	CEN
TC30041	RIO BRANCO	BR	RORAIMA	01-41-00N	061-08-00W	AU SN	PLACER	PLACER AU-PGE	GRAVELS	QUAT, HOLO
TC30040	GARIMPO MOCIDADE, SE	BR	RORIAMA	02-12-00N	061-35-00W	AU	PLACER AND VEIN	PLACER AU-PGE	GRAVELS	CEN
TC30039	RIO COUTO MAGALHAES	BR	RORIAMA	02-42-00N	062-59-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30038	IGARAPE PRAINHA	BR	RORIAMA	02-41-00N	062-39-00W	AU		PLACER AU-PGE #39A	GRAVEL	CEN
TC30037	SURUCUCUS	BR	RORIAMA	02-50-00N	063-45-00W	SN	PLACER		GRAVELS	CEN
TC30036	RIO URARIQUERA	BR	RORIAMA	03-28-00N	063-25-00W	AU	PLACER		GRAVELS	CEN
TC30035	RIO TACUTU	BR	RORIAMA	03-38-00N	060-06-00W	DIA	PLACER		GRAVELS	CEN
TC30034	TEPEQUEM	BR	RORIAMA	03-45-00N	061-45-00W	DIA AU	PLACER		GRAVELS	CEN
TC30033	RIO URARICAA	BR	RORIAMA	03-36-00N	062-23-00W	AU DIA	PLACER		GRAVELS	CEN
TC30032	RIO PARA	BR	PARA	00-50-00N	054-09-00W	SN NB TA	PLACER		GRAVELS	CEN
TC30159	RIO MARUPA	BR	PARA	07-15-00S	056-55-00W	AU SN	PLACER		GRAVEL	CEN
TC30031	RIO TACUTU	BR	RORIAMA	02-05-00N	059-45-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30156	RIO MARUPA	BR	PARA	07-03-00S	056-55-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30030	SERRA DO TUCANO	BR	RORIAMA	03-25-00N	059-55-00W	DIA	PLACERS		SANDSTONES	CRET
TC30029	SERRA GUARIBA	BR	RORIAMA	03-45-00N	059-51-00W	MO	VEINS		BIOTITE GRANITE	PROT
TC30157	CABECEIRAS DO SURUBI	BR	PARA	07-02-00S	056-34-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30028	IGARAPE DO LAGO	BR	AMAPA	00-02-00N	051-16-00W	AL1	LATERITE	LATERITIC TYPE BAUXITE	SEPIMENTS	TERT
TC30156	GARIMPO MUNDICO COEL	BR	PARA	06-50-00S	056-50-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30027	RIO PRETO	BR	AMAPA	00-04-00N	051-43-00W	CR	PODIFORM CHROMITE, M		SERPENTINIZED ULTRAM	ARCH
TC30155	CREPORIZINHO	BR	PARA	06-49-00S	056-37-00W	AU SN	PLACER		GRAVEL	CEN
TC30026	SERRA DO IPITINGA	BR	PARA	00-19-00N	053-24-00W	FE	STRATAFORM, BEDDED,		IRON FORMATION, ITAB	ARCH
TC30154	RIO NOVO	BR	PARA	06-44-00S	056-10-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30025	SANTA MARIA	BR	AMAPA	00-22-00N	051-50-00W	AU DIA	PLACER		GRAVELS	CEN
TC30153	IGARAPE SANTO ANTONI	BR	PARA	06-44-00S	057-33-00W	SN	PLACER		GRAVEL	CEN
TC30024	RIO VILLA NOVA	BR	AMAPA	00-24-00N	051-35-00W	FE	STRATIFORM, BEDDED,		IRON FORMATION, ITAB	ARCH
TC30152	GARIMPO PATROCINIO	BR	PARA	06-44-00S	056-27-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30023	SANTA MARIA	BR	AMAPA	00-29-00N	052-05-00W	SN NB TA	PLACER		GRAVEL	CEN
TC30151	RIO SURUBIM	BR	PARA	06-43-00S	056-15-00W	SN AU	PLACER		GRAVEL	CEN
TC30022	MONGUBAS	BR	AMAPA	00-36-00N	051-54-00W	MN	STRATAFORM		METAMORPHIC ROCKS	ARCH
TC30150	PORTO ALEGRE	BR	PARA	06-41-00S	056-55-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30021	PORTO GRANDE, SERRA	BR	AMAPA	00-57-00N	051-44-00W	SN NB TA	PLACER		GRAVELS	CEN
TC30149	GERMANO	BR	PARA	06-42-00S	056-37-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30020	RIO AMAPARI	BR	AMAPA	01-44-00N	052-26-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30148	RIO CABURA, CABITUTU	BR	PARA	06-36-00S	057-28-00W	SN	PLACER		GRAVEL	CEN
TC30019	RIO AMAPA	BR	AMAPA	02-40-00N	051-02-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC30147	MALOQUINHA	BR	PARA	06-38-00S	057-26-00W	SN	PLACER		GRAVEL	CEN
TC30016	RIO CALCOENE	BR	AMAPA	02-25-00N	051-10-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30146	GARIMPO AGUA BRANCA	BR	PARA	06-31-00S	050-17-00W	SN AU	PLACER		GRAVEL	CEN
TC30017	RIO CACIPORE	BR	AMAPA	02-46-00N	057-30-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30145	RIO CREPORI	BR	PARA	06-27-00S	056-54-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC30144	RIO DAS TROPAS	BR	PARA	06-27-00S	057-28-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30016	RIO CUNARI	BR	AMAPA	02-24-00N	051-15-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30143	RIO CURUA	BR	PARA	06-22-00S	054-43-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30015	RIO ANOTAIE	BR	AMAPA	02-51-00N	051-58-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30142	GARIMPO SAO DOMINGOS	BR	PARA	06-23-00S	056-17-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30014	RIO VAUARIS	BR	RORAIMA	04-01-00N	064-15-00W	AU SN	PLACER		GRAVELS	CEN
TC30141	CABACEIRAS DO TOCANT	BR	PARA	06-20-00S	056-26-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30013	FAZENDA MORENINHA, S	BR	RORIMA	04-40-00N	060-47-00W	MO	VEIN		BIOTITE GRANITE	MPROT
TC30012	SERRA DO MEL	BR	RORIAMA	04-10-00N	060-55-00W	MO	VEINS		BIOTITE GRANITE	MPROT
TC30139	GARIMPO PIRANHAS	BR	PARA	06-07-00S	050-28-00W	AU SN	PLACER		GRAVEL	CEN
TC30011	SERRA DO ARAI	BR	RORIAMA	04-32-00N	060-58-00W	AL1	LATERITE	LATERITE-TYPE BAUXITE	CLAYS	CEN
TC30138	RIO PACU	BR	PARA	06-06-00S	057-22-00W	AU SN	PLACER		GRAVEL	CEN
TC30010	BOA VISTA MUNICIPIO	BR	RORIAMA	04-34-00N	060-15-00W	DIA AU	PLACER		CONGLOMERATES AND SA	M PROT
TC30009	XIRIQUI, VOLTA REDON	BR	RORIMA	04-28-00N	059-52-00W	DIA	PLACER		CONGLOMERATE	MPROT
TC30136	GARIMPO MAENE FARIAS	BR	PARA	06-04-00S	056-18-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30008	APERTAR DA HORA, VID	BR	RORIAMA	04-25-00N	059-45-00W	DIA	PLACER		CONGLOMERATE	MPROT
TC30007	MINA VELHA, MINA BRA	BR	RORAIMA	04-33-00N	060-10-00W	DIA AU	PLACER		CONGLOMERATES	MPROT
TC30135	CARNEIRINHO	BR	PARA	06-00-00S	056-39-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30006	SANTO ANTONIO DO PAO	BR	RORAIMA	04-30-00N	060-28-00W	DIA	PLACER		CONGLOMERATES	M PROT
TC30134	CUIU-CUIU	BR	PARA	05-57-00S	056-36-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30005	FAZENDA SUAPI	BR	RORAIMA	04-36-00N	060-51-00W	DIA AU	PLACER		CONGLOMERATES	MPROT
TC30133	IGARAPE CANTAGALO	BR	PARA	05-55-00S	057-22-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30004	GARIMPOS PEDRA PRETA	BR	RORAIMA	04-39-00N	060-30-00W	DIA AU	PLACER		CONGLOMERATES	MPROT
TC30132	IGARAPE BOMJARDIM	BR	PARA	05-51-00S	056-57-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30003	RIO QUINO	BR	RORIAMA	04-40-00N	060-40-00W	DIA AU	PLACER		SANDSTONES	M PROT
TC30131	RIO JAMANXIM	BR	PARA	05-44-00S	055-49-00W	DIA	PLACER		GRAVEL	CEN
TC30002	ORINDUNQUE	BR	RORAIMA	04-43-00N	060-04-00W	DIA	PLACERS		CONGLOMERATE	MPROT
TC30130	RIO TOCANTINS	BR	PARA	05-33-00S	056-16-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30001	SERRA VERDE	BR	RORAIMA	04-50-00N	060-35-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30129	RIO RATO	BR	PARA	05-36-00S	056-41-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30128	BATISTA	BR	PARA	05-24-00S	055-56-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30127	BOA ESPERANCA	BR	PARA	05-23-00S	056-02-00W	SN	PLACER		GRAVEL	CEN
TC30126	GARIMPO JOAO LEITE	BR	PARA	05-20-00S	056-55-00W	AU SN	PLACER		GRAVEL	CEN
TC30125	RIO BRANCO, SERRA PO	BR	PARA	05-07-00S	055-43-00W	SN	PLACER		GRAVEL	CEN
TC30124	LUA NOVA	BR	PARA	05-13-00S	056-50-00W	AU SN	PLACER		GRAVEL	CEN
TC30123	PARAISO	BR	AMAZONAS	06-25-00S	058-15-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30122	SUCUNDURI	BR	AMAZONAS	06-45-00S	059-04-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30121	LIBERTADORES	BR	AMAZONAS	06-01-00S	057-56-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30120	MAUES	BR	AMAZONAS	06-01-00S	058-09-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30119	ZE PRETINHO	BR	AMAZONAS	06-02-00S	057-54-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30118	TEODORICO, CRIPU	BR	AMAZONAS	05-51-00S	058-04-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30117	SERRA MORENA, ROSA D	BR	AMAZONAS	05-42-00S	058-01-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30116	SUCUNDURI	BR	AMAZONAS	05-54-00S	058-58-00W	MN	STRATAFORM		SANDSTONE	LPROT
TC30115	RIO ABACAXIS	BR	AMAZONAS	05-37-00S	058-49-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30114	GARIMPO CANELA	BR	PARA	05-29-00S	057-56-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30237	RIO JAMANXIM	BR	PARA	06-03-00S	055-51-00W	DIA	PLACER		GRAVEL	CEN
TC30224	RIO NOVO	BR	RONDONIA	01-58-00S	063-48-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30223	SAO LUIS	BR	RONDONIA	01-58-00S	064-00-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30222	IATA	BR	RONDONIA	01-38-00S	065-22-00W	AU AG PB PT	PLACER, VEINS		GRAVEL, GENEISSES	ARCH
TC30221	SERRA DA PROVIDENCIA	BR	RONDONIA	01-30-00S	061-45-00W	MN	STATAFORM, LATERITE		PHYLLITES	M PROT
TC30220	GARIMPO FORMOSO	BR	RONDONIA	01-17-00S	064-28-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30219	ARARAS, TAQUARA	BR	RONDONIA	09-56-00S	065-18-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30218	MUTUM-PARANA, JIRAU	BR	RONDONIA	09-36-00S	065-05-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30214	RIACHUELO	BR	RONDONIA	01-59-00S	061-37-00W	SN	PLACER, STOCKWORK	SN GREISEN	GRAVEL	CEN
TC30213	ALTO CANDEIAS-S, DOM	BR	RONDONIA	01-33-00S	063-37-00W	SN	PLACER	SN GREISEN	GRAVEL	CEN
TC30212	CARIRI	BR	RONDONIA	01-00-00S	062-54-00W	SN	PLACER, STOCK WORK	SN GREISEN	GRAVEL	CEN
TC30211	SAO DOMINGOS	BR	RONDONIA	01-04-00S	063-07-00W	SN	PLACER, STOCKWORK	SN GREISEN	GRAVEL	CEN
TC30210	MACANGANA, TABOCA	BR	RONDONIA	01-00-00S	063-22-00W	SN	PLACER, STOCKWORK	SN GREISEN	GRAVEL	CEN

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC30209	MORRO POTOSI	BR	RONDONIA	09-16-00S	062-52-00W	SN	PLACER, VEINS, DISSE	SN GREISEN	GRAVELS	CEN
TC30208	SAN CARLOS	BR	RONDONIA	09-48-00S	063-02-00W	SN	PLACER		GRAVEL	CEN
TC30207	ABUNA, SAO SEBASTIAN	BR	RONDONIA	09-42-00S	065-34-00W	SN	PLACER	SN GREISEN	GRAVEL	CEN
TC30206	ALTO RIO PRETO	BR	RONDONIA	09-42-00S	063-14-00W	SN	PLACER		GRAVEL	CEN
TC30205	ORIENTE NOVO, PRIMAV	BR	RONDONIA	09-34-00S	062-25-00W	SN	PLACER, VEINS	SN GREISEN	GRAVEL	CEN
TC30204	ORIENTE VELHO	BR	RONDONIA	09-29-00S	062-43-00W	SN	PLACER, STOCK WORK	SN GREISEN	GRAVEL	CEN
TC30203	IGARAPE ALVES	BR	RONDONIA	09-28-00S	065-10-00W	SN	PLACER, VEINS, GREIS	SN GREISEN	GRAVEL	CEN
TC30202	CARITIANAS	BR	RONDONIA	09-24-00S	063-04-00W	SN	PLACER, STOCKWORK, G	SN GREISEN	GRANITE	L PROT
TC30201	RIO MADEIRA	BR	RONDONIA	09-09-00S	064-28-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	PLEIS HOLO
TC30200	BURITI, BOM FUTURO,	BR	RONDONIA	09-23-00S	062-55-00W	SN	PLACER		GRANITE	L PROT
TC30199	RIO JACI-PARANA	BR	RONDONIA	09-22-00S	064-23-00W	SN	PLACERS		GRANITE DERIVED FROM	L PROT
TC30198	SAO LOURENCO, MACISA	BR	RONDONIA	09-22-00S	065-00-00W	SN	PLACER, VEINS, GREIS	SN GREISEN	GRANITE	L PROT
TC30197	QUEIMADA, CACHOEIRIN	BR	RONDONIA	09-19-00S	062-17-00W	SN	PLACER, STOCKWORK, G	SN GREISEN	GRANITE	L PROT
TC30196	RIO PRETO	BR	RONDONIA	09-18-00S	062-36-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30195	RIO DAS GARCAS	BR	RONDONIA	09-18-00S	064-08-00W	SN	PLACER,	SN GREISEN	GRANITE	L PROT
TC30194	RIO JIPARANA	BR	RONDONIA	09-17-00S	061-43-00W	DIA	PLACER		GRAVEL	CEN
TC30193	SAO FRANCISCO, TIRIR	BR	MATO GROSSO	09-13-00S	061-25-00W	SN	PLACER, VEINS, GREIS	SN GREISEN	GRANITE	L PROT
TC30192	RIO COTI	BR	AMAZONAS	09-13-00S	065-01-00W	SN	PLACER, GREISEN	SN GREISEN	GRANITE	LPROT
TC30191	SANTA BARBARA	BR	RONDONIA	09-12-00S	063-03-00W	SN	VEINS, PLACER, GREIS	SN GREISEN	GRANITE	U PROT
TC30190	JACUNDA	BR	RONDONIA	09-09-00S	062-54-00W	SN	PLACER, VEINS, GREIS	SN GREISEN	GRANITE	LPROT
TC30189	IGARAPE PRETO-TIRIRI	BR	AMAZONAS	08-37-00S	061-13-00W	SN	PLACER, VEINS, GREIS	SN GREISEN	GRANITE	LPROT
TC30188	RIO GUARIBA	BR	AMAZONAS	08-01-00S	060-27-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30187	RIO MARMELOS-MAFUI	BR	AMAZONAS	08-01-00S	061-51-00W	SN	PLACER		GRAVEL	CEN
TC30182	SERRA DO CACHIMBO	BR	PARA	09-20-00S	054-50-00W	AU DIA	PLACER		SANDSTONE	PAL
TC30181	GARIMPO CENTRAL DO J	BR	MATO GROSSO	09-05-00S	058-34-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30180	MURIRU	BR	MATO GROSSO	08-53-00S	059-10-00W	PB ZN	STRATAFORM		CALCAREOUS SILTSTONE	M PROT
TC30177	GARIMPO NOVO PLANETA	BR	MATO GROSSO	09-31-00S	057-07-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30176	GARIMPO PARANAITA	BR	MATO GROSSO	09-30-00S	056-43-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30175	GARIMPO NOVO ASTRO	BR	MATO GROSSO	09-04-00S	058-21-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC30174	RIO DO SONO	BR	GOIAS	09-07-00S	048-08-00W	DIA	PLACER		GRAVEL	QUAT-HOLO
TC30160	CABECEIRAS DO RIO NO	BR	PARA	07-18-00S	058-34-00W	AU	PLACER	PLACER AU-PGE	GRAVEL	CEN
TC00582	NOVO ASTRO MINE	BR		09-04- S	058-21- W	AU	LODE		SCHISTOSE TONALITE	
TC00527	SERRA PELADA	BR	PARA	05-54- S	049-42- W	AU PD	SEDIMENTARY HOSTED G		GRAPHITIC, MANGANIFE	EPROT
W700643	TROMBETAS -SARACA	BR	PARA	01-30-00S	056-28-00W	AL1	LATERITE	LATERITE-TYPE BAUXITE	SHALES AND SILTSTONE	TERT
TC30161	NATAL	BR	AMAZONAS	06-59-00S	060-31-00W	MN	STRATAFORM		SANDSTONE	M PROT
W700476	PITINGA	BR	AMAZONIA	00-40-00S	059-55-00W	SN	ALLUVIAL AND ELLUVIA		GRANITE	PREC
TC30162	BENEFICENTE, COTOVEL	BR	AMAZONAS	07-06-00S	060-44-00W	MN	STRATAFORM		SANDSTONE	M PROT
W700054	SERRO DO NOVIO	BR		00-59- N	052-03- W	MN	SECONDARY ENRICHMENT		GRAPHITIC SCHIST	PREC
W029766	SERRA DO NAVIO, BRAZ	BR		01-00- N	052-00- W	MN	METAMORPHIC STRATABO		MICASCHISTS GARNETIF	PREC
W026222	SERRA DOS CARAJAS AR	BR	PARA	06-05-00S	050-00-00W	FE	SEDIMENTARY, STRATAF		CARAJAS FM., ITABIRI	ARCH
W026202	URUCARA-RIO JATAPU	BR		02-05-00S	058-00-00W	FE	SEDIMENTARY, MINETTE			
W026201	MAZAGAO DEPOSIT	BR		00-40-00N	052-00-00W	FE	SEDIMENTARY, LAKE SU			
W002311	FERRADURA-TRES ILHOT	BR	PARA	06-38-00S	052-02-00W	PB CU ZN	VEINS		ACID AND INTERMEDIAT	PROT
W002292	COLONIA LAURO SODRE	BR		01-50- S	054-43- W	PB BA	VEINS AND LENSES		LIMESTONE, (280-345	CARB
W002135	RIO AMAPARI TANTALIT	BR		01-00- N	052-00- W	TA NB	PLACER		PEGMATITE	PREC
W001413	AMAPA TIN PLACERS	BR		00-45- N	051-33- W	SN TA NB AU DIA	PLACER		METASEDIMENTS	PREC
W001390	AMAZON VALLEY BAUXIT	BR		02- - S	058- - W	AL1	LATERITE		LATERITIC CLAY AND S	PLIO
W001384	IGARAPE-PRETO TIN DE	BR		09-40- S	061-15- W	SN	PLACER		GRANITE, GRAVELS DER	PREC
TC30163	RIO MANICORE-JATUARA	BR	AMAZONAS	07-20-00S	061-05-00W	SN	PLACER		GRAVEL	CEN
TC30164	GARIMPO MAFUI	BR	AMAZONAS	07-53-00S	062-09-00W	SN AU	PLACER		GRAVEL	CEN
TC30165	RIO TABACAO	BR	GOIAS	09-13-00S	048-21-00W	DIA	PLACER		GRAVEL	CEN
TC30166	LAJEADO	BR	GOIAS	09-46-00S	048-21-00W	DIA	PLACER		GRAVEL	CEN
TC30167	RIO TAQUARACU	BR	GOIAS	01-19-00S	048-18-00W	DIA	PLACER		GRAVEL	CEN
TC30168	RIO AGUA SUJA	BR	GOIAS	01-54-00S	048-17-00W	DIA	PLACER		GRAVEL	CEN
TC30169	QUATIPURU	BR	PARA	08-12-00S	049-22-00W	NI	LATERITE RESIDUAL	LATERITIC NICKEL	LATERITE ON SERPENTI	M PROT
ISM0547	PEDRA PRETA	BR	PARA	07-11- S	050-34- W	W	VEIN/PLACER		METASEDIMENTARY, MET	
ISM0152	AZUL (CARAJAS) DEPOS	BR	8	06-06-00S	050-25-00W	MN	RESIDUAL ENRICHMENT,		SILTSTONE	EPROT
ISM0151	SERRO DO NAVIO MINE	BR		00-57-00S	052-03-00W	MN	METAMORPHIC STRATABO		MICASCHISTS, GARNETI	PREC

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC30170	SERRA DO IMAJA	BR	PARA	08-40-00S	050-36-00W	FE	STRATAFORM, SEDIMENT		IRON FORMATION, ITAB	ARCH
TC30171	FAZENDA CUMARU	BR	GOIAS	07-48-00S	050-51-00W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC30172	UNNAMED CHROMITE PRO	BR	PARA	08-58-00S	049-45-00W	CR	MAGMATIC, PODIFORM C	PODIFORM CHROMITE	SERPENTINIZED ULTRAM	M PROT
D000723	(SUMMARY OF BRAZILIA	BR		10- S	055- W	MO CU	CACAPAVA-FRACTURE FI		ALKALIC INTRUSIVE RO	
TC30173	FAZENDA COQUERIO	BR	GOIAS	08-50-00S	049-28-00W	CR NI CO	MAGMATIC, PODIFORM C	PODIFORM CHROMITE	SERPENTINIZED ULTRAM	M PROT
W002324	FRENCH GUIANA BAUXIT	FG		04- - N	053- - W	AL1	LATERITE		SCHIST, GREENSTONE	PREC
M046527	AICOUPAI	FG		04-05-13N	052-27-47W	AU AG PT	PLACER			
TC35034	TIGER HILL	GY		03-28-41N	059-34-38W	FE CU	IRON FORMATION	ALGOMA FE (?)	MIGMATITE, ACID GRAN	PREC
TC34901	LOCUST LANDING QUARR	GY		05-19-56N	057-18-04W	STN	IGNEOUS		GABBRO	PREC
TC34902	SEBA QUARRY	GY		05-40-19N	058-18-15W	STN	IGNEOUS		BIOTITE GRANITE	PREC
TC34903	HOPE QUARRY - BLUE M	GY		06-05-25N	058-18-15W	STN	METAMORPHIC		GNEISSIC GRANITE - E	PREC
TC34904	LA ROSE CREEK	GY		06-59-00N	059-27-00W	AU DIA	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34905	QUARTZSTONE CREEK	GY		06-50-00N	059-12-38W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34906	UPPER WAIAMU	GY		06-45-14N	059-15-05W	AU	PLACER	PLACER AU-PGE	ELUVIAL AND ALLUVIAL	CEN
TC34651	OMBOPARU CREEK	GY		06-14-57N	060-05-59W	DIA AU	PLACER		ALLUVIAL GRAVELS	CEN
TC34907	SODAM MOUNTAIN	GY		06-46-08N	059-14-28W	AU	PLACER	PLACER AU-PGE	ELUVIAL AND ALLUVIAL	CEN
TC34652	LUDGATE HILL	GY		06-14-19N	080-07-06W	DIA AU	PLACER			CEN
TC34908	MIDDLE AREMU TRIBUTA	GY		06-41-14N	059-13-15W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34909	NORTHWEST AREMU RIVE	GY		06-43-49N	059-13-50W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34653	ENACHU RIVER	GY		06-13-37N	060-02-15W	DIA	PLACER		TERRACE AND FLOOD PL	CEN
TC34654	EPING RIVER	GY		06-06-27N	060-06-35W	DIA	PLACER	DIAMOND PLACERS	TERRACE AND ALLUVIAL	CEN
TC34910	FLOOD CREEK	GY		06-33-31N	058-59-03W	AU	PLACER	PLACER AU-PGE	TERRACE GRAVELS	CEN
TC34655	UPPER EPING RIVER	GY		06-04-56N	060-08-03W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34911	WARIRI CREEK	GY		06-33-10N	058-56-21W	AU	PLACER	PLACER AU-PGE	ALLUVIAL TERRACE GRA	CEN
TC34656	PERENONG AREA	GY		06-08-00N	060-07-03W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34912	ARIAN ISLAND - FLAT	GY		06-23-05N	058-43-24W	STN	IGNEOUS		GRANITE	PREC
TC34657	M.C. CORREIA'S CLAIM	GY		06-09-17N	060-21-40W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34913	ST. EDWARD MISSION Q	GY		06-22-38N	058-41-49W	STN	IGNEOUS		GRANITE	PREC
TC34658	WEST OF KUMERAU FALL	GY		06-08-02N	060-22-01W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34914	SANT HOEK PT QUARRY	GY		06-20-44N	058-41-56W	STN	IGNEOUS		APLITE GRANITE	PREC
TC34659	RUPUNUNI DIAMOND DIS	GY		04-28-00N	059-50-00W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34915	MOCAMOCA QUARRY	GY		06-21-46N	058-41-02W	STN	IGNEOUS		MUSCOVITE GRANITE	PREC
TC34660	POTARO DISTRICT DIAM	GY		05-19-21N	059-05-54W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34916	ARIMAI QUARRY	GY		06-02-08N	058-40-49W	STN	METAMORPHIC		GNEISSIC GRANITE	PREC
TC34661	IABARATUIK CREEK	GY		05-17-16N	059-23-16W	DIA	PLACER	DIAMOND PLACERS	ALLUVIAL GRAVELS	CEN
TC34917	BARACARA QUARRY	GY		06-23-01N	058-40-12W	STN	IGNEOUS		GRANITE	PREC
TC34918	FLAT ROCK AND PALMER	GY		06-23-09N	058-40-02W	STN	METAMORPHIC		GNEISSIC GRANITE	PREC
TC34662	AKAIWONG RIVER	GY		06-37-54N	059-33-02W	DIA	PLACER	DIAMOND PLACERS	ALLUVIAL GRAVELS	CEN
TC34663	IANNA CREEK	GY		07-20-58N	059-48-23W	DIA	PLACER	DIAMOND PLACERS	ALLUVIAL GRAVELS	CEN
TC34919	BARTICA - POTARO ROA	GY		06-14-08N	058-38-44W	STN1	IGNEOUS		DOLERITE GABBRO	MES (?)
TC34664	UNNAMED PLACER ON BA	GY		07-21-59N	060-24-19W	DIA AU	PLACER	DIAMOND PLACERS	CEMENTED ALLUVIAL GR	CEN
TC34920	BARTICA - POTARO ROA	GY		06-23-32N	058-37-36W	STN	IGNEOUS		GNEISSIC GRANITE	PREC
TC34665	MOSCOW CREEK	GY		04-45-16N	058-14-27W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34921	KARIA ISLAND QUARRY	GY		06-19-25N	058-42-52W	STN	IGNEOUS		GRANITE	PREC
TC34666	LINDO CREEK	GY		04-48-57N	058-14-40W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34922	KURTABU POINT	GY		06-23-10N	058-41-39W	STN	IGNEOUS		GRANITE	PREC
TC34667	ROBIN CREEK	GY		04-51-05N	058-15-20W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34923	KALACOON QUARRY	GY		06-23-15N	058-39-06W	STN	METAMORPHIC		GNEISSIC GRANITE	PREC
TC34668	ITABURU CREEK	GY		04-51-25N	058-14-34W	DIA AU	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34924	SAKARARA BAY QUARRY	GY		06-21-51N	058-36-59W	STN	IGNEOUS		GRANITE	PREC
TC34925	SAXACALLI QUARRY	GY		06-34-23N	058-36-49W	STN	IGNEOUS		GRANITE	PREC
TC34869	MARLISSA RIVER	GY		04-53-42N	058-15-41W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34926	ROCK POINT QUARRY	GY		06-32-52N	058-37-18W	STN	IGNEOUS		GREY GRANITE	PREC
TC34670	KAMWATTA RIVER	GY		04-55-25N	058-15-08W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34990	OLD ENGLAND DEPOSIT	GY		05-53-32N	058-18-04W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34927	AGATASH QUARRY	GY		06-21-10N	058-36-44W	STN	METAMORPHIC		HORNBLENDE SCHIST	PREC
TC34671	VENUS CREEK	GY		04-46-51N	058-14-08W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34991	DACOURA	GY		05-54-39N	058-19-57W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC BAUXITE	EO-OLIGO

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TC34672	BERBICE DISTRICT	GY		04-55-32N	058-13-22W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34928	WINEPERU QUARRY	GY		06-10-39N	058-35-07W	STN	IGNEOUS		GRANITE	PREC
TC34992	MONTGOMERY MINE	GY		05-49-36N	058-15-22W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC BAUXITE	EO-OLIGO
TC34673	MAZARUNI DIAMOND DIS	GY		06-05-41N	059-54-52W	DIA	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34929	BARTICA - POTARO ROA	GY		06-14-52N	058-39-05W	STN	RESIDUAL (?)		CONCRETIONARY IRONST	
TC34993	DORABECE DEPOSIT	GY		05-51-47N	058-14-13W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC BAUXITE	EO-OLIGO
TC34674	PURUNI DIAMOND DISTR	GY		06-19-03N	059-52-18W	DIA	PLACERS	DIAMOND PLACERS	GRAVELS	CEN
TC34930	MONKEY JUMP QUARRY	GY		06-14-39N	058-34-12W	STN	IGNEOUS		MEDIUM-GRAINED GABBR	PREC
TC34994	TREWERN MINE	GY		05-48-30N	058-15-22W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34931	TAPARAU CREEK	GY		06-02-11N	059-22-43W	NB TA	PLACER		ELUVIAL AND ALLUVIAL	CEN
TC34995	MARIA ELIZABETH	GY		05-47-20N	058-17-15W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34932	NEW ENGLAND MINE	GY		06-25-44N	059-09-48W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SCHIST	PREC
TC34996	THREE FRIENDS	GY		05-47-22N	058-17-17W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EOC-OLIGO
TC34933	SENTENCE-THE-MAN HIL	GY		06-28-40N	059-06-38W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS, SA	CEN
TC34997	PLANBA	GY		06-00-42N	058-16-53W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EOC-OLIGO
TC34934	LA JEANETTE CREEK	GY		06-25-38N	059-07-01W	AU	PLACER	PLACER AU-PGE		CEN
TC34998	CHRISTIANBURG	GY		06-02-12N	058-16-31W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EOC-OLIGO
TC34551	SIR WALTER CREEK	GY		06-56-19N	059-37-02W	AU	PLACER	PLACER AU-PGE	ALLUVIAL, ELUVIAL AN	CEN
TC34935	MAZARUNI CREEK	GY		06-25-19N	059-08-47W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34999	DALLI QUARRY	GY		06-27-48N	058-32-36W	STN	METAMORPHIC		BIOTITE GNEISS AND G	PREC
TC34552	AREA BETWEEN SIR WAL	GY		06-56-22N	059-37-31W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34936	HONEY BEE	GY		06-25-54N	059-09-35W	AU	PLACER	PLACER AU-PGE	ELUVIAL-ALLUVIAL GRA	CEN
TC35000	PUTARIMA AREA	GY		06-16-18N	058-33-26W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34553	WEST TRIBUTARY OF NU	GY		06-58-33N	059-35-10W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34937	ROBELLO CREEK (1)	GY		05-57-52N	059-32-46W	NB TA	PLACER		ELUVIAL AND ALLUVIAL	CEN
TC35001	BLUE MOUNTAINS	GY		06-29-42N	058-45-21W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	
TC34554	UNNAMED CREEK EAST O	GY		06-58-26N	059-33-48W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34938	ROBELLO CREEK (2)	GY		05-58-09N	059-31-38W	NB TA	PLACER		ELUVIAL AND ALLUVIAL	CEN
TC35002	BONASIKA HEAD DEPOSI	GY		06-28-16N	058-33-04W	AL1	LATERITIC BAUXITE	LATERITIC BAUXITE	LATERITIC CLAY.	
TC34555	UNNAMED CREEK E. OF	GY		06-58-47N	059-32-14W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34939	MAPLE CREEK	GY		07-05-51N	059-25-28W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC35003	ARAWARRI - GROETE CR	GY		06-36-15N	058-43-04W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAYS	
TC34556	UNNAMED CREEK E. OF	GY		06-56-41N	059-33-06W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34940	BLACK CREEK	GY		07-11-56N	059-24-43W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC35004	SUPENAAM RIVER	GY		06-51-49N	058-32-17W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	SURFACE BAUXITE PEBB	
TC34557	UNNAMED TRIBUTARY OF	GY		06-54-31N	059-38-23W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34941	RUMONG-RUMONG DRAINA	GY		06-00-16N	059-45-41W	NB TA	PLACER		ELUVIAL AND ALLUVIAL	CEN
TC35005	YARIKITA HILL	GY		08-04-08N	059-56-32W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	
TC34558	CALEB'S WORKINGS	GY		06-45-13N	059-41-12W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34942	PIPIANI CREEK	GY		07-22-31N	059-45-51W	AU	PLACER	PLACER AU-PGE	ALLUVIAL AND ELUVIAL	CEN
TC35006	MABARUMA	GY		08-13-54N	059-43-57W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	
TC34559	UNNAMED TRIBUTARY OF	GY		06-43-05N	059-42-58W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34943	KINGS RANSOM	GY		07-21-13N	059-45-46W	AU	PLACER	PLACER AU-PGE	ALLUVIAL AND TERRACE	CEN
TC35007	POMEROON	GY		07-14-56N	058-40-44W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAYS	
TC34560	BENNETTS WORKINGS	GY		06-31-01N	059-42-44W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34944	POTAIKUSHURU WORKING	GY		07-27-42N	059-35-43W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC35008	SAND CREEK	GY		02-40-00N	059-19-25W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34561	DUKWARRI FALL	GY		06-51-43N	059-53-47W	DIA	PLACER		GRAVELS	CEN
TC34945	RASKASA CREEK	GY		07-01-22N	059-38-27W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC35009	ACHIMERIWAU CREEK	GY		02-53-40N	059-18-47W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34946	UNITY CREEK	GY		07-01-28N	059-36-29W	AU	PLACER	PLACER AU-PGE		CEN
TC34562	ROBERT'S WORKINGS	GY		06-39-08N	059-34-11W	DIA	PLACER		GRAVELS	CEN
TC35010	TAKUTU HEAD GOLDFIEL	GY		02-30-26N	059-32-56W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34947	LIME-TREE HILL	GY		07-01-53N	059-32-21W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34563	CHISHOLM'S WORKINGS	GY		06-38-11N	059-34-13W	DIA	PLACER		GRAVELS	CEN
TC34564	CHINESE LANDING WORK	GY		06-40-18N	059-34-11W	DIA	PLACER		ALLUVIAL GRAVELS	CEN (?)
TC34948	TASAWINNI DISTRICT M	GY		07-35-55N	059-59-43W	MN	RESIDUAL		ACID-INTERMEDIATE VO	PREC
TC34949	CHINESE CREEK	GY		07-30-48N	059-32-59W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC34565	UNNAMED CREEK	GY		06-49-17N	059-44-05W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC34566	ORANAPAI LANDING - T	GY		06-05-38N	059-54-51W	DIA	PLACER	PLACER DIAMOND	ALLUVIAL GRAVELS	CEN
TC34950	ITE CREEK	GY		07-31-41N	059-32-20W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34951	DOUBTFUL CREEK	GY		07-30-54N	059-34-15W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34567	TOMASING CREEK	GY		06-04-53N	059-58-59W	DIA	PLACER	DIAMOND PLACER		CEN
TC34568	LOWER MERUME RIVER	GY		05-50-50N	059-55-22W	DIA	PLACER	DIAMOND PLACERS	ALLUVIAL GRAVELS	CEN
TC34952	ITE CREEK	GY		07-31-52N	059-32-24W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	TUFFS AND MANGANIFER	PREC
TC34953	PANCAK CREEK	GY		02-13-26N	059-10-39W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34569	UPPER MERUME, UNNAME	GY		05-47-57N	059-57-06W	DIA	PLACER	DIAMOND PLACERS	ALLUVIAL GRAVELS	CEN
TC34570	KARANANG RIVER	GY		05-41-33N	059-44-54W	DIA AU	PLACER	DIAMOND PLACERS	GRAVELS	CEN
TC34954	SEALS	GY		02-13-01N	059-09-49W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34571	MERUWINNI CREEK AREA	GY		05-50-53N	059-43-27W	DIA	PLACER	DIAMOND PLACERS	CREEK FLAT AND TERRA	CEN
TC34955	TOUCAN CREEK	GY		02-13-16N	059-09-52W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34572	SEMANG RIVER	GY		05-37-41N	059-40-35W	DIA AU	PLACER	DIAMOND PLACERS	ALLUVIAL GRAVELS	CEN
TC34956	AMOS CREEK	GY		02-14-28N	059-09-40W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34573	SAGENANG CREEK RIGHT	GY		06-09-29N	060-19-37W	DIA	PLACER		FLOODPLAIN AND HIGH	CEN
TC34957	PAUNCH'S CAMP	GY		02-13-51N	059-10-03W	AU	PLACER	PLACER AU-PGE	ELUVIAL AND ALLUVIAL	CEN
TC34574	IMATTA CREEK RIGHT B	GY		06-09-55N	060-17-21W	DIA	PLACER		FLOOD PLAIN AND HIGH	CEN
TC34958	LOCUST CREEK	GY		02-12-45N	059-10-28W	AU	PLACER	PLACER AU-PGE	ELUVIAL AND ALLUVIAL	CEN
TC34575	TACOUBA CREEK RIGHT	GY		06-10-14N	060-16-21W	DIA	PLACER		FLOOD PLAIN AND HIGH	CEN
TC34959	UPPER ARANGOY CREEK	GY		06-59-09N	059-31-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34576	IWANG CREEK RIGHT BA	GY		06-10-32N	060-14-48W	DIA AU	PLACER		FLOOD PLAIN AND HIGH	CEN
TC34960	CREAMES WORKINGS	GY		06-57-11N	059-34-35W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVEL	CEN
TC34577	NO HILL RIGHT BANK O	GY		06-11-52N	060-13-44W	DIA AU	PLACER		FLOOD PLAIN GRAVELS,	CEN
TC34961	SAND CREEK	GY		06-58-05N	059-32-25W	AU	PLACER	PLACER AU-PGE	TERRACE AND ALLUVIAL	CEN
TC34578	KUMAKA LANDING RIGHT	GY		06-12-50N	060-13-08W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34962	UNNAMED CREEKS AND G	GY		06-57-19N	059-34-12W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34579	MCGILLIVRAY LANDING	GY		06-13-12N	060-12-37W	DIA	PLACER		FLOODPLAIN, CEMENTED	CEN
TC34963	JOHNS CREEK	GY		06-57-29N	059-33-46W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34580	UPPER FORTUNE CREEK	GY		06-11-01N	060-11-26W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34964	CHRISTIAN CREEK	GY		06-58-00N	059-35-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34581	LOWER FORTUNE CREEK	GY		06-12-39N	060-11-39W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34965	NUMBFISH CREEK	GY		06-57-57N	059-34-43W	AU	PLACER	PLACER AU-PGE	ALLUVIAL, ELUVIAL GR	CEN
TC34582	LOWER KURUPUNG RIGHT	GY		06-12-60N	060-09-48W	DIA	PLACER		FLOOD PLAIN ALLUVIAL	CEN
TC34966	SUCCESS CREEK	GY		06-59-51N	059-34-37W	AU	PLACER	PLACER AU-PGE		CEN
TC34583	LOWER KURUPUNG LEFT	GY		06-13-13N	060-09-46W	DIA	PLACER		FLOOD PLAIN ALLUVIAL	CEN
TC34967	SOWARRI HILL	GY		06-58-13N	059-37-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC34968	WEST FORK CREEK	GY		06-58-31N	059-40-59W	AU	PLACER	PLACER AU-PGE		CEN
TC34584	CASH BOY CREEK	GY		06-13-13N	060-10-25W	DIA	PLACER		FLOOD PLAIN AND HIGH	CEN
TC34585	ANZAC CREEK	GY		06-12-59N	060-11-49W	DIA	PLACER		FLOOD PLAIN ALLUVIAL	CEN
TC34969	LADY WALTER CREEK	GY		06-56-20N	059-37-49W	AU	PLACER	PLACER AU-PGE	ALLUVIAL, ELUVIAL, A	CEN
TC34586	LOWER ARICHCENG CREE	GY		06-13-23N	060-13-40W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34970	YUROWA DEPOSITS	GY		04-52-46N	057-53-48W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAYS	EOC-OLIGO
TC34587	UPPER ARICHENG CREEK	GY		06-14-57N	060-14-21W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34971	AROAIMA DEPOSIT	GY		05-18-20N	058-02-18W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EOC-OLIGO
TC34588	NO HILL LEFT BANK	GY		06-12-42N	060-14-14W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34972	TOPIRA DEPOSIT	GY		05-26-55N	058-09-57W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34589	IWANG CREEK LEFT BAN	GY		06-11-35N	060-14-38W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34973	SIRABINA DEPOSITS	GY		05-28-48N	058-08-04W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34590	LOWER PILGRIM CREEK	GY		06-11-15N	060-15-39W	DIA	PLACER		FLOOD PLAIN AND HIGH	CEN
TC34974	KAMAKABRA DEPOSITS	GY		05-23-12N	058-11-53W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34591	UPPER PILGRIM CREEK	GY		06-12-24N	060-16-07W	DIA	PLACER		FLOODPLAIN ALLUVIAL	CEN
TC34975	YAWAKURI DEPOSIT	GY		05-22-05N	058-07-40W	AL1	LATERITIC BAUXITE	LATERITIC-TYPE BAUXITE	LATERITIC CLAYS	EO-OLIGO
TC34592	IMATTA CREEK LEFT BA	GY		06-10-37N	060-16-37W	DIA	PLACER		FLOOD PLAIN AND HIGH	CEN
TC34976	HARIWA DEPOSITS	GY		05-28-05N	058-15-44W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	FERRIGINOUS LATERITI	EO-OLIGO
TC34593	LOWER SAGENANG CREEK	GY		06-11-00N	060-18-25W	DIA	PLACER		FLOOD PLAIN AND ALLU	CEN
TC34977	WIRUNI DEPOSIT	GY		05-32-12N	058-13-04W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC BAUXITE	EO-OLIGO
TC34594	UPPER SAGENANG CREEK	GY		06-11-37N	060-19-24W	DIA	PLACER		FLOOD PLAIN AND HIGH	CEN

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TC34978	ANNAWANA PAI DEPOSI	GY		05-46-04N	058-22-17W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34979	COOMAKA DEPOSITS	GY		05-53-10N	058-16-09W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34595	MEAMU RIVER	GY		06-18-60N	060-21-50W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34596	WHITEWATER CREEK - A	GY		06-21-28N	060-22-19W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34980	LUCKY SPOT DEPOSIT	GY		05-53-32N	058-16-53W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAYS	EO-OLIGO
TC34597	BUMBUMPARU CREEK (UP	GY		06-21-27N	060-25-27W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34981	WISMAR DEPOSIT	GY		06-01-05N	058-16-09W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34598	C. ALVES	GY		06-19-16N	060-17-42W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34982	NOITGEDACHT DEPOSIT	GY		05-54-17N	058-14-35W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34599	UNNAMED TRIBUTARY OF	GY		06-15-31N	060-12-13W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34983	WATUKA DEPOSIT	GY		05-54-17N	058-14-37W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34600	PUTARENG RIVER	GY		06-15-38N	060-08-51W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC34984	YARARIBO DEPOSITS	GY		05-51-39N	058-14-13W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34985	NIEU HAARDEN	GY		05-49-46N	058-16-09W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34986	BLUE MOUNTAINS	GY		05-50-32N	058-18-04W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	SURFICIAL PEBBLE ORE	
TC34987	KARA-KARA DEPOSIT	GY		05-55-24N	058-13-48W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY	EO-OLIGO
TC34988	CAPE STAR	GY		05-50-53N	058-19-13W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC BAUXITE	EO-OLIGO
TC34989	HOPE DEPOSIT	GY		05-49-46N	058-20-44W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC BAUXITE	EO-OLIGO
TC32240	TIGER RIVER	GY		05-17-00N	059-03-15W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS AND	CEN
TC32276	JORDAN'S LANDING	GY		05-09-50N	059-03-10W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32168	THOMAS ISLAND (VEIN	GY		06-05-56N	059-17-35W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	HORNBLENDE-BIOTITE G	PREC
TC32132	GOOD HOPE CREEK	GY		05-10-07N	058-59-14W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32275	EAGLE MOUNTAIN MOLYB	GY		05-13-12N	059-06-52W	AU MO W	VEIN		GRANITE, QUARTZ PORP	PREC
TC32167	TAPARAU CREEK	GY		06-03-19N	059-17-48W	AU			AMPHIBOLITE-GRANITE	PREC
TC32059	MARUDI MOUNTAIN	GY		02-13-19N	059-10-28W	AU	VEIN, DISSEMINATED	LOW-SULFIDE AU-QUARTZ VEIN	SILICEOUS METASEDIME	PREC
TC32131	UNNAMED CREEK	GY		05-15-55N	058-58-49W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SANDS (?)	CEN
TC32274	EWANG RIVER	GY		05-20-42N	059-17-41W	DIA AU	PLACER		ALLUVIAL GRAVELS	CEN
TC32166	PURUARI RIVER	GY		06-03-42N	059-11-54W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	HORNBLENDE-BIOTITE G	PREC
TC32130	LONG FALLS	GY		05-16-35N	058-59-17W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32058	POTT FALLS GOLDMINE	GY		04-58-57N	058-46-37W	AU	VEIN AND PLACER	PLACER AU-PGE	GREENSTONE	
TC32273	KANAIMA CREEK	GY		05-19-14N	059-19-45W	DIA AU	PLACER		ALLUVIAL GRAVELS	CEN
TC32165	JACKASS CREEK (VEIN	GY		06-11-14N	059-22-47W	AU	VEIN	LOW-SULFIDE AND QUARTZ VEIN	AMPHIBOLITE	PREC
TC32057	LOWER SIPARUNI GOLDF	GY		04-44-32N	058-55-13W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32056	UNNAMED CREEK PLACER	GY		04-45-32N	058-54-40W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32272	HOIT CREEK	GY		05-18-45N	059-17-52W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32164	LE DESIR	GY		06-22-54N	060-22-09W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32271	ILU CREEK	GY		05-18-08N	059-14-52W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32199	WHITE CREEK	GY		07-23-25N	059-59-59W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32163	ANABARONG CREEK	GY		06-17-19N	060-11-90W	DIA AU	PLACER		ALLUVIAL GRAVELS	CEN
TC32055	UNNAMED CREEK PLACER	GY		04-45-37N	058-56-10W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32270	POTARO DIAMOND FIELD	GY		05-19-15N	059-13-01W	DIA AU	PLACER		ALLUVIAL GRAVELS	CEN
TC32198	HYMA CREEK	GY		07-25-03N	060-01-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32054	GEORGE CREEK AND TRI	GY		04-46-40N	058-56-14W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32162	KARATUKAPAI CREEK	GY		06-23-59N	060-23-10W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32197	TAKATU CREEK	GY		07-26-52N	060-01-03W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32053	UNNAMED CREEK PLACER	GY		04-45-59N	058-55-18W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32161	DEER CREEK	GY		06-29-38N	060-17-54W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32160	TRIBUTARY OF CARACAR	GY		06-28-39N	060-13-17W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32196	WAIARIPATI CREEK	GY		07-02-01N	060-07-54W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32052	PARRIS CREEK	GY		04-46-22N	058-54-38W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32051	UNNAMED CREEK PLACER	GY		04-46-42N	058-53-19W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32195	NOSENO CREEK	GY		07-06-47N	060-06-57W	AU	PLACER AND VEIN	PLACER AU-PGE	ALLUVIAL GRAVELS AND	
TC32050	IRENG CREEK GOLDFIEL	GY		04-43-10N	058-02-37W	AU DIA	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32194	TAKATUNI HEAD	GY		07-05-33N	060-05-51W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32193	ARAWINI RIVER	GY		07-06-35N	060-00-59W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32309	TOWAKAIMA CREEK	GY		07-20-20N	060-27-14W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32192	SHURAIPATI CREEK	GY		07-02-21N	060-01-20W	AU	PLACER	PLACER AU-PGE	ALLUVIAL AND ELUVIAL	

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC32308	APPAPARU CREEK AND T	GY		05-27-09N	058-25-01W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32191	KALIAKU GOLDFIELD	GY		07-35-04N	060-00-14W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32190	ARAWATTA GOLDFIELD	GY		07-37-29N	060-11-46W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32307	YUKIARI VALLEY PLACE	GY		05-30-21N	058-26-41W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32306	MARIABA VALLEY PLACE	GY		05-29-24N	058-30-09W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32305	SWIFT MINE	GY		05-29-45N	058-28-03W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANIC ROCKS	PREC
TC32304	WINTER CREEK	GY		05-28-40N	058-29-16W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32303	WINTER MINE	GY		05-28-58N	058-29-24W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	CHLORITE SCHIST	PREC
TC32302	ROCKDAM CREEK	GY		05-22-39N	058-29-56W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32301	KANIMAPU MINES	GY		05-23-02N	058-29-38W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	CHLORITE SCHIST	PREC
TC32229	HANDRAIL CREEK	GY		05-16-46N	059-09-11W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32300	KANAIMAPU CREEK	GY		05-23-00N	058-30-12W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32228	UPPER MAHDIA RIVER	GY		05-17-11N	059-09-04W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32227	MAHDIA FLOOD LEVEL F	GY		05-18-58N	059-12-52W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32119	MUNOSSE RIVER AND TR	GY		07-57-32N	059-56-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32226	LAURIES WORKINGS	GY		05-18-36N	059-11-08W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS AND	CEN
TC32118	CLAYS REEF, GIVE HIL	GY		07-22-46N	059-45-45W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS AND EL	PREC
TC32225	RAFFLE'S WORKINGS	GY		05-18-44N	059-11-19W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32009	DOUBTFUL CREEK	GY		07-35-47N	059-59-57W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32117	YAKI SHURU HILL	GY		07-21-08N	059-47-12W	AU	VEIN AND PLACER	LOW-SULFIDE AU QUARTZ VEIN	METAVOLCANIC ROCKS	PREC
TC32224	JERRICK'S WORKINGS	GY		05-19-03N	059-11-32W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SANDS AND G	CEN
TC32116	MORAKAISHURU WORKING	GY		07-25-43N	059-49-41W	AU	PLACER	PLACER AU-PGE	ALLUVIAL AND ELUVIAL	CEN
TC32008	ABOYA CREEK	GY		06-47-28N	059-55-24W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32259	WINEPERU CREEK	GY		05-08-40N	059-05-07W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32223	FREEMAN'S WORKINGS	GY		05-19-04N	059-12-09W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVEL AND	CEN
TC32007	HAIMARALLI FALLS	GY		06-47-17N	059-46-55W	CU			METAMORPHOSED SEDIME	PREC
TC32115	TEKI RIVER GOLDFIELD	GY		07-25-32N	059-44-01W	AU	PLACER	PLACER AU-PGE	ELUVIAL GRAVELS ON H	CEN
TC32258	ACCOURIE CREEK	GY		05-07-00N	059-08-23W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32222	WATT'S WORKINGS	GY		05-19-01N	059-12-27W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32114	MARIN CREEK	GY		07-28-32N	059-47-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32006	WILLIAMS WORKINGS	GY		06-40-47N	059-45-25W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32257	WHITE CREEK	GY		05-06-26N	059-11-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32149	HAIMARAKA RIVER	GY		06-26-59N	060-22-40W	AU DIA	PLACER	PLACER AU-PGE	ALLUVIAL AND ELUVIAL	CEN
TC32221	MATURIN'S WORKINGS	GY		05-21-51N	059-05-08W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32113	SIPIARISHURU CREEK	GY		07-29-45N	059-48-20W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32005	ALLIGATOR CREEK	GY		06-42-53N	059-47-53W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32256	PATIENCE CREEK	GY		05-06-00N	059-11-06W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVEL	CEN
TC32148	JACOB'S CAMP	GY		06-28-21N	060-21-06W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32220	ALVE'S WORKINGS	GY		05-22-01N	059-05-25W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32112	WILLIAMS MINE	GY		07-19-34N	059-35-19W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	BLACK, RED, GREEN TU	PREC
TC32004	LABARIA CREEK	GY		06-45-00N	059-47-08W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32255	STAR CREEK HEADWATER	GY		05-02-58N	059-12-51W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32147	CHARITY CREEK	GY		06-26-31N	060-16-14W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32003	AURORA MINE	GY		06-47-28N	059-44-15W	AU	VEIN, STOCKWORK	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONES AND QUAR	PREC
TC32111	BLACK CREEK	GY		06-37-44N	058-42-01W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC32254	MACEDONIA CREEK	GY		05-04-03N	059-12-06W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32110	WHITE CREEK	GY		06-36-27N	058-42-17W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS AND	RECENT
TC32146	HAIMARAPARU CREEK	GY		06-23-52N	080-15-58W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32002	GOLD CREEK	GY		06-44-42N	059-42-50W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS ON	
TC32253	DEER RIVER	GY		05-04-36N	059-14-28W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32001	ARANKA	GY		06-52-14N	059-37-09W	CU AU	VEINS, VEINLETS		GREENSTONE	PREC
TC32145	PLACER ON GRASS CREE	GY		06-23-45N	060-15-21W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32252	UNNAMED TRIBUTARY OF	GY		05-05-39N	059-15-34W	AU DIA	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32144	GRASS CREEK	GY		06-24-17N	060-15-33W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32000	ARANKA RIVER	GY		06-51-50N	059-37-16W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32251	POTARO DISTRICT GOLD	GY		05-19-20N	059-05-54W	AU	PLACER AND VEIN	PLACER AU-PGE	TERRACE AND ALLUVIAL	CEN
TC32179	WINTER MINE	GY		07-35-04N	060-02-53W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GNEISSES AND GREENST	PREC
TC32143	IPETE CREEK	GY		06-22-19N	060-13-22W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN

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TC32178	BARIMA MINE	GY		07-35-27N	060-02-31W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	AMPHIBOLITES AND AMP	PREC
TC32250	DAZIER, WILLIAMS, FA	GY		05-17-00N	059-04-13W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PREC
TC32142	WHITE'S WORKING	GY		06-23-23N	060-16-22W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32177	AREMU RIVER	GY		06-28-08N	059-07-32W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32141	WARONG CREEK	GY		06-21-58N	060-15-47W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32069	NORTHWEST KABURI RIV	GY		05-45-58N	059-08-08W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32176	AREMU MINE	GY		06-25-37N	059-08-50W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GRAPHITIC SLATE	PREC
TC32140	UNNAMED BRANCH OF PE	GY		06-20-01N	060-13-41W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32068	MILE 5	GY		05-37-23N	059-00-42W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32175	BARAMALLI CREEK	GY		06-28-51N	059-06-08W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32067	LARKENS VEIN	GY		05-36-30N	059-03-04W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SHALE AND GRAYWACKE	PREC
TC32174	MARA-MARA-PURUNI RIV	GY		06-17-21N	059-19-25W	AU DIA	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32066	HICKS VEIN	GY		05-36-02N	059-02-33W	AU	VEIN	LOW-SILFIDE AU-QUARTZ VEIN	SHALE AND GRAYWACKE	PREC
TC32281	MIDDLE TO UPPER KONA	GY		05-12-53N	059-02-09W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32173	MILLION MOUNT	GY		06-17-40N	059-19-47W	AU	VEIN AND PLACER	LOW-SULFIDE AU-QUARTZ VEIN	YOUNGER GRANITES	PREC
TC32065	WHARTON'S MINE	GY		05-36-53N	059-03-28W	AU	VEIN	LOW-SULFIDE AU QUARTZ VEIN	GRAPHITIC SHALE AND	PREC
TC32280	KURIBRONG MOUTH	GY		05-25-07N	059-08-59W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32064	DA SILVA'S MINE	GY		05-38-50N	059-06-52W	AU	VEIN, PLACER	LOW-SULFIDE AU-QUARTZ VEIN	SLATE AND GRAYWACKE	CEN, PREC
TC32172	MARA-MARA RIVER MOUT	GY		06-18-16N	059-18-50W	AU	VEIN	LOW-SULFIDE GOLD-QUARTZ VEIN	ACID AND INTERMEDIAT	PREC
TC32063	HIT-OR-MISS CREEK	GY		05-38-39N	059-07-33W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32171	TIGER CREEK (NORTH)	GY		06-17-55N	059-19-11W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32062	UNNAMED CREEK	GY		05-41-37N	059-03-31W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32170	CHINESE CREEK	GY		06-16-10N	059-20-39W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32061	OHIO CREEK	GY		05-41-27N	059-01-34W	AU	PLACER, VEIN	PLACER AU-PGE	GRAVELS, GREENSTONE	CEN, PREC
TC32060	GEM CREEK	GY		05-42-29N	059-04-26W	AU DIA	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32209	CROCODILE	GY		07-21-19N	060-28-19W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONE	PREC
TC32208	MARCUS WORKINGS	GY		07-20-31N	060-25-53W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONE	PREC
TC32315	DE SANTOS WORKINGS	GY		06-54-00N	061-03-00W	DIA AU	PLACER		OLD TERRACE GRAVELS	
TC32207	MILLIONAIRE	GY		07-19-35N	060-26-51W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	VOLCANIC ROCKS	PREC
TC32314	WUTULUIK CREEK	GY		06-33-40N	061-14-00W	AU	PLACER	PLACER AU-PGE	GRAVEL, CLAYS, AND S	CEN
TC32206	OLD WORLD	GY		07-21-34N	060-28-38W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONE	PREC
TC32313	TAMBERLIN AND LITTLE	GY		06-45-00N	061-12-20W	AU	PLACER AND VEIN	PLACER AU-PGE	GRAVELS AND CLAYS, V	
TC32205	GOLDEN CITY	GY		07-21-03N	060-26-45W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GRANITE	PREC
TC32204	HAIARI CREEK	GY		07-18-36N	060-11-37W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC32312	PETERS MINE	GY		06-15-08N	059-21-07W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	PELITIC AND PSAMMITI	PREC
TC32311	WILL'S WORKINGS	GY		06-32-17N	060-23-31W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32203	ANSON CREEK	GY		07-27-45N	060-05-09W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32239	JOHANNE CREEK	GY		05-16-41N	059-04-55W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32310	RESERVE	GY		07-22-14N	060-01-08W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONE	PREC
TC32238	CHANCE CREEK	GY		05-16-26N	059-04-55W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32202	MANIKURU CREEK	GY		07-29-25N	060-05-47W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32237	WILLIAM'S CREEK	GY		05-16-36N	059-04-37W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32129	SAXACALLI	GY		06-34-39N	058-36-44W	MN	RESIDUAL, LENSES, GO		PHYLLITE	PREC
TC32201	MACAW CREEK	GY		07-22-02N	060-02-59W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32236	FATE CREEK	GY		05-16-56N	059-03-47W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32200	MAZAWINI CREEK	GY		07-23-48N	060-01-58W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32128	SAND CREEK WORKINGS	GY		06-38-01N	058-46-18W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32127	MIZPAH CREEK	GY		06-37-59N	058-43-18W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVEL	CEN
TC32235	GOODHOPE CREEK	GY		05-16-59N	059-03-36W	AU	PLACER AND VEIN	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32234	DAZIER CREEK PLACERS	GY		05-17-26N	059-03-31W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32126	BLACK CREEK LANDING	GY		06-37-48N	058-42-10W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32269	QUEEN OF DIAMONDS-OH	GY		05-19-56N	059-12-44W	DIA AU	PLACER		ALLUVIAL GRAVELS	CEN
TC32233	WASHERWOMAN FALL	GY		05-19-43N	059-00-40W	AU	PLACER	PLACER AU-PGE	SANDY CEMENTED ALLUV	CEN
TC32017	TASSAWINI MINE	GY		07-30-54N	059-33-44W	AU AG	VEIN, RESIDUAL	LOW-SULFIDE AU-QUARTZ VEIN	SHEARED TUFFS AND PH	PREC
TC32125	ARMSTRONG WORKINGS	GY		06-37-27N	058-41-48W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32268	STOUT FALLS	GY		05-16-07N	059-00-33W	AU	PLACER	PLACER AU-PGE	BLACK PEATY SANDS	CEN
TC32016	TURUBARU CREEK	GY		07-35-16N	059-56-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN

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TC32232	CRAPAUD AND TURTLE C	GY		05-15-56N	059-08-28W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32124	GRAVEL BANK CREEK	GY		06-37-54N	058-41-10W	AU	PLACER	PLACER AU-PGE	GRAVELS	CEN
TC32267	HELGA CREEK	GY		05-16-11N	059-00-16W	AU	PLACER	PLACER AU-PGE	ALLUVIAL LATERITE GR	CEN
TC32231	MAHDIANA CREEK AND P	GY		05-16-11N	059-08-12W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32159	ISSINERU RIVER	GY		06-29-01N	060-19-52W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32123	FORTY DOLLAR CREEK	GY		06-37-37N	058-41-08W	AU	PLACER	PLACER AU-PGE	COARSE GRAVEL	CEN
TC32015	ADAMS HILL	GY		07-34-44N	059-55-12W	AU	VEIN	LOW SULFIDE-AU-QUARTZ VEIN	METASEDIMENTS-METAVO	PREC
TC32266	BREAKFAST POINT	GY		05-14-09N	059-01-28W	AU	PLACER, LATERITE	PLACER AU-PGE	LATERITE	CEN
TC32122	IANNA GOLDFIELD	GY		07-49-41N	059-48-12W	AU	VEIN AND PLACER	LOW SULFIDE AU-QUARTZ VEIN	SHEARED METAVOLCANIC	PREC, CEN
TC32230	GLORIA AND UNITY CRE	GY		05-16-59N	059-08-22W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVEL	CEN
TC32158	UPPER TAMAKAY CREEK	GY		06-28-17N	060-15-09W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC32014	PERSERVERANCE CREEK	GY		07-33-42N	059-56-26W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32265	CHINESE CREEK	GY		05-13-30N	059-02-24W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32157	TAMAKAY CREEK	GY		06-23-58N	060-11-58W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32121	CASMAPARU CREEK	GY		07-49-54N	059-57-38W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32049	EAST KABURI RIVER (U	GY		05-37-17N	058-55-45W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32013	TENAPU CREEK AND TRI	GY		07-34-44N	059-55-10W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32264	DAWSON'S CREEK	GY		05-09-55N	059-01-46W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32156	DEADMAN'S HILL-TAMAK	GY		06-24-49N	060-11-44W	AU	PLACER AND ASSOCIATE	PLACER AU-PGE, LOW SULFIDE AU-QUARTZ V	GRANITE, ALLUVIAL GR	PREC, CEN
TC32120	MAZAWINI LANDING	GY		07-52-33N	059-57-28W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32012	WHITE CREEK	GY		07-43-12N	059-46-04W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32048	EAST KABURI RIVER (U	GY		05-35-34N	058-54-31W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32155	FLORIAN-TAMAKAY MINE	GY		06-24-38N	060-13-40W	AU	VEIN AND ASSOCIATED	LOW SULFIDE AU-QUARTZ VEIN	GRANITE	PREC
TC32263	ST. MARY'S CREEK	GY		05-10-35N	059-02-30W	AU	PLACER	PLACER AU-PGE	ALLUVIAL SAND AND GR	CEN
TC32047	WHITE KABURI RIVER	GY		05-31-18N	058-50-31W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32011	BLACK CREEK	GY		07-42-56N	059-46-57W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32262	JENNETTE CREEK	GY		05-10-52N	059-03-03W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVEL AND	CEN
TC32154	QUEENSLANE VEIN-TAMA	GY		06-24-02N	060-11-58W	AU	VEIN AND ASSOCIATED	LOW-SULFIDE AU-QUARTZ VEIN	GRANITE	PREC
TC32010	ANATURI RIVER	GY		07-40-35N	059-56-14W	AU	PLACER	PLACER AU-PGE	ALUVIAL AND TERRACE	CEN
TC32046	PROSPECT CREEK	GY		05-46-23N	058-58-27W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32261	BUCKET CREEK	GY		05-10-07N	059-04-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32189	FIVE STARS GOLDFIELD	GY		07-36-48N	060-23-00W	AU	PLACER	PLACER AU-PGE	ELUVIAL AND ALLUVIAL	CEN
TC32153	MAIN REEF-TAMAKAY MI	GY		06-24-20N	060-13-01W	AU	VEIN AND ASSOCIATED	LOW-SULFIDE AU-QUARTZ VEIN	GRANITE	PREC
TC32045	OKO RIVER MOUTH	GY		06-27-43N	058-50-26W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32260	DOROTHEA CREEK	GY		05-08-23N	059-04-08W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32188	BARIMA RIVER DREDGE	GY		07-35-14N	060-01-14W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32152	UNNAMED CREEK	GY		06-29-39N	060-20-38W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32151	CREEK W. OF ISSINERU	GY		06-28-45N	060-20-16W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32187	ARAWATTA BARU CREEK,	GY		07-35-22N	060-05-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32186	ARAKAKA CREEK	GY		07-35-27N	060-02-32W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32150	UNNAMED TRIBUTARY OF	GY		06-26-01N	060-23-02W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32185	PAKERA CREEK	GY		07-34-22N	060-04-27W	AU	PLACER	PLACER AU-PGE	ALLUVIAL AND ELUVIAL	CEN
TC32184	MANIKURU CREEK	GY		07-34-16N	060-01-31W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32183	SAUNDERS MINE	GY		07-34-05N	060-04-21W	AU	VEIN, ELUVIAL, PLACE	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONE	PREC
TC32182	BARR-ROBERTSON SYNDI	GY		07-36-05N	060-01-45W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONE	PREC
TC32074	UPPER KURIBRONG GOLD	GY		05-30-06N	059-25-58W	AU	PLACER		ALLUVIAL TERRACE SAN	CEN
TC32073	KURIBRONG RIVER UNNA	GY		05-34-13N	059-18-09W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32181	SIR WALTER RALEIGH G	GY		07-35-55N	060-01-56W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SCHISTOSE GREENSTONE	PREC
TC32072	TURESI GOLD WORKINGS	GY		05-52-17N	059-19-09W	AU			GRAVEL	CEN
TC32180	GATES SYNDICATE	GY		07-35-60N	060-03-37W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GREENSTONE	PREC
TC32071	OKUWA GOLDFIELDS	GY		05-49-51N	059-19-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL AND ELUVIAL	CEN
TC32070	HONEY CAMP GOLDFIELD	GY		05-45-03N	059-18-33W	AU	VEIN, PLACER	LOW-SULFIDE AU-QUARTZ VEIN	BANDED ARGILLITE AND	PREC
TC32219	HOPKINSON'S WORKINGS	GY		05-22-00N	059-05-44W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS AND GR	CEN
TC32218	PAUL'S WORKINGS	GY		05-22-01N	059-06-04W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32217	SHOREY'S WORKINGS	GY		05-22-26N	059-07-21W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32109	WHITEWATER CREEK AND	GY		06-34-44N	058-50-06W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS AND	CEN
TC32216	KINGSTON'S WORKINGS	GY		05-23-01N	059-07-16W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS AND GR	CEN

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC32108	TUPURU CREEK	GY		06-37-03N	058-53-20W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32215	BOBB'S WORKINGS	GY		05-23-22N	059-08-40W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32107	MARIWA CREEK AND SAR	GY		06-36-22N	058-51-54W	AU	PLACER	PLACER AU-PGE	ALLUVIAL AND ELLUVIA	
TC32106	WARIRI MINE	GY		06-33-18N	058-56-14W	AU	VEIN AND PLACER	LOW-SULFIDE AU-QUARTZ VEIN	MEDIUM GRAINED AMPHI	PREC AND R
TC32214	BOURNE, TURPIN, AND	GY		05-24-20N	059-08-40W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32249	WILLIAMS HILL	GY		05-16-43N	059-04-43W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	BASIC METAVOLCANICS	PREC
TC32105	GROETE CREEK GOLD-CO	GY		06-38-36N	058-41-57W	AU CU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	MICACEOUS SCHISTS CU	PREC
TC32213	N. BANK TERRACES BEL	GY		05-27-28N	059-09-43W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32248	MARABUNTA CREEK	GY		05-18-14N	059-08-01W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32212	MOUTH OF SUKABI CREE	GY		05-24-02N	059-10-02W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32104	URLUOWRA AND AMUNGA	GY		06-41-00N	060-32-58W	AU DIA	PLACER	PLACER AU-PGE	GRAVELS	
TC32211	TORRINGTON CAMP	GY		05-23-28N	059-11-22W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32247	SAINT ELIABETH CREEK	GY		05-18-47N	059-07-42W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS AND	CEN
TC32139	TWEET'S WORKINGS	GY		06-20-05N	060-12-52W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32103	MCNAUGHTEN'S DIAMOND	GY		06-51-39N	060-32-05W	DIA	PLACER		ALLUVIAL SAND AND GR	CEN
TC32246	NOITGEDACHT CREEK	GY		05-21-24N	059-07-44W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32210	CUMBERBATCH'S CAMP	GY		05-22-28N	059-10-41W	AU	PLACER	PLACER AU-PGE	TERRACE SANDS	CEN
TC32138	HENERSON'S WORKINGS	GY		06-20-12N	060-12-26W	AU	PLACER	PLACER AU-PGE	ELUVIAL-ALLUVIAL GRA	CEN
TC32102	ARAWAPAI GOLDFIELD	GY		07-06-59N	059-20-55W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32137	MUKRU CREEK	GY		06-50-49N	060-22-26W	AU DIA	PLACER	PLACER AU-PGE	GRAVELS	
TC32245	LOWER KONAWAK RIVER	GY		05-19-47N	059-07-09W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32101	IMOTAI GOLDFIELD	GY		07-14-51N	059-25-08W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32244	MIDDLE KONAWAK RIVER	GY		05-18-02N	059-06-49W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32136	KOAMA RIVER	GY		06-47-32N	060-24-41W	AU DIA	PLACER	PLACER AU-PGE	GRAVEL OF ANGULAR QU	
TC32100	MINABARU GOLDFIELD	GY		07-13-28N	059-29-24W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32279	TUMATUMARI	GY		05-22-04N	059-00-05W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32135	TRY CREEK	GY		06-51-25N	060-17-06W	DIA	PLACER		ALLUVIAL SAND AND GR	CEN
TC32243	KONAWAK RIVER (UPPER	GY		05-17-08N	059-06-52W	AU DIA	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32278	NORTHFORK RIVER	GY		05-08-48N	059-08-38W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	
TC32242	SPECIAL CREEK	GY		05-16-54N	059-06-36W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32134	KAMARU CREEK	GY		06-51-43N	060-15-09W	DIA	PLACER		ALLUVIAL SAND AND GR	CEN
TC32277	WILLIE'S (WILLIS') L	GY		05-14-31N	059-01-27W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS; SA	CEN
TC32241	QUINTETTE CREEK	GY		05-16-54N	059-06-36W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC32169	TIGER CREEK (SOUTH)	GY		06-06-21N	059-21-46W	AU	PLACER	PLACER AU-PGE	GRAVELS	
TC32133	KURASHI DIAMOND AREA	GY		06-55-37N	060-19-50W	DIA	PLACER		ALLUVIAL GRAVELS	CEN
TC00809	MAHDIA	GY		05-20-49N	059-07-16W	AU	PLACER	PLACER AU-PGE	GRAVELS	TERT-HOLO
TC00808	OMAI PROPERTY	GY		05-28- N	058-45- W	AU	VEIN, SAPROLITE-LATE	LOW-SULFIDE, AU-QUARTZ VEIN	YOUNGER GRANITE GROU	LARCH-EPRO
TC00876	EAST MONTGOMERY MINE	GY		06-10- N	058-15- W	AL1	LATERITIC BAUXITE		CLAY, SAND	EO-OLIGO
TC00875	PETERS MINE	GY		06-15-12N	059-20-53W	AU	VEIN, LODE	LOW SULFIDE-AU QUARTZ VEIN	AMPHIBOLITE: BARTICA	PREC
TC00874	FIVE STAR	GY		07-36-05N	060-22-27W	AU	LODE AND ELUVIAL		BARIMA-WHANAMAPURA G	PREC
TC00873	AROAIMA MINING COMPA	GY		05-15- N	058-00- W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE		EOC-OLIGO
I000220	TEPURU CREEK QUARRY	GY	MAZURUNI-POTARO	06-25- N	058-17- W	STN1	GRANITE AGGREGATE		GRANITE	E. PROT
I000217	LINDEN KAOLIN	GY	EAST DEMERARA	05-10- N	058-00- W	CLY3 AL1	RESIDUAL KAOLIN		SEDIMENTARY AND VOLC	E. PROT, Q
I000221	ST. MARY'S QUARRY	GY	MAZARUNI-POTARO	06-15- N	058-18- W	STN1	AGGREGATE		GRANITE	E. PROT
I000219	ITABU	GY	MAZARUNI-POTARO	06-25- N	058-17- W	STN1	GRANITE AGGREGATE		GRANITE	E. PROT
I000216	TOPIRA	GY	EAST DEMERARA	05-25- N	058-10- W	CLY3 AL1	RESIDUAL KAOLIN		SEDIMENTARY AND VOLC	E. PROT, Q
W002322	GUYANA BAUXITE DEPOS	GY		05- - N	059- - W	AL1 AL2	BRECCIA AND LATERITE		CLAY AND SAND	PLIO
W700090	MACKENZIE DISTRICT	GY		06-00- N	058-10- W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXIT	RESIDUAL CLAY ON GRA	
W700089	KWAKWANI DEPOSIT	GY		05-16-06N	058-01-09W	AL1	LATERITIC BAUXITE	LATERITE-TYPE BAUXITE	LATERITIC CLAY AND S	EOC-OLIG
W026887	BLUE MOUNTAINS	GY		06-33- N	058-49- W	FE AL TI	RESIDUAL LATERITIC;			
W026886	TIGER HILL	GY		05-40- N	058-25- W	FE AL TI	RESIDUAL LATERITIC;			GABBROS &
W026885	WAMARA MOUNTAINS	GY		05-09- N	058-35- W	FE AL TI	RESIDUAL LATERITIC;			
W026884	PUTARENG	GY		06-16-00N	060-10-00W	FE	MASSIVE - NOT CLASSI			
W026883	POMEROON HEAD	GY		06-52-00N	059-12-00W	FE TI	MASSIVE - NOT CLASSI			
W026882	IRON MOUNTAIN	GY		05-00-00N	058-50-00W	FE AL TI	RESIDUAL LATERITIC;			
W001964	BAUXITE - GUYANA	GY		05-00-00N	058-00-00W	AL1				
W001961	BAUXITE - GUYANA	GY		05- - N	058- - W	AL1 AL2	LATERITE, BRECCIA		GRANITIC, KAOLIN, SA	PLIO PLEIS

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M046526	OEWANG AND TUKEIT	GY		05-19-23N	059-19-23W	DIA PD	PLACER		GRAVELS & ALLUVIUM	QUAT
M046525	AMU CREEK	GY		05-17-04N	059-18- W	DIA PD	PLACER			GRAVELS AN
M046524	KANGARUMA	GY		05-22-37N	059-11- W	DIA PD AU	PLACER			GRAVELS AN
M046523	POTARO DISTRICT	GY		05-20-46N	059- - W	DIA PD AU	PLACERS		GRAVELS & ALLUVIUM	QUAT
M046522	KAIETEUR FALLS	GY		05-11-30N	059-28-40W	DIA PD AU	PLACER		GRAVELS & ALLUVIUM	QUAT
M046521	TAPPA RIVER	GY		04-54-55N	059-45-41W	DIA PD	PLACER		GRAVELS	QUAT
TC00871	AURORA MINE	GY		06-47-35N	059-44-07W	AU	LODE VEIN	LOW SULFIDE-AU QUARTZ VEIN	MAZARUNI GROUP	PREC
TC00872	AKAIWONG	GY		06-37-54N	059-33-02W	AU			SAPROLITE; DIORITE	TERT-HOLO;
TC36140	WEST OF UPPER SARAMA	NS		03-56-00N	055-57-00W	CR	RESIDUAL		ULTRAMAFIC ROCKS	
TC38141	WEDEBOH SOELA	NS		04-28-00N	055-47-00W	CU	VEIN, DISSEMINATED		GRANITE, DOLERITE	
TC38139	UPPER TAPANAHONY RIV	NS		03-12-00N	055-45-00W	CU	RESIDUAL		LATERITIC SOIL	
TC38105	UNKNOWN NAME	NS		04-16-00N	054-33-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38152	TOEMATOE AND TEMPATI	NS		04-53-00N	054-33-00W	HG	VEIN			
TC38116	TIBITI RIVER	NS		05-01-00N	055-40-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVEL	CEN
TC36104	SOUTH OF STOELMANSEI	NS		04-19-00N	054-24-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38137	RUFIN VALLEY	NS		03-39-00N	054-06-00W	AU	PLACER, VEIN	LOW SULFIDE GOLD-QUARTZ	ALLUVIAL GRAVEL, SER	CEN, PREC
TC38109	ROSEBEL CREEK	NS		05-05-00N	055-12-00W	AU DIA	PLACER		ALLUVIAL AND ELUVIAL	CEN
TC36111	ROSEBEL AREA	NS		05-06-00N	055-35-00W	AU W	VEIN, PLACER	LOW-SULFIDE GOLD-QUARTZ	CHLORITIC PHYLLITE	
TC38103	RAMA PEGMATITE	NS		05-16-00N	055-02-00W	BE	PEGMATITE		PEGMATITE IN TOURMAL	
TC38148	POEKOTI HILL	NS		04-09-00N	054-38-00W	MN	RESIDUAL		SPESSARTITE QUARTZIT	
TC38142	PLET RIDGE	NS		04-02-00N	058-10-00W	MN MO BE NB-TA	RESIDUAL		SPESSARTITE QUARTZIT	
TC38134	PLATINA CREEK	NS		03-16-00N	054-03-00W	AU PT	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38125	PHEDRA QUARRY	NS		05-20-20N	055-03-41W	STN1	IGNEOUS		GRANITE	
TC38114	PETE CREEK	NS		04-56-00N	055-37-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC36124	PAPATAMKONDRE QUARRY	NS		05-27-03N	054-04-14W	STN1	IGNEOUS			
TC38143	NORTH OF PLET RIDGE	NS		04-05-00N	056-08-00W	CR	RESIDUAL		PERIDOTITE, BIOTITE	
TC38126	NORTH OF LEFT ADAMPA	NS		04-33-00N	055-39-00W	NI	DISSEMINATED		PERIDOTITE	
TC38115	NAME UNNKOWN	NS		04-44-00N	056-39-00W	FE TI				
TC38108	NAME UNKNOWN W OF MA	NS		05-00-00N	054-31-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38150	NAME UNKNOWN	NS		04-36-00N	054-28-00W	MN	RESIDUAL		SPESSARTITE QUARTZIT	
TC38147	NAME UNKNOWN	NS		03-39-00N	057-27-00W	MN	RESIDUAL			
TC38145	NAME UNKNOWN	NS		03-07-00N	057-08-00W	CU				
TC38144	NAME UNKNOWN	NS		03-12-00N	056-44-00W	CU				
TC38138	NAME UNKNOWN	NS		03-47-00N	054-46-00W	AU	PLACER (?)			
TC38136	NAME UNKNOWN	NS		03-20-00N	054-12-00W	AU	PLACER			
TC38135	NAME UNKNOWN	NS		03-27-00N	054-02-00W	AU	PLACER			
TC36132	NAME UNKNOWN	NS		01-55-00N	056-02-00W	DIA	PLACER			
TC38131	NAME UNKNOWN	NS		01-57-00N	055-57-00W	DIA	PLACER			
TC38130	NAME UNKNOWN	NS		01-59-00N	055-58-00W	SN	PLACER (?)			
TC38119	NAME UNKNOWN	NS		04-25-00N	057-03-00W	CU	MAGMATIC (?)		GABBROID	
TC38116	NAME UNKNOWN	NS		04-26-00N	056-50-00W	MN	RESIDUAL		GONDITE, SPESSARTINE	
TC38117	NAME UNKNOWN	NS		04-39-00N	056-42-00W	NI				
TC38112	NAME UNKNOWN	NS		04-57-00N	055-27-00W	AU	PLACER		ALLUVIAL GRAVELS	
TC38110	MINDRINETTI CREEK	NS		05-10-00N	055-10-00W	DIA	PLACER		ALLUVIAL AND ELUVIAL	CEN
TC38120	MATAPI CREEK	NS		04-58-00N	057-16-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38122	MAROWIJNE RIVER SUCT	NS		05-22-47N	054-06-21W	SDG	SEDIMENTARY		ALLUVIAL SAND AND GR	CEN
TC38149	MARIPA HILL	NS		04-42-00N	054-52-00W	MN	RESIDUAL		QUARTZITE, SPESSARTI	
TC38133	LADA SOELA	NS		02-51-00N	055-44-00W	MN	RESIDUAL		SPESSARTITE QUARTZIT	
TC38101	JORKA CREEK AND GRAN	NS		05-20-00N	054-20-00W	LI SN NB TA	PEGMATITE		PEGMATITE IN HIGH GR	
TC38128	JANDEE CREEK	NS		04-59-00N	055-11-00W	CU	DISSEMINATED		BASIC ROCKS	
TC38129	GOUATHBERG	NS		05-07-24N	055-35-20W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38106	EAST OF SARA CREEK	NS		04-24-00N	054-42-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38107	EAST OF MAROWIJNE CR	NS		04-24-00N	054-33-00W	AU	PLACER	PLACER AU-PGE	ALLUVIAL GRAVELS	CEN
TC38121	DU BOIS HILL	NS		05-07-00N	054-51-00W	KYN	METAMORPHIC			
TC38102	BROKOPONDO	NS		05-05-00N	054-59-00W	MN CO	VEINS		METASEDIMENTS	
TC38153	BILLITON CO. PEGMATI	NS		05-19-00N	054-15-00W	SN LI NB-TA	PEGMATITE		PEGMATITE IN TOURMAL	
TC38113	BEMAU CREEK	NS		04-53-00N	055-35-00W	NI CU MO	MAGMATIC (?)		TALC SCHISTS	
TC38123	BALLING SOELA QUARRY	NS		05-00-00N	055-00-00W	STN 1	METAMORPHIC		METASEDIMENTS AND GR	

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TC38151	APOEMA SOCLA	NS		04-39-00N	054-26-00W	MN	RESIDUAL		SPESSARTITE QUARTZIT	
TC38127	ADAMPADA CREEK	NS		04-25-51N	056-49-49W	MN	RESIDUAL		SPESSARTITE QUARTZIT	
W026906	RECHTE COPPENAME RIV	NS		05-48- N	056-00- W	FE	ITABIRITE BOULDERS			METASEDIME
W026852	LAKE BROKOPONDO DIST	NS		05-04- N	054-58- W	FE AL	RESIDUAL LATERITIC		LATERITES IN PARKAMA	PREC
W026851	ADAMPABA - KABALEBO	NS		04-33- N	056-36- W	FE AL TI	RESIDUAL LATERITIC		LATERITES IN PARKAMA	PREC
W026850	TAPAJE CREEK DISTRIC	NS		02-48- N	055-23- W	FE AL	LAKE SUPERIOR; ITABI			METASEDIME
W002323	SURINAM BAUXITE DEPO	NS		06- - N	056- - W	AL1 AL2	LATERITE		SCHIST	PREC
W001967	ONVERDACHT	NS		05-38- N	055-09- W	AL1	SEDIMENTARY, BAUXITE	LATERITE TYPE BAUXITE	ARKOSIC SANDSTONE, K	EOC
W001966	MOENGO	NS		05-45- N	054-30- W	AL1	SEDIMENTARY	LATERITE TYPE BAUXITE	ARKOSIC SANDSTONE, K	EOC
W001965	PARANAM	NS		05-35- N	055-07- W	AL1	BAUXITE	LATERITE TYPE BAUXITE	ARKOSIC SANDSTONE, K	EOC
M046907	UNNAMED	NS		03-55-00N	056-00-00W	CR PT PGM	LODE			
M046906	UNNAMED	NS		04-03-00N	056-10-00W	CR PT PGM	STRATIFORM			
TC35012	UNIDENTIFIED KAOLIN	VE	BOLIVAR	07-47-50N	063-29-55W	CLY3	SEDIMENTARY?		DELTAIC AND ALLUVIAL	TERT?
TC35011	UNIDENTIFIED KAOLIN	VE	BOLIVAR	07-49-05N	064-19-25W	CLY3	SEDIMENTARY?		DELTAIC AND ALLUVIAL	TERT
TC35023	LA PLANADA	VE	BOLIVAR	08-01-59N	061-31-45W	AU	UNKNOWN			
TC35021	UNIDENTIFIED MAGNESI	VE	BOLIVAR	07-58-45N	062-25-20W	MG	UNKNOWN			
TC35020	UNIDENTIFIED KAOLIN	VE	BOLIVAR	08-03-45N	062-51-25W	CLY3	UNKNOWN			
TC35019	UNIDENTIFIED KAOLIN	VE	BOLIVAR	07-58-00N	062-32-30W	CLY3	RESIDUAL			
TC35018	UNIDENTIFIED VERMICU	VE	BOLIVAR	07-54-20N	062-30-05W	VRM	UNKNOWN			
TC35017	KAOLIN OCCURRENCE	VE	BOLIVAR	06-34-45N	063-03-00W	CLY3	RESIDUAL?			
TC35016	NICKEL OCCURRENCE	VE	BOLIVAR	07-16-25N	063-20-15W	NI	UNKNOWN			
TC35015	UNIDENTIFIED ASBESTO	VE	BOLIVAR	07-19-40N	063-21-15W	ASB	UNKNOWN			
TC50374	SAN ANTONIO	VE	BOLIVAR	07-44-35N	063-34-30W	REE	SEDIMENTARY			
TC35014	BARITE OCCURRENCE	VE	BOLIVAR	07-13-30N	063-13-20W	BA	UNKNOWN			
TC35013	RARE EARTH OCCURRENC	VE	BOLIVAR	08-07-00N	063-28-20W	REE	SEDIMENTARY?		DELTAIC AND ALLUVIAL	TERT?
TC35033	VENAMO	VE	BOLIVAR	06-17-37N	061-09-44W	AU	UNKNOWN			
TC35026	LA LAMBRIZ	VE	BOLIVAR	06-50-44N	061-35-48W	AU	UNKNOWN			
TC35025	GUAITO	VE	BOLIVAR	06-52-00N	061-39-56W	AU	UNKNOWN			
TC35024	CARMEN ROSA	VE	BOLIVAR	06-56-20N	061-37-20W	DIA	ALLUVIAL, PLACER			
TC20293	RIO ESPIRITU	VE	ANZOATEGUI	08-31- N	063-13- W	MG	EVAPORITE			
TC10286	EXPERIENCIA	VE	BOLIVAR	07-23-23N	061-50-05W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	METABASALTS	PROT
TC10287	REMINGTON	VE	BOLIVAR	07-20-51N	061-47-53W	AU	LODE	LOW-SULFIDE AU QUARTZ VEIN	METAVOLCANIC AND MET	PROT
TC10288	TALISMAN	VE	BOLIVAR	07-23-47N	061-49-51W	AU	LODE, STOCKWORK	LOW-SULFIDE AU-QUARTZ VEIN	GREENSCHIST, ARGILLA	PROT
TC10289	MOCUPIA	VE	BOLIVAR	07-18-17N	061-48-09W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANIC AND MET	PROT
TC10290	CENICERO	VE	BOLIVAR	07-17-42N	061-49-48W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANIC AND MET	PROT
TC10291	IGUANA	VE	BOLIVAR	07-20-36N	061-49-29W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANIC AND MET	PROT
TC10292	PERU	VE	BOLIVAR	07-18-28N	061-50-09W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANIC AND MET	PROT
TC10293	SAN FELIPE	VE	BOLIVAR	07-18-36N	061-47-32W	AU	LODE, VEIN	LOW-SULFIDE AU-QUARTZ VEINS	METAVOLCANIC AND MET	PROT
TC10294	CONCORDIA	VE	BOLIVAR	07-13-32N	061-53-16W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEINS	METAVOLCANIC AND MET	PROT
TC10295	CHILE	VE	BOLIVAR	07-18-01N	061-50-06W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEINS	METAVOLCANIC AND MET	PROT
TC10296	VIEJO CALLAO	VE	BOLIVAR	07-20-51N	061-48-40W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEINS	METAVOLCANIC AND MET	PROT
TC10297	MINA A	VE	BOLIVAR	07-24-33N	061-48-50W	AU	VEIN, ALLUVIAL	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANIC ROCKS,	PROT
TC10298	LO INCREIBLE DISTRIC	VE	BOLIVAR	07-20-20N	062-02-46W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEINS	SHEARED QUARTZ-MICA	PROT
TC10299	MINA COLOMBIA	VE	BOLIVAR	07-19-43N	061-47-37W	AU AS	VEIN, LODE	LOW-SULFIDE AU-QUARTZ VEIN	METABASALT AND METAV	PROT
TC20019	POTOSI	VE	BOLIVAR	07-15-31N	061-52-11W	AU	LODE, VEINS	LOW SULFIDE AU-QUARTZ VEINS	ME	PROT
TC20022	VUELVAN CARAS	VE	BOLIVAR	07-06-22N	060-45-41W	AU CU	LODE	LOW SULFIDE AU-QUARTZ VEIN	METAVOLCANIC, METASE	PROT
TC20029	SAN ANTONIO	VE	BOLIVAR	07-04-00N	060-55-44W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEINS	GNEISSOID GRANITE, G	PROT
TC20030	BOTANAMO	VE	BOLIVAR	07-02-18N	061-11-48W	AU W	LODE, VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SERICITIC SCHIST, CH	EPROT
TC20032	CARMEN ROSA	VE	BOLIVAR	06-59-52N	061-32-15W	AU	PLACER, VEIN, ALLUVI	PLACER AU-PGE	ALLUVIAL SEDIMENTS	
TC20033	LA CAMORRA	VE	BOLIVAR	06-45-32N	061-33-19W	AU	LODE, VEIN	LOW-SULFIDE AU-QUARTZ VEIN	GREENSCHIST, METATU	PROT
TC20037	CICAPRA ZONE	VE	BOLIVAR	07-31-03N	062-12-13W	AU	LODE, PLACER	LOW-SULFIDE AU-QUARTZ VEINS	SCHIST	PREC
TC20038	MANDINGAL	VE	BOLIVAR	07-33-15N	062-11-08W	AU	LODE, VEIN	LOW SULFIDE AU-QUARTZ VEIN	PORPHYRITIC GRANITE	EPROT

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC20040	CERRO AZUL VALLEY PL	VE	BOLIVAR	07-35-58N	062-44-39W	AU AG CU	PLACER, ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC20045	CIUDAD PIAR	VE	BOLIVAR	07-20-58N	063-21-36W	DIA	ALLUVIAL	PLACER DIAMOND		
TC20052	REAL CORONA	VE	BOLIVAR	07-23-09N	064-02-43W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
TC20055	CERRO ETUNA	VE	BOLIVAR	07-10-27N	064-51-51W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GNEISS, QUARTZITE	ARCH
TC20065	EL CASABE PLACERS	VE	BOLIVAR	06-26-42N	063-36-50W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	QUARTZ GRAVELS	CEN
TC20074	GUARICHE	VE	BOLIVAR	06-42-44N	062-26-43W	AU	GOLD PLACER	PLACER AU-PGE	GRAVELS	
TC20075	PARAPAPOY	VE	BOLIVAR	06-29-14N	062-28-49W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	GRAVELS	CEN
TC20078	PISTON DE UROY	VE	BOLIVAR	06-17-27N	061-55-18W	AU	LODE, PLACER	LOW-SILFIDE AU-QUARTZ VEINS	ULTRAMAFIC; ALLUVIAL	
TC20084	SALTO ARAGUAI	VE	BOLIVAR	06-12-08N	061-15-21W	AU	PLACER, ALLUVIAL			
TC20066	GRAN SABANA	VE	BOLIVAR	05-47-14N	061-32-03W	AL1 CLY3	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20087	GRAN SABANA	VE	BOLIVAR	05-45-37N	061-46-20W	AL1 CLY3	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20088	GRAN SABANA	VE	BOLIVAR	05-38-46N	061-51-25W	AL1 CLY3	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20104	UNIDENTIFIED DIAMOND	VE	BOLIVAR	05-10-46N	062-16-42W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20105	UNIDENTIFIED DIAMOND	VE	BOLIVAR	05-00-53N	061-57-33W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20106	UNIDENTIFIED DIAMOND	VE	BOLIVAR	05-19-23N	061-24-29W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20112	CHIRICAYEN PLACER	VE	BOLIVAR	04-46- N	061-16-45W	AU DIA	PLACER, ALLUVIAL		GRAVELS	HOLO
TC20128	MEREVARI GEOCHEMICAL	VE	BOLIVAR	04-06-35N	063-46-21W	AU AG	EPITHERMAL VEIN		RHYOLITE, ANDESITE,	EPROT
TC20129	CHURUATA URANIUM OCC	VE	AMAZONAS	03-33-26N	065-29-19W	U TH REE ZR SN	SEDIMENTARY		SANDSTONE	PROT
TC20138	AGUAMENA AND BOQUERO	VE	BOLIVAR	06-13-10N	067-20-07W	SN NB TA TI ZR FE W	PLACERS, ALLUVIAL		SEDIMENTS	CENOZOIC
TC20161	CERRO MONTE CRISTO	VE	BOLIVAR	07-59-02N	063-22-26W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE (ITABIRITE	ARCH
TC20178	CERRO LA ESTRELLA	VE	BOLIVAR	07-28-35N	063-08-12W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GNEISS, G	ARCH
TC20235	CARDONA	VE	AMAZONAS	01-04- N	066-11- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	ALLUVIAL SEDIMENTS	CEN
TC20236	AVISPA	VE	AMAZONAS	01-22- N	065-04- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	ALLUVIAL SEDIMENTS	CEN
TC20237	GUAIBAL-EL MANGO	VE	AMAZONAS	02-04- N	066-25- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20238	SOLANO	VE	AMAZONAS	02-06- N	066-42- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20239	CASIQUIARE	VE	AMAZONAS	02-15- N	066-41- W	ALt	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE	PLATFORM COVER ROCKS	
TC20240	MAVACA-CASUQUARE	VE	AMAZONAS	02-26- N	065-40- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20241	PLANTANAL II	VE	AMAZONAS	02-33- N	064-42- W	AL1	LATERITE	LATERITE TYPE BAUXITE	FELSIC ROCKS	
TC20242	GUARAMONI	VE	AMAZONAS	02-42- N	066-38- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20243	PLATANAL I	VE	AMAZONAS	02-45- N	066-45- W	AL1	LATERITE	LATERITE TYPE BAUXITE	FELSIC ROCKS	
TC20244	ALTO ORINOCO	VE	AMAZONAS	03-04- N	066-41- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20245	TAMATAMA	VE	AMAZONAS	03-17- N	065-54- W	FE	STRATIFORM CHEMICAL		FELSIC GRANULITES	ARCH
TC20246	CUNUCUNUMA	VE	AMAZONAS	03-16- N	066-04- W	MO	VEIN OR SHEAR ZONE		FELSIC ROCKS	PROT
TC20247	EL PADAMO	VE	AMAZONAS	03-36- N	065-23- W	FE	BANDED IRON FORMATIO		FELSIC GRANULITE	ARCH
TC20249	EL INFIERNO	VE	BOLIVAR	04-35- N	061-31- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	ALLUVIAL SEDIMENTS	CEN
TC20251	RIO MEREVARI	VE	BOLIVAR	04-41- N	063-56- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20252	SANTA TERESA	VE	BOLIVAR	04-42- N	061-05- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20253	EL PARU	VE	AMAZONAS	04-49- N	065-51- W	ALt	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20254	APONGUAO	VE	BOLIVAR	04-56- N	061-53- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20255	ALTO KUKENAN	VE	BOLIVAR	04-58- N	060-48- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	ALLUVIAL SEDIMENTS	CEN
TC20256	ALTO VENTUARI	VE	AMAZONAS	05-04- N	065-11- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20257	ALTO VENTUARI	VE	BOLIVAR	05-07- N	065-00- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20258	CARUAY	VE	BOLIVAR	05-09- N	062-17- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20259	ARABOPO	VE	BOLIVAR	05-11- N	061-05- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	ALLUVIAL SEDIMENTS	CEN
TC20260	ALTO VENTUARI	VE	BOLIVAR	05-11- N	064-51- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20261	APARUREN	VE	BOLIVAR	05-12- N	062-57- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	ALLUVIAL SEDIMENTS	CEN
TC20262	ALTO APONGUAO	VE	BOLIVAR	04-49-56N	061-35-39W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20263	URADAY	VE	BOLIVAR	05-34- N	061-17- W	DIA	PLACER, ALLUVIAL	DIAMOND PLACER		
TC20264	MAUA	VE	BOLIVAR	05-40- N	061-51- W	ALt	LATERITE	LATERITE TYPE BAUXITE		
TC20265	LA CARABOBO	VE	BOLIVAR	06-16-37N	061-26-22W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	ALLUVIAL SEDIMENTS	CEN
TC20266	LUEPA	VE	BOLIVAR	05-45- N	061-32- W	AL1	LATERITE	LATERITE TYPE BAUXITE		
TC20267	KAVANAYEN	VE	BOLIVAR	05-47- N	061-47- W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20268	GUAYARACA	VE	BOLIVAR	05-51- N	062-53- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20269	KM. 88	VE	BOLIVAR	06-06- N	061-34- W	ALt	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20271	URAIMA-URUTANI	VE	BOLIVAR	06-21- N	063-35- W	DIA	PLACER, ALLUVIAL	DIAMOND PLACER		
TC20272	URAIMA-URUTANI	VE	BOLIVAR	06-22- N	063-18- W	DIA	PLACER, ALLUVIAL	DIAMOND PLACER		
TC20273	URAIMA-URUTANI	VE	BOLIVAR	06-22- N	063-42- W	DIA	PLACER, ALLUVIAL	DIAMOND PLACER		
TC20274	EL FOCO	VE	BOLIVAR	06-16-39N	061-40-58W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC20275	CAURA	VE	BOLIVAR	06-28- N	064-49- W	TI CR ZR	PLACER, ALLUVIAL			
TC20276	CORAZON DE JESUS	VE	BOLIVAR	06-41-59N	061-47-00W	AU	PLACER, ALLUVIAL		ALLUVIAL SEDIMENTS	
TC20277	AZA	VE	BOLIVAR	06-50- N	063-19- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20278	YURUAN	VE	BOLIVAR	06-52- N	062-08- W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	ALLUVIAL SEDIMENTS	CEN
TC20279	SAN RAFAEL	VE	BOLIVAR	06-51-41N	061-35-35W	AU	PLACER, VEIN, ALLUVI	PLACER AU-PGE		
TC20280	MARHUANTA	VE	BOLIVAR	07-05- N	063-31- W	REE	DISSEMINATED STRATAB			
TC20281	VUELVAN CARAS PLACER	VE	BOLIVAR	07-10- N	061-12- W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		
TC20282	SANTA BARBARA	VE	BOLIVAR	07-20-45N	063-15-30W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE		ARCH
TC20283	RIO ARO	VE	BOLIVAR	07-20- N	063-52- W	AL1	LATERITE	LATERITE TYPE BAUXITE		
TC20286	MONTE BELLO	VE	BOLIVAR	07-59- N	062-34- W	FE		ALGOMA (?) FE		ARCH
TC20287	DELTA	VE	DELTA AMACURO	08-10- N	060-57- W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE	GABBROID ROCKS	
TC20288	MONTE ROMERO	VE	BOLIVAR	08-11- N	062-06- W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE		ARCH
TC20289	POLVO DE ORO	VE	DELTA AMACURO	08-19- N	060-15- W	FE	LATERITE, BANDED IRO	ALGOMA (?) FE	GRANULITE, QUARTZITE	ARCH
TC20290	CUYUBINI	VE	DELTA AMACURO	08-11-00N	060-24-37W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GNEISS, QUARTZITE	ARCH
TC20291	POLVO DE ORO	VE	DELTA AMACURO	07-51-27N	060-18-00W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		
TC20292	SANTA CATALINA	VE	DELTA AMACURO	08-28-06N	061-59-37W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
TC20294	SACUPANA	VE	DELTA AMACURO	08-34-21N	062-12-58W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GRANULITE, QUARTZITE	ARCH
TC20295	EL CARMEN	VE	BOLIVAR	07-26-31N	061-45-23W	AU	LODE, VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SCHISTS?	PROT
TC50000	LA MARGARITA	VE	BOLIVAR	07-55-55N	063-31-08W	CLY3	RESIDUAL KAOLIN		FELDSPATHIC GNEISS	PRECAMBRIA
TC50002	SANTA RITA	VE	BOLIVAR	07-55-35N	063-08-05W	CLY3	RESIDUAL KAOLIN		FELDSPATHIC GNEISS	PRECAMBRIA
TC50003	MUNDO NUEVO	VE	BOLIVAR	07-57-06N	063-30-49W	CLY3	RESIDUAL KAOLIN		FELDSPATHIC GNEISS	PRECAMBRIA
TC50004	KM 88 KAOLIN DEPOSIT	VE	BOLIVAR	06-08-39N	061-25-14W	CLY3	RESIDUAL KAOLIN, HYD		DIORITE, GRANITE	PREC
TC50006	CERRO COPEYAL	VE	BOLIVAR	08-02-27N	062-24-53W	CLY3	RESIDUAL		FELSIC GRANULITIC GN	PREC
TC50007	SAN LORENZO	VE	BOLIVAR	07-57-45N	062-26-50W	CLY3	RESIDUAL	RESIDUAL KAOLIN	GNEISS; BAUXITE	PROT
TC50011	CERRO SANTA ROSA	VE	BOLIVAR	07-59-02N	062-29-22W	CLY3	RESIDUAL		GNEISS, BAUXITE	PRECAMBRIA
TC50012	GUACURIPIA AREA DOLO	VE	BOLIVAR	07-41-21N	062-18-58W	DOL	SEDIMENTARY		DOLOMITE	ARCH
TC50013	EL CARACOL	VE	BOLIVAR	06-27-27N	065-53-32W	DIA	PLACER, RESIDUAL, AL	DIAMOND PLACER	GRAVEL, CLAY, LATERI	CEN
TC50014	EL CARACOLITO	VE	BOLIVAR	06-25-47N	065-52-11W	DIA	PLACER, RESIDUAL, AL	DIAMOND PLACER	GRAVEL, CLAY, LATERI	CEN
TC50015	LA BICICLETA	VE	BOLIVAR	06-24-07N	065-51-14W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, CLAY, LATERI	CEN
TC50016	EL MILAGRO	VE	BOLIVAR	06-23-40N	065-50-55W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, CLAY, LATERI	CEN
TC50017	LA CUAIMA	VE	BOLIVAR	06-22-36N	065-52-43W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, CLAY, LATERI	CEN
TC50018	LA CUAIMITA	VE	BOLIVAR	06-21-29N	065-53-43W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, CLAY, LATERI	CEN
TC50019	LA HOYA	VE	BOLIVAR	06-17-31N	065-48-27W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, CLAY, LATERI	CEN
TC50020	EL RESBALON DEL DIAB	VE	BOLIVAR	06-24-42N	065-49-11W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, LATERITE, CL	CEN
TC50021	CURAO	VE	BOLIVAR	06-23-00N	065-50-58W	DIA	PLACER, RESIDUAL, AL	PLACER DIAMOND	GRAVEL, LATERITE, CL	CEN
TC50022	TRES CHOQUES	VE	BOLIVAR	06-22-34N	065-50-50W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, LATERITE, CL	CEN
TC50023	EL CANDADO	VE	BOLIVAR	06-21-09N	065-50-27W	DIA	PLACER, RESIDUAL, AL	PLACER DIAMOND	GRAVEL, LATERITE, CL	CEN
TC50024	LA SALVACION	VE	BOLIVAR	06-21-31N	065-50-55W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, LATERITE, CL	CEN
TC50025	LA CU-CA	VE	BOLIVAR	06-22-02N	065-50-39W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, LATERITE, CL	CEN
TC50026	MATUTE	VE	BOLIVAR	06-20-43N	065-49-38W	DIA	PLACER, RESIDUAL	PLACER DIAMOND	GRAVEL, CLAY, LATERI	CEN
TC50027	CEPILLITO	VE	BOLIVAR	06-19-59N	065-49-58W	DIA	PLACER, RESIDUAL, AL	PLACER DIAMOND	GRAVEL, CLAY, LATERI	CEN
TC50028	SALVA LE PEINE	VE	BOLIVAR	07-28-08N	061-45-27W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50029	AMPARO	VE	BOLIVAR	07-25-14N	061-47-38W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN		PROT
TC50030	SAN FELIPE	VE	BOLIVAR	07-39-29N	061-42-42W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50031	NACUPAL	VE	BOLIVAR	07-16-52N	061-50-44W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN		PROT
TC50032	LAS CHICHORRAS	VE	BOLIVAR	07-30-01N	061-17-52W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	METAANDESITE?	PROT
TC50033	LA INTRODUCCION	VE	BOLIVAR	07-41-24N	060-54-57W	AU	VEIN, PLACER	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50034	BOCHI	VE	BOLIVAR	07-40-42N	060-42-11W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50035	LA ESPERANZA	VE	BOLIVAR	07-29-50N	060-55-32W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PROT
TC50036	MARGARITA	VE	BOLIVAR	07-25-15N	060-44-35W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PROT
TC50037	LA REFORMA	VE	BOLIVAR	07-11-59N	060-49-43W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	METAANDESITE?	PROT
TC50038	PURGATORIO	VE	BOLIVAR	07-11-17N	060-41-28W	AU CU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS, METAS	PROT
TC50039	NUEVO CALLAO	VE	BOLIVAR	07-03-16N	061-13-28W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN		PROT
TC50040	MERCEDES	VE	BOLIVAR	07-07-33N	061-43-31W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50041	SAN MIGUEL	VE	BOLIVAR	06-49-11N	061-35-31W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN		PROT
TC50042	APOLLO 8	VE	BOLIVAR	07-20- N	062-03- W	AU	VEIN, STOCKWORK	LOW-SULFIDE AU-QUARTZ VEIN	GREENSCHIST, ARGILLA	PROT
TC50043	PIERINA	VE	BOLIVAR	07-23-49N	061-49-39W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SCHIST	PROT
TC50044	CANAIMA	VE	BOLIVAR	06-47-46N	061-28-27W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	CHLORITIZED FRAGMENT	PROT

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC50045	CAñO YAGUA	VE	AMAZONAS TERRITORY	03-33-35N	066-33-28W	AU	VEIN, ALLUVIAL	PLACER AU-PGE	QUARTZITE	PROT
TC50046	CERRO YAPACANA I	VE	BOLIVAR	03-46-50N	066-49-07W	AU	ALLUVIAL, VEIN	PLACER AU-PGE	QUARTZITE	
TC50047	EL CHOCO	VE	BOLIVAR	07-14-30N	061-58-59W	AU W MN	VEIN	LOW-SULFIDE AU-QUARTZ VEINS	METAVOLCANICS	PROT
TC50046	EL CRUCERO	VE	BOLIVAR	07-24-08N	062-10-10W	AU	QUARTZ VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METABASALT, ANDESITE	L PROT
TC50049	EL CARMON	VE	BOLIVAR	06-51-00N	061-30-30W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEINS		
TC50050	EL ROBLE	VE	BOLIVAR	07-23-49N	061-49-42W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS, ARGIL	PROT
TC50051	EL TESORO	VE	BOLIVAR	07-37-07N	060-55-25W	AU	QUARTZ VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC50052	EL TIGRE	VE	BOLIVAR	07-32-13N	060-58-25W	AU	VEIN, PLACER, ALLUVI	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50053	EUREKA	VE	BOLIVAR	07-17-55N	061-51-46W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PROT
TC50054	LA ARMóNICA	VE	BOLIVAR	07-23-52N	061-49-10W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	ARENACEOUS SCHIST	PROT
TC50055	LA CULEBRA	VE	BOLIVAR	07-22-39N	061-52-46W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN		PROT
TC50056	LA DIVINA PASTORA	VE	BOLIVAR	07-24-21N	061-48-48W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PROT
TC50057	LA LOCA	VE	BOLIVAR	07-24-11N	061-48-42W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	BASALT	PROT
TC50058	LA ROSA	VE	BOLIVAR	07-05-25N	060-44-23W	AU CU	VEIN, PLACER	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS, METAS	PROT
TC50059	LA SALVACIóN	VE	BOLIVAR	07-48-16N	061-07-23W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50060	LAS FLORES	VE	BOLIVAR	07-03-52N	061-24-17W	AU CU	LOW SULFIDE QUARTZ V	LOW SULFIDE AU-QUARTZ VEIN		
TC50061	LA FORTALEZA	VE	BOLIVAR	07-24-25N	061-48-44W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50062	LAS NIEVES	VE	BOLIVAR	07-51-53N	060-31-17W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN		PROT
TC50063	MACONDO	VE	BOLIVAR	07-23-56N	061-49-04W	AU	VEIN, VEINLETS	LOW-SULFIDE AU-QUARTZ VEIN	GREENSCHIST FACIES R	PROT
TC50064	MEJICO	VE	BOLIVAR	07-14-27N	061-51-21W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC50065	MI VENEZUELA	VE	BOLIVAR	07-24-06N	061-49-06W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PROT
TC50066	MINA B	VE	BOLIVAR	07-20- N	062-03- W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC50067	MINA C	VE	BOLIVAR	07-20- N	062-03- W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC50066	MINA CALI	VE	BOLIVAR	07-24-03N	061-48-42W	AU	VEIN, VEINLETS	LOW-SULFIDE AU-QUARTZ VEIN	GREENSCHIST, ARGILLA	PROT
TC50069	MINA COROZO	VE	BOLIVAR	07-24-19N	061-48-36W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SCHIST	PROT
TC50071	MINA NUEVA	VE	BOLIVAR	03-40-14N	066-50-01W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SANDSTONE	PROT
TC50073	MINA ORTEGA	VE	BOLIVAR	07-24-22N	061-48-39W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	SCHIST	PROT
TC50074	MINA PLATANEAL	VE	AMAZONAS TERRITORY	03-42-51N	066-49-33W	AU	VEIN		QUARTZITE	PROT
TC50075	MINA SONIA	VE	BOLIVAR	07-24-14N	061-48-42W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METALAVA, SCHIST	PROT
TC50076	MINA ZENOVIA	VE	BOLIVAR	07-23-47N	061-49-51W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METALAVA	PROT
TC50077	PAYAPAL	VE	BOLIVAR	06-49-07N	061-44-52W	AU	QUARTZ VEIN, ALLUVIA	LOW-SULFIDE AU-QUARTZ VEIN	MICA SCHIST, META GA	PROT
TC50079	LA ESTRELLA	VE	BOLIVAR	06-34-19N	062-38-02W	AU	VEIN, PLACER		METAVOLCANIC ROCK	LPROT
TC50060	QUEBRADA CACHANACA	VE	BOLIVAR	06-17- N	061-45- W	AU	ALLUVIAL, PLACER	PLACER AU-PGE	ALLUVIAL SEDIMENTS	CEN
TC50081	ANACOCO PLACERS	VE	BOLIVAR	06-47-04N	061-11-42W	AU	ALLUVIAL, PLACER	PLACER AU-PGE	ALLUVIAL SEDIMENTS	CEN
TC50083	QUEBRADA DE ORO	VE	BOLIVAR	07-33-15N	062-11-08W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN		PROT
TC50084	RIO CUYUNI-RIO UEY	VE	BOLIVAR	06-05-23N	061-34-20W	AU	ALLUVIAL, VEINS			
TC50085	ROPEWAY AND REFUGIO	VE	BOLIVAR	07-16-32N	061-50-59W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PROT
TC50067	SANTA ANA	VE	BOLIVAR	07-24-56N	061-47-58W	AU	VEINS, STOCKWORK	LOW-SULFIDE AU-QUARTZ VEIN	GREENSCHIST, ARGILLA	PROT
TC50066	SANTA BARBARA	VE	BOLIVAR	07-24-20N	061-49-01W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC50089	SANTA INéS	VE	BOLIVAR	07-24-18N	061-48-56W	AU ZN	VEIN, VEINLETS	LOW-SULFIDE AU-QUARTZ VEIN	GREENSCHIST, ARGILLA	PROT
TC50090	SESINA	VE	BOLIVAR	06-53-43N	061-46-11W	AU	ALLUVIAL, PLACER	PLACER AU-PGE	ALLUVIAL SEDIMENTS	CEN?
TC50091	TALISMAN COVA	VE	BOLIVAR	07-23-41N	061-49-53W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANICS	PROT
TC50093	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-52-12N	061-49-36W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC50095	PLACERS OF BOCHINCHE	VE	BOLIVAR	07-32-53N	060-47-07W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	MAFIC METAVOLCANIC R	
TC50097	CAñO MARAYA	VE	BOLIVAR	03-49-33N	066-49-28W	AU	ALLUVIAL		QUARTZITE, METASEDIM	PREC
TC50098	CORREGENTE	VE	BOLIVAR	07-45-05N	061-06-01W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	ALLUVIAL SEDIMENTS	CEN
TC50099	EL CHIVAO PLACERS	VE	BOLIVAR	06-17-13N	061-50-57W	AU	ALLUVIAL, METEORIZED	PLACER AU; LOW-SULFIDE AU-QTZ VEIN	TUFFACEOUS METAVOLCA	PROT
TC50101	GUATUAIMA	VE	BOLIVAR	06-44-28N	061-52-44W	AU	ALLUVIAL, PLACER		GREENSTONES	
TC50102	LA CAYENA	VE	BOLIVAR	07-43-27N	060-57-22W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	ALLUVIAL SEDIMENTS	
TC50103	LA PLAYITA	VE	BOLIVAR	06-26-26N	061-50-21W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	ALLUVIAL	
TC50104	LA SALVACION	VE	BOLIVAR	07-48-29N	061-07-13W	AU	PLACER, ALLUVIAL	PLACER AU-PGE	ALLUVIAL SEDIMENTS	
TC50105	LAS PAVAS	VE	BOLIVAR	07-48-59N	060-33-19W	AU	PLACER, ALLUVIAL	PLACER AU		
TC50107	PANAMá	VE	BOLIVAR	06-28-28N	061-50-21W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		
TC50108	QUEBRADA MOCHILA PLA	VE	BOLIVAR	06-32-29N	061-57-41W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		
TC50110	RIO SURUMA	VE	BOLIVAR	07-44-38N	060-59-07W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		

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TC50111	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-43-15N	061-54-38W	AU	ALLUVIAL, PLACER	PLACER AU		
TC50114	SOFIA	VE	BOLIVAR	07-23-26N	061-49-53W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	SCHIST	PROT
TC50115	SANTA ELENA	VE	BOLIVAR	07-25-09N	061-47-47W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50116	LA CUBANITA	VE	BOLIVAR	07-23-49N	061-49-30W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50117	TE ESPERABA	VE	BOLIVAR	07-23-55N	061-48-57W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50118	UNION-1	VE	BOLIVAR	07-23-50N	061-49-30W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50119	UNION-2	VE	BOLIVAR	07-24-31N	061-46-24W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50120	LAS TRES ROSAS - 2	VE	BOLIVAR	07-24-08N	061-48-56W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50121	LA LAPA-1	VE	BOLIVAR	07-24-08N	061-48-43W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50122	LA LAPA	VE	BOLIVAR	07-24-37N	061-48-19W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50123	EL VALLE	VE	BOLIVAR	07-24-06N	061-48-41W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50124	LA PLATA	VE	BOLIVAR	07-24-40N	061-46-20W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50125	LA ESPANOA	VE	BOLIVAR	07-24-43N	061-46-13W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50126	LA FORESTA	VE	BOLIVAR	07-24-54N	061-48-13W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50127	EL GRITO	VE	BOLIVAR	07-25-03N	061-47-51W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50128	MALAVE	VE	BOLIVAR	07-24-05N	061-49-07W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50129	YI YI	VE	BOLIVAR	07-24-15N	061-48-54W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50130	LA	VE	BOLIVAR	07-24-18N	061-48-55W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEINS	SCHIST	PROT
TC50131	LAS MOROCHAS	VE	BOLIVAR	07-24-24N	061-48-46W	AU	VEIN	LOW SULFIDE AU-QUARTZ VEIN	SCHIST	PROT
TC50132	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-17-09N	061-52-23W	AU	ALLUVIAL		SANDSTONE, GRAVELS,	PROT
TC50133	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-12-59N	061-07-57W	AU	ALLUVIAL			
TC50134	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-16-23N	061-51-56W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC50135	GRAN SABANA	VE	BOLIVAR	05-08-36N	061-33-55W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50137	PARAGUA	VE	BOLIVAR	06-42-25N	063-28-46W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50138	CAICARA	VE	BOLIVAR	07-34-01N	066-08-30W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50139	PILA BLANCA	VE	BOLIVAR	08-05-13N	062-57-26W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50140	ANCHO CARONI	VE	BOLIVAR	08-06-57N	062-51-51W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50141	RIO CARONI (NO. 18)	VE	BOLIVAR	06-29-39N	062-58-57W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50142	RIO ORIS	VE	BOLIVAR	06-16-36N	063-51-06W	DIA	ALLUVIAL	DIAMOND PLACER	RIVER SEDIMENTS	CEN
TC50143	LAS CLARITAS DE UROY	VE	BOLIVAR	08-15-36N	061-54-21W	AU	QUARTZ VEIN	LOW-SULFIDE AU-QUARTZ VEIN	SCHIST, METAVOLCANIC	
TC50144	VERI	VE	BOLIVAR	06-49-55N	063-59-08W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50145	DORI	VE	BOLIVAR	06-29-17N	063-57-43W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50146	PAVICHE	VE	BOLIVAR	07-16-49N	062-41-54W	AU DIA	ALLUVIAL			
TC50147	EL MANTECO	VE	BOLIVAR	07-28-06N	062-35-43W	AU				
TC50148	RANCHO VERDE	VE	BOLIVAR	06-51-18N	061-18-37W	AU				
TC50149	TRIUNFO	VE	BOLIVAR	06-45-50N	062-32-04W	AU	UNKNOWN			
TC50150	EL DORADO	VE	BOLIVAR	06-44-06N	061-41-47W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC50151	GRAN SABANA	VE	BOLIVAR	04-51-26N	060-49-59W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC50152	GUACHARACA	VE	BOLIVAR	05-29-20N	062-53-36W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50153	UNIDENTIFIED GOLD OC	VE	AMAZONAS	03-43-27N	065-51-20W	AU	UNKNOWN		GRANITIC ROCKS	PREC
TC50154	UNIDENTIFIED GOLD OC	VE	AMAZONAS	02-18-28N	063-37-41W	AU	UNKNOWN, VEIN?			PREC
TC50155	UNIDENTIFIED GOLD OC	VE	AMAZONAS	02-12-01N	063-30-28W	AU	UNKNOWN		FOLIATED BASEMENT CO	PREC
TC50156	UNIDENTIFIED GOLD OC	VE	AMAZONAS	03-22-26N	064-20-45W	AU	UNKNOWN		VOLCANIC ROCKS?	PREC
TC50157	UNIDENTIFIED GOLD OC	VE	AMAZONAS	03-44-19N	065-40-31W	AU	UNKNOWN		GRANITIC ROCKS	PREC
TC50158	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-46-38N	061-52-06W	AU	ALLUVIAL	PLACER AU		
TC50159	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-50-31N	061-47-16W	AU	ALLUVIAL	PLACER GOLD		

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TC50160	UNIDENTIFIED GOLD OC	VE	BOLIVAR	06-52-12N	061-49-36W	AU	ALLUVIAL	PLACER AU		
TC50161	FLORINDA	VE	BOLIVAR	07-25-27N	062-06-41W	AU	VEIN?			
TC50162	QUARTZ MINE	VE	BOLIVAR	07-37-02N	062-26-56W	QTZ	UNKNOWN			
TC50163	SAND QUARRY	VE	BOLIVAR	07-40-46N	062-22-36W	SDG	ALLUVIAL		ALLUVIAL	CEN
TC50164	LA PARAGUA	VE	BOLIVAR	06-42-25N	063-28-46W	DIA	ALLUVIAL	DIAMOND PLACER		
TC50165	COROCORO	VE	BOLIVAR	06-16-30N	061-31-00W	AU	ALLUVIAL, PLACER	PLACER AU-PGE		
TC50300	BOGARIN MINE	VE	BOLIVAR	06-01-37N	062-54-09W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER	FLUVIAL GRAVEL	HOL
TC50301	AGUA COLORADA	VE	BOLIVAR	04-14-30N	061-50-15W	DIA	PLACER DIAMONDS, ALL	PLACER DIAMOND	GRAVELS, QUARTZITE	PROT
TC50302	CARAPO	VE	BOLIVAR	05-42-49N	063-25-28W	DIA	ALLUVIAL, PLACER	PLACER DIAMOND		
TC50303	CAMPO GRANDE	VE	BOLIVAR	06-09-37N	063-03-16W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER	GRAVEL	QUAT
TC50304	CERBATANA	VE	BOLIVAR	06-21-22N	065-48-46W	DIA	KIMBERLITE, GRAVELS,	DIAMOND PLACER	ALLUVIAL SEDIMENT, K	CEN PROT
TC50305	C.O.D.S.A.	VE	BOLIVAR	04-43-11N	061-08-53W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER	SEDIMENT	CEN
TC50306	EL CARMEN	VE	BOLIVAR	05-50-08N	062-54-26W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER		
TC50307	EL TOCO	VE	BOLIVAR	06-20-15N	065-49-38W	DIA	PLACER DIAMOND, ALLU		POORLY SORTED GRAVEL	CEN EPROT
TC50308	GRAN SABANA	VE	BOLIVAR	04-59-53N	061-55-14W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER	GRAVEL	CEN
TC50309	LA LIBERTAD	VE	BOLIVAR	06-51-25N	063-15-57W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER	SEDIMENT	CEN
TC50310	MARIA VARELA	VE	BOLIVAR	05-06-52N	062-33-15W	DIA AU	ALLUVIAL, PLACER	DIAMOND PLACER	GRAVEL	CEN
TC50311	GALLITO	VE	BOLIVAR	06-01-00N	062-54-25W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER	GRAVEL	HOL
TC50312	RIO ANTAVARI	VE	BOLIVAR	05-15-45N	062-50-10W	DIA?	ALLUVIAL	DIAMOND PLACER		
TC50313	UNIDENTIFIED DIAMOND	VE	BOLIVAR	06-05-01N	063-04-53W	DIA	ALLUVIAL, PLACER	DIAMOND PLACER	GRAVELS	CEN
TC50315	SANTA ELENA DE UAIRE	VE	BOLIVAR	05-15-00N	061-07-30W	U TH	UNKNOWN		SANDSTONE	PROT 1.6 G
TC50316	CERRO DEL HORMIGUERO	VE	BOLIVAR	07-37-04N	061-27-01W	AL1	LATERITE, RESIDUAL	LATERITE-TYPE BAUXITE		
TC50317	LAS DELICIAS	VE	BOLIVAR	08-11-02N	061-57-17W	MN FE	RESIDUAL		GNEISS, QUARTZITE, D	ARCH
TC50318	CERRO ABANICO	VE	BOLIVAR	08-09-41N	062-00-43W	MN			GNEISS, QUARTZITE, D	ARCH
TC50319	TERECAY	VE	BOLIVAR	07-30- N	062-32- W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GRANULITE FACIES ROC	ARCH
TC50320	RIO SUAPURE BAUXITE	VE	BOLIVAR	06-07-07N	066-30-09W	AL1	LATERITE, RESIDUAL	LATERITE-TYPE BAUXITE		
TC50321	RIO VILLACOA BAUXITE	VE	BOLIVAR	06-15-29N	066-43-30W	AL1	LATERITE, RESIDUAL	LATERITE-TYPE BAUXITE		
TC50322	SERRANIA LA CERBUTAN	VE	BOLIVAR	06-038-52	066-27-11W	AL1	LATERITE, RESIDUAL	LATERITE-TYPE BAUXITE		
TC50323	SERRANIA LOS PIJIGUA	VE	BOLIVAR	06-24-03N	066-44-37W	AL1	LATERITE, RESIDUAL	LATERITE-TYPE BAUXITE		
TC50324	SERRANIA PARGUAZA	VE	BOLIVAR	06-16-34N	066-51-43W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BUAXITE		
TC50325	UNIDENTIFIED BAUXITE	VE	BOLIVAR	08-32-56N	066-26-04W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC50326	GUASIPATI - LA PAST	VE	BOLIVAR	07-30-00N	062-00-00W	P	RESIDUAL WEATHERING		META SEDIMENTS?	PROT
TC50327	CONSTRUCTION SAND QU	VE	BOLIVAR	07-54-02N	062-12-57W	SDG	ALLUVIAL SEDIMENTS			
TC50328	CONSTRUCTION SAND QU	VE	BOLIVAR	07-55-42N	062-13-60W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50329	SAND QUARRY	VE	BOLIVAR	07-57-45N	062-15-05W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50330	SAND QUARRY	VE	BOLIVAR	07-55-32N	062-17-40W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50331	SAND QUARRY	VE	BOLIVAR	07-47-09N	062-23-24W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50332	SAND QUARRY	VE	BOLIVAR	07-59-06N	062-21-37W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50333	SAND QUARRY	VE	BOLIVAR	07-54-58N	062-26-03W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50334	SAND QUARRY	VE	BOLIVAR	07-49-00N	062-28-43W	SDG	ALLUVIAL		ALLUVIAL SEDIMENT	CEN
TC50335	SAND QUARRY	VE	BOLIVAR	07-53-37N	062-42-06W	SDG	ALLUVIAL		ALLUVIAL SEDIMENT	CEN
TC50336	STONE QUARRY	VE	BOLIVAR	07-43-52N	062-29-05W	STN	METAMORPHIC, GNEISS		GNEISS	ARCH
TC50337	DIMENSION STONE QUAR	VE	BOLIVAR	08-06-27N	062-30-35W	STN2	DIMENSION STONE, MET		GNEISS	ARCH
TC50338	SAND QUARRY	VE	BOLIVAR	08-07-14N	062-22-30W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50339	SAND QUARRY	VE	BOLIVAR	08-21-09N	062-32-34W	SDG	ALLUVIAL		ALLUVIAL SEDIMENT	CEN
TC50340	CONSTRUCTION SAND QU	VE	BOLIVAR	08-23-58N	062-36-26W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50341	SAND QUARRY	VE	BOLIVAR	08-15-50N	062-55-29W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50342	SAND QUARRY	VE	BOLIVAR	08-16-04N	062-56-58W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50343	SAND QUARRY	VE	BOLIVAR	08-16-40N	062-59-27W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN
TC50344	GAVILAN	VE	BOLIVAR	08-10-30N	062-11-58W	AL1	RESIDUAL	LATERITE-TYPE BAUXITE		
TC50346	LAS NIEVES	VE	BOLIVAR	07-36-44N	061-29-43W	AL1	RESIDUAL LATERITE	LATERITE-TYPE BAUXITE		
TC50347	DOLOMITE QUARRY	VE	BOLIVAR	08-05-53N	062-07-28W	DOL	METAMORPHIC (?)		DOLOMITE	PROT
TC50348	UNIDENTIFIED PLACER	VE	BOLIVAR	08-17-08N	061-47-04W	AU	ALLUVIAL, PLACER	PLACER AU-PGE	ALLUVIAL SEDIMENTS	CEN
TC50349	KAOLIN QUARRY	VE	BOLIVAR	08-23-13N	062-38-34W	CLY3	SEDIMENTARY	SEDIMENTARY KAOLIN	ALLUVIAL SEDIMENTS	CEN
TC50350	KAOLIN QUARRY	VE	BOLIVAR	08-05-54N	062-34-44W	CLY3	RESIDUAL		HIGH GRADE METAMORPH	PREC
TC50351	BUENA ESPERANZA PLAC	VE	BOLIVAR	07-11-30N	063-00-01W	DIA (?)	ALLUVIAL, PLACER		ALLUVIAL SEDIMENTS	
TC50352	EL PAGON PLACER	VE	BOLIVAR	07-15-00N	063-16-39W	DIA (?)	ALLUVIAL, PLACER		ALLUVIAL SEDIMENTS	CEN
TC50353	SAND QUARRY	VE	BOLIVAR	07-48-54N	062-01-21W	SDG	ALLUVIAL		ALLUVIAL SEDIMENTS	CEN

Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC50357	AVECHICA	VE	BOLIVAR	07-04-35N	062-00-50W	AU	ALLUVIAL, PLACER	PLACER AU-PGE		
TC50359	EL MANTECO	VE	BOLIVAR	07-54-20N	062-47-00W	MN	SEDIMENTARY			
TC50363	LA HORQUETA	VE	BOLIVAR	07-55-03N	060-17-13W	MN	SEDIMENTARY			ARCH
TC50365	LAS PAVAS	VE	BOLIVAR	07-48-59N	060-33-19W	MN				
TC50368	MOITACO	VE	BOLIVAR	07-51-35N	064-23-32W	AL1	LATERITE	LATERITE TYPE BAUXITE		
TC50372	RIO LOS DOS POZOS	VE	BOLIVAR	07-28-48N	063-31-19W	DIA	ALLUVIAL			
TC50391	CERRO ARRENDAJO	VE	BOLIVAR	06-05- N	061-52- W	AU	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	MAFIC FLOWS, PILLOW	PROT
TC50392	CERRO LA PINTO MINE	VE	BOLIVAR	07-25-56N	064-06-15W	AU PGE	VEIN	LOW-SULFIDE AU-QUARTZ VEIN	METAVOLCANIC GREENST	
TC50393	HUECO RICO	VE	BOLIVAR	07-28-20N	064-08-26W	AU	VEIN, ALLUVIAL, PLAC	LOW-SULFIDE AU-QUARTZ VEIN	PORPHYRITIC VOLCANIC	
TC50398	POTOSI	VE	BOLIVAR	07-43-54N	062-12-41W	AU	VEIN		AMPHIBOLITE	L PROT
W026905	EL PAO	VE	BOLIVAR	08-02-56N	062-36-09W	FE MN	BANDED IRON	ALGOMA FE	FERRUGINOUS QUARTZIT	ARCH
W026904	CERRO TORIBIO	VE	BOLIVAR	07-36-17N	063-39-20W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GNEISS	ARCH
W026903	CERRO REDONDO	VE	BOLIVAR	07-29-42N	063-04-29W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GNEISS	ARCH
W026902	CERRO FRONTERA	VE	BOLIVAR	07-27-40N	063-19-55W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GNEISS, GRANULITE, Q	ARCH
W026901	ALTAMIRA 2	VE	BOLIVAR	07-30- N	063-25- W	FE AU	BANDED IRON FORMATIO	ALGOMA (?) FE	GRANULITE, QUARTZITE	ARCH
W026900	CERRO BOLIVAR	VE	BOLIVAR	07-27-28N	063-23-52W	FE MN TI P	BANDED IRON FORMATIO	ALGOMA (?) FE	FELSIC GNEISS, QUART	ARCH
W026899	CERRO ALTAMIRA	VE	BOLIVAR	07-28-28N	063-13-40W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	FELSIC GNEISS, QUART	ARCH
W026898	CERRO ARIMAGUA	VE	BOLIVAR	07-40-45N	063-05-40W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, FELSIC GN	ARCH
W026897	LAS PAILAS	VE	BOLIVAR	07-17-30N	063-13-45W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
W026896	LOS BARRANCOS I AND	VE	BOLIVAR	07-17-30N	063-13-45W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
W026895	SAN JOAQUIN	VE	BOLIVAR	07-25-02N	063-13-06W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
W026894	EL TRUENO	VE	BOLIVAR	07-08-37N	064-05-08W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, FELSIC GR	ARCH
W026893	MARIA LUISA	VE	BOLIVAR	07-47-46N	063-04-20W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
W026892	PLACOA	VE	BOLIVAR	07-17-30N	063-13-45W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GRANULITE, QUARTZITE	ARCH
W026891	LAS GRULLAS	VE	BOLIVAR	07-13-30N	063-13-45W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GNEISS, GRANULITE	ARCH
W026890	CERRO LAS ADJUNTAS A	VE	BOLIVAR	07-22-52N	063-05-41W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GNEISS, QUARTZITE	ARCH
W026854	SAN ISIDRO	VE	BOLIVAR	07-23-31N	063-13-37W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
W026853	SAN ISIDRO IRON QUAD	VE	BOLIVAR	07-25-00N	063-10-00W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GNEISS AND AMPHIBOLI	ARCH
W002329	VENEZUELA BAUXITE	VE		06- - N	064- - W	AL1	LATERITE		GNEISS, AMPHIBOLITE,	
W002102	UPATA BAUXITE	VE	BOLIVAR	08-06-46N	062-15-51W	AL MN	LATERITE	LATERITE TYPE BAUXITE		
W002101	GUAICAS	VE	BOLIVAR	06-13-01N	063-05-16W	AL1 FE TI	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE	GABBRO-DIABASE, META	PROT, CEN
W002099	EL CALLAO GOLD DISTR	VE	BOLIVAR	07-20-49N	061-48-17W	AU W	VEIN/SHEAR, PLACER	LOW-SULFIDE AU-QUARTZ VEINS	GREENSTONE BELT ROCK	E PROT
W001387	AMACURO DELTA REGION	VE	DELTA AMACURO	08-25- N	060-30- W	AL1	LATERITE BAUXITE, RE	LATERITE TYPE BAUXITE		
TC20177	RIO APONGUAU PLACERS	VE	BOLIVAR	04-49-56N	061-35-39W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	QUARTZ GRAVELS	
TC20176	URIMAN PLACERS	VE	BOLIVAR	05-20-48N	063-02- W	DIA	PLACER, ALLUVIAL	DIAMOND PLACER	QUARTZ GRAVELS	
TC20175	PARAITEPUY PLACERS	VE	BOLIVAR	04-35- N	061-26- W	DIA	DIAMOND PLACERS	DIAMOND PLACER	QUARTZ GRAVELS	QUAT (HOLO
TC20174	EL PAO DE LA FORTUNA	VE	BOLIVAR	07-02-47N	063-13-20W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	QUARTZ GRAVELS	CEN
TC20173	BOCON PLACERS	VE	BOLIVAR	06-30-00N	062-53-30W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	QUARTZ GRAVELS	
TC20172	RIO CARRAO PLACERS	VE	BOLIVAR	06-17-00N	062-55-00W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	QUARTZ GRAVELS	
TC20171	SAN FELIX PLACERS	VE	BOLIVAR	08-22-30N	062-39-30W	DIA	DIAMOND PLACERS, ALL	DIAMOND PLACERS	QUARTZ GRAVELS	CEN?
TC20170	PLAYA BLANCA PLACERS	VE	BOLIVAR	08-05-15N	062-58-05W	DIA	DIAMOND PLACER	DIAMOND PLACERS	QUARTZ GRAVELS	
TC20169	EL MEREY PLACERS	VE	BOLIVAR	07-51-26N	063-03-38W	DIA	DIAMOND PLACERS, ALL	DIAMOND PLACERS	QUARTZ GRAVELS	CEN
TC20168	CERRO PANDO	VE	BOLIVAR	08-09-04N	062-01-56W	MN FE			GNEISS, SCHIST, QUAR	ARCH
TC20167	SANTA ROSA	VE	BOLIVAR	07-58-19N	062-29-13W	FE MN			SCHIST, GNEISS, QUAR	ARCH
TC20166	SAN LORENZO	VE	BOLIVAR	07-57-05N	062-27-10W	MN FE			GNEISS, QUARTZITE	ARCH
TC20165	SANTA MARIA DEPOSIT	VE	BOLIVAR	07-56-54N	062-17-30W	MN FE			GNEISS, SCHIST, QUAR	ARCH
TC20164	GANGES III	VE	BOLIVAR	08-08-12N	062-03-51W	MN FE			SCHIST	ARCH
TC20163	GANGES II	VE	BOLIVAR	08-07-57N	062-04-17W	MN FE			SCHIST, QUARTZITE, G	ARCH
TC20162	GANGES I	VE	BOLIVAR	08-07-44N	062-04-45W	MN FE			SCHIST, GNEISS, DOLO	ARCH
TC20159	IMPERIAL MINE	VE	DELTA AMACURO	08-32-28N	062-20-01W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
TC20157	CERRO GUTIERREZ	VE	BOLIVAR	08-03-45N	062-37-30W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GNEISS, GRANULITE	ARCH
TC20153	CERRO SAN CRISTOBAL	VE	BOLIVAR	07-26-57N	060-45-35W	MN FE CU PB ZN	LATERITE, RESIDUAL		QUARTZITE, PHYLLITES	EPROT
TC20152	CERRO DE LA ESPERANZ	VE	BOLIVAR	07-31-40N	064-02-52W	MN FE	LATERITE, RESIDUAL		GREENSTONE, QUARTZIT	EPROT-CEN
TC20149	EL BAÚL	VE	BOLIVAR	08-03-30N	062-25-06W	AL1	LATERITE, RESIDUAL			PREC
TC20148	MESA DE LA CARATA	VE	BOLIVAR	08-03-30N	062-25-06W	AL1	LATERITE	LATERITE TYPE BAUXITE		PREC
TC20147	CERRO ONCE	VE	BOLIVAR	08-03-30N	062-25-06W	AL1 CLY3 FE	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		PREC
TC20146	LOS GUAMOS	VE	BOLIVAR	08-03-30N	062-25-06W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		PREC

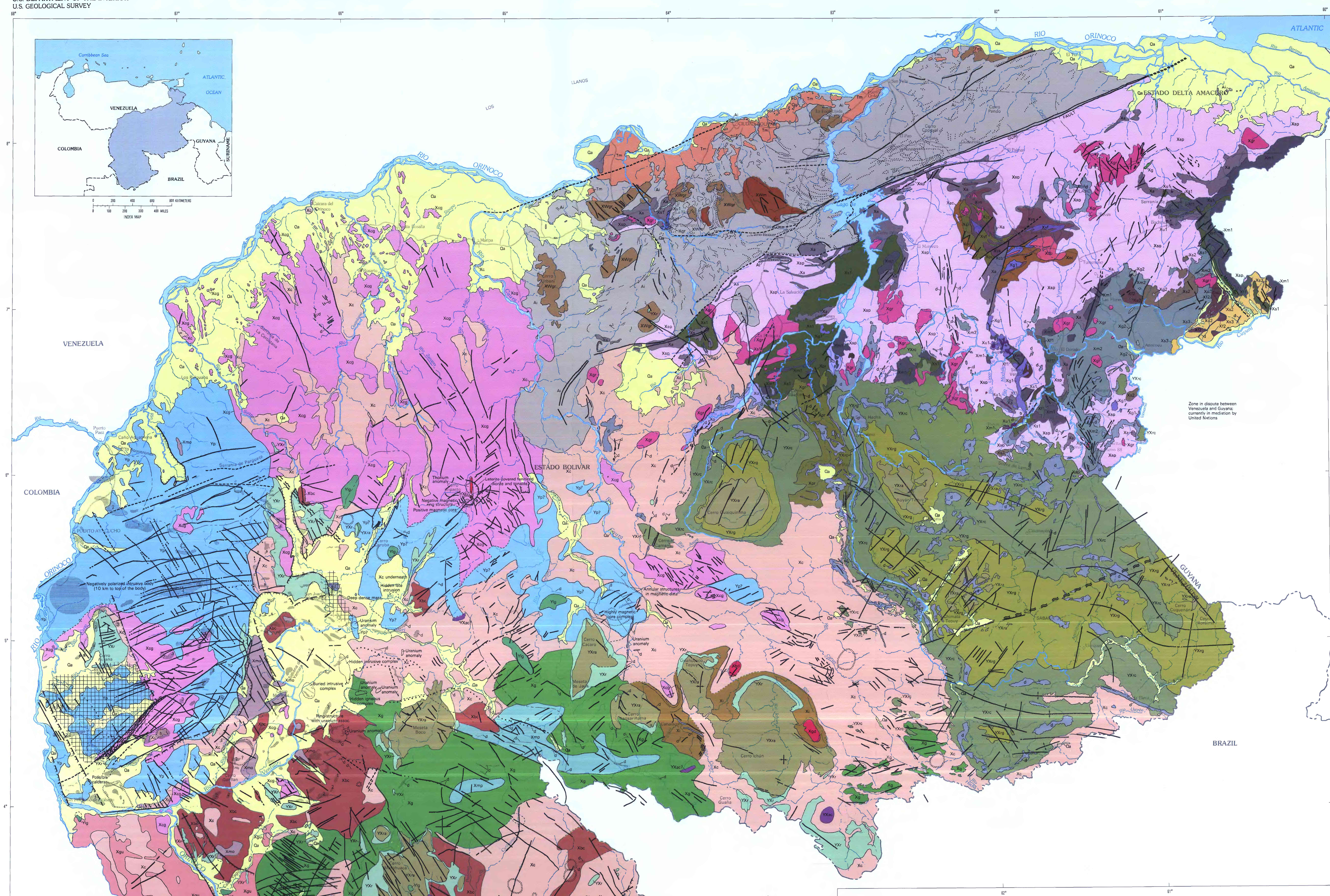
Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC20145	ELCHORRO	VE	BOLIVAR	08-03-30N	062-25-06W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BUAXITE	FERRUGINOUS QUARTZIT	PREC
TC20144	COPEYAL	VE	BOLIVAR	08-03-30N	062-25-06W	CLY3 AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE	FERRIGINOUS QUARTZIT	PREC
TC20143	KAMOIRAN	VE	BOLIVAR	05-43-54W	061-24-36W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE	GRANITE	PREC
TC20131	SOSA MENDEZ-UNION MI	VE	BOLIVAR	07-18-12N	061-47-42W	AU W	LODE/SHEAR ZONE	LOW-SULFIDE AU-QUARTZ VEIN	METABASALT, METAANDE	PROT
TC20130	LAGUNA MINE-SANTA RI	VE	BOLIVAR	07-19-04N	061-50-10W	AU W	VEIN, ELUVIAL	LOW-SULFIDE AU-QUARTZ VEIN	META-ANDESITE, SILIC	PREC
TC20127	PARAMICHI PLACERS	VE	BOLIVAR	04-04-31N	062-46-27W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	
TC20126	ALTO PARAGUA	VE	BOLIVAR	04-02-50N	062-58-08W	SN			RHYOLITIC TUFF	PREC
TC20125	MAIJIA PLACERS	VE	BOLIVAR	04-15-10N	062-51-22W	DIA	DIAMOND PLACER	DIAMOND PLACER	GRAVELS	
TC20124	PUMPIRI	VE	BOLIVAR	04-09-03N	062-43-53W	AU	PLACER, ALLUVIAL		ALLUVIAL SEDIMENTS	
TC20123	HACHA PLACERS	VE	BOLIVAR	04-20-04N	062-11-11W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20122	UONAN PLACERS	VE	BOLIVAR	04-32-07N	062-15-50W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20121	SAN LUIS PLACERS	VE	BOLIVAR	04-24-18N	062-11-41W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	
TC20120	LA BANDERA PLACERS	VE	BOLIVAR	04-19-27N	062-08-02W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20119	LOS CARIBES PLACERS	VE	BOLIVAR	04-13-12N	062-03-43W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	
TC20118	UAIPARU PLACERS	VE	BOLIVAR	04-27-42N	081-54-39W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20117	ICABARU PLACERS	VE	BOLIVAR	04-18-18N	061-44-38W	AU DIA	PLACER, ALLUVIAL	PLACER AU-PGE, PLACER DIAMOND	QUARTZ AND SANDSTONE	QUAT (HOLO
TC20116	CINCO RANCHOS PLACER	VE	BOLIVAR	04-31-50N	061-34-16W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20115	LA HOLLADA PLACERS	VE	BOLIVAR	04-35-21N	061-26-45W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20114	EL POLACO PLACERS	VE	BOLIVAR	04-42-00N	081-29-01W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	QUARTZ GRAVELS	CEN
TC20113	LA FAISCA PLACER	VE	BOLIVAR	04-43-59N	061-19-51W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20111	LA PENA PLACER	VE	BOLIVAR	04-43-02N	061-14-46W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20110	SANTA ELENA DE UAIRE	VE	BOLIVAR	04-42-14N	061-06-54W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	QUAT
TC20109	DIVINA PASTORA	VE	BOLIVAR	04-41-47N	061-01-42W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20108	FLORA BLANCA PLACERS	VE	BOLIVAR	05-01-28N	060-42-52W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	CEN
TC20107	EL LOCO PLACERS	VE	BOLIVAR	05-14-12N	061-10-08W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	CEN
TC20103	CONOROTO PLACERS	VE	BOLIVAR	05-01-05N	062-27-37W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20102	YIGUIRIPIN PLACERS	VE	BOLIVAR	05-04-25N	062-35-54W	DIA	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	
TC20101	LOS FRIJOLES PLACERS	VE	BOLIVAR	05-11-48N	062-42-42W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	CEN?
TC20100	CAPAURA PLACERS	VE	BOLIVAR	05-20-39N	062-46-00W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	CEN
TC20099	AVEQUI PLACERS	VE	BOLIVAR	05-20-16N	062-54-12W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	CEN
TC20098	LA SABANITA PLACERS	VE	BOLIVAR	05-17-42N	063-00-42W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	
TC20097	PARUPA PLACERS	VE	BOLIVAR	05-36-36N	062-53-19W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	QUARTZ GRAVELS	CEN
TC20096	PAO	VE	BOLIVAR	05-07-17N	063-11-01W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		
TC20095	LA PARAGUA PLACERS	VE	BOLIVAR	05-07-17N	063-37-24W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	
TC20094	CAURA PLACERS	VE	BOLIVAR	05-21-12N	064-13-30W	DIA AU	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	QUAT
TC20093	BARRIALON PLACERS	VE	BOLIVAR	06-01-30N	063-19-37W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20092	KAMU PLACERS	VE	BOLIVAR	05-26-26N	063-16-23W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20091	RIO CHIGUAO PLACERS	VE	BOLIVAR	05-49-24N	063-02-11W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	QUARTZ GRAVEL	CEN
TC20090	KAMARATA	VE	BOLIVAR	05-36-46N	062-26-41W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20089	LARINAL	VE	BOLIVAR	05-54-20N	062-21-08W	DIA AU	PLACER, ALLUVIAL	DIAMOND PLACER	GRAVELS	CEN
TC20085	SAN JUAN	VE	BOLIVAR	06-05-24N	081-20-44W	DIA	DIAMOND PLACER	DIAMOND PLACER		
TC20083	EL PAUJI	VE	BOLIVAR	06-11-09N	061-33-28W	AU CU	LODE	LOW-SULFIDE AU-QUARTZ VEIN	SCHIST	PROT
TC20082	APONWAO	VE	BOLIVAR	06-34-02N	061-18-23W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		
TC20081	LA LIRA	VE	BOLIVAR	06-39-55N	061-24-05W	AU	LODE			
TC20080	CRISTINA-BIZKAITARRA	VE	BOLIVAR	06-14-24N	061-25-47W	AU	LODE, VEIN	LOW-SULFIDE AU-QUARTZ VEINS	SCHIST	
TC20079	KM 88 - LAS CLARITAS	VE	BOLIVAR	06-14-40N	061-32-50W	AU	LODE, STOCKWORK, PLA		SCHIST	PROT
TC20077	CHICANAN	VE	BOLIVAR	06-31-35N	061-46-15W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	GRAVELS	CEN
TC20076	LA ESTRELLA	VE	BOLIVAR	07-08-42N	060-40-42W	AU	LODE, VEIN, PLACER	LOW SULFIDE AU-QUARTZ VEINS	LAVAS, METAVOLCANIC	PREC
TC20073	SAN PEDRO DE LAS BOC	VE	BOLIVAR	06-53-46N	062-52-29W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	QUARTZ GRAVEL	
TC20072	GUACHARAQUITO	VE	BOLIVAR	05-20-35N	062-49-10W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20071	SAN SALVADOR DE PAUL	VE	BOLIVAR	06-03-29N	062-53-42W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	QUARTZ AND SANDSTONE	QUAT
TC20070	RIO CARONI PLACERS	VE	BOLIVAR	06-23-37N	062-57-57W	DIA	DIAMOND PLACERS, ALL	DIAMOND PLACERS	QUARTZ GRAVELS	
TC20067	LEONCIO	VE	BOLIVAR	06-13-56N	063-13-54W	DIA	DIAMOND PLACER	DIAMOND PLACER		
TC20066	ASA PLACERS	VE	BOLIVAR	06-17-50N	063-15-09W	DIA	DIAMOND PLACERS, ALL	DIAMOND PLACER	QUARTZ GRAVELS	CEN
TC20064	MANAIMA	VE	BOLIVAR	06-11-26N	063-46-55W	AU	PLACER, ALLUVIAL	PLACER AU-PGE		
TC20063	RIO NICHARE	VE	BOLIVAR	06-27-48N	064-51-54W	TI	ALLUVIAL			

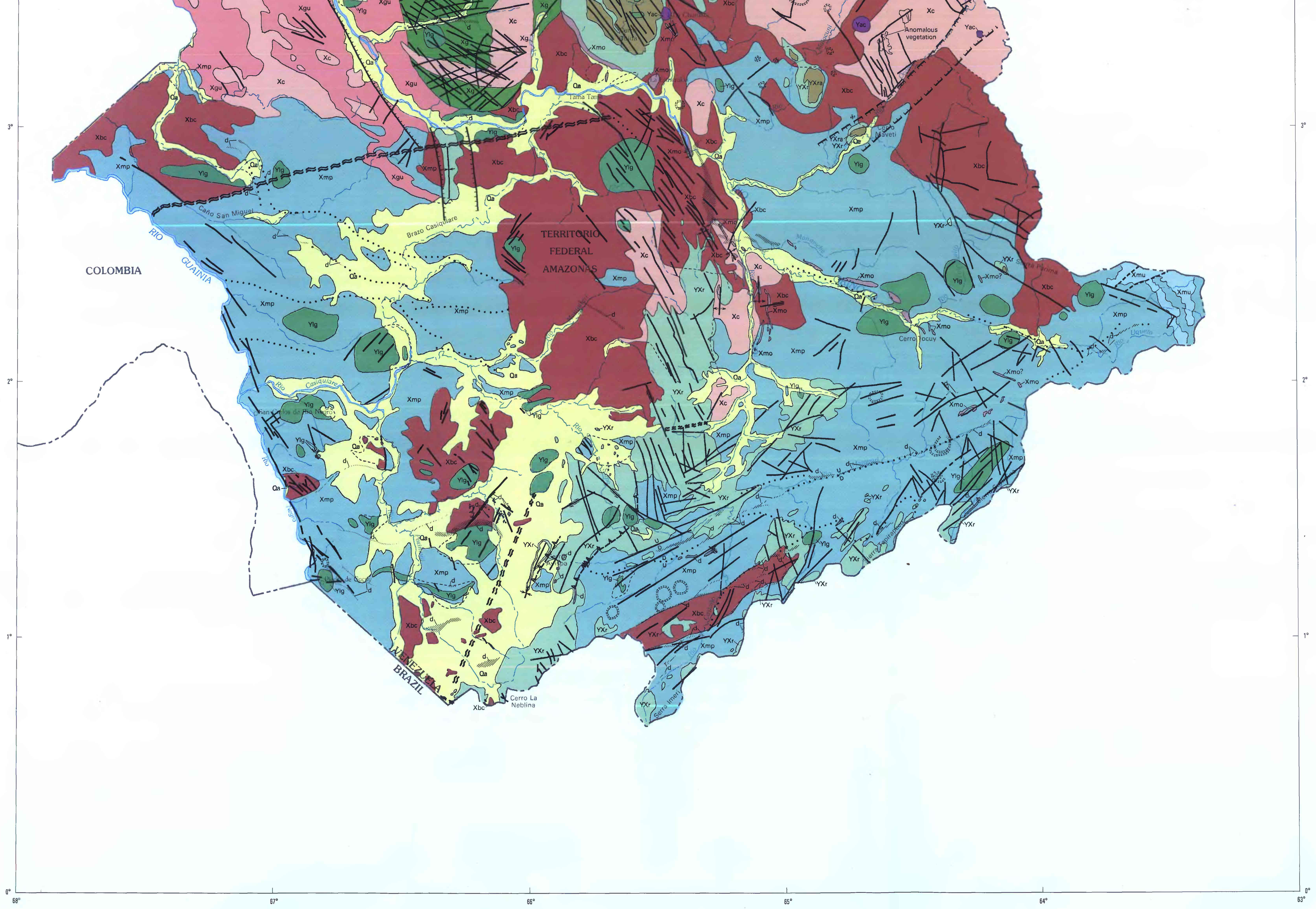
Record Number	Site for Sort	Country Code	State Name	Latitude DMS	Longitude DMS	Commod Present	Dep Type first	USGSModel first	Host Rock Type	Host Rock Age
TC20062	CERRO IMPACTO	VE	BOLIVAR	05-54-39N	065-13-17W	NB TH REE BA FE MN AL CE	LATERITE, CARBONATIT	CARBONATITE	CARBONATITE	PREC (OR Y
TC20061	QUEBRADA GRANDE PLAC	VE	BOLIVAR	06-26-30N	065-53-06W	DIA	PLACER, RESIDUAL, AL	DIAMOND PLACERS	GRAVEL, CLAY, LATERI	CEN PREC
TC20060	RIO SUAPURE	VE	BOLIVAR	06-16-14N	066-26-50W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACERS	RIVER SEDIMENTS	CEN
TC20059	LOS PIJIGUAOS	VE	BOLIVAR	06-25-40N	066-35-08W	AL1 CLY3 GA GE TI FE	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE	GRANITE (TWO MICA),	PROT-CEN 1
TC20057	GUANIAMO DISTRICT	VE	BOLIVAR	06-53-54N	065-55-01W	DIA AU	DIAMOND PIPES, PLACE	DIAMOND PLACERS, KIMBERLITE	GRAVELS, KIMBERLITES	
TC20056	SIPAO	VE	BOLIVAR	07-30-29N	065-19-47W	AU DIA	PLACER, ALLUVIAL			
TC20053	RIO ARO	VE	BOLIVAR	07-12-43N	063-55- W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER		
TC20041	EL GRILLERO	VE	BOLIVAR	07-26-56N	062-59- W	AU	ALLUVIAL, PLACER	PLACER AU-PGE		
TC20034	SUA-SUA	VE	BOLIVAR	06-53-43N	061-46-11W	AU	LODE, VEIN	LOW-SULFIDE AU-QUARTZ VEIN		PROT
TC20031	EL PLACER	VE	BOLIVAR	06-47-39N	061-35-42W	AU	LODE, VEIN	LOW-SULFIDE AU-QUARTZ VEIN		
TC20028	MARWANI - LOS CARIBE	VE	BOLIVAR	06-59-36N	060-44-28W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEINS	MAFIC TO FELSIC VOLC	
TC20026	AGUA NEGRA	VE	BOLIVAR	07-00-17N	060-27-05W	DIA AU	PLACER, ALLUVIAL	PLACER DIAMONDS, GOLD		
TC20025	RIO MARWANI	VE	BOLIVAR	07-04-07N	060-33-43W	AU	PLACER, ALLUVIAL			
TC20024	MARWANI IV	VE	BOLIVAR	07-06-42N	060-40-40W	AU	VEINS, PLACERS	LOW-SULFIDE AU-QUARTZ VEINS	WEATHERED QUARTZ-MIC	PROT?
TC20023	MARWANI I	VE	BOLIVAR	07-10-12N	060-37-33W	AU	LODE	LOW-SULFIDE AU-QUARTZ VEINS	MAFIC TO FELSIC VOLC	
TC20021	BOCHINCHE	VE	BOLIVAR	07-32-53N	060-47-07W	AU	VEINS, LODE, PLACER	LOW-SULFIDE AU-QUARTZ VEIN	META TUFFS, VOLCANIC	EPROT
TC20020	NURIA PLATEAU	VE	BOLIVAR	07-39-04N	061-33-57W	AL1 CLY3	LATERITE	LATERITE TYPE BAUXITE	GABBROID ROCKS	PREC
TC20017	RIO CLARO PLACERS	VE	BOLIVAR	08-02-53N	063-02-55W	DIA	DIAMOND PLACER, ALLU	DIAMOND PLACER	QUARTZ GRAVELS	
TC20015	UPATA DISTRICT	VE	BOLIVAR	08-06-46N	062-15-51W	AL1	LATERITE	LATERITE TYPE BAUXITE	FERRUGINOUS QUARTZIT	PREC
TC20014	EL MANGANESO	VE	BOLIVAR	08-02-33N	062-02-52W	MN				
TC20012	GUACURIPIA	VE	BOLIVAR	07-57-02N	062-14-15W	MN	LATERITE, RESIDUAL		QUARTZITE AND DOLOMI	ARCH
TC20011	EL PALMAR	VE	BOLIVAR	08-11-46N	061-55-09W	MN FE AL			SCHIST AND KAOLINIZE	ARCH
TC20009	CARUACHI PLACERS	VE	BOLIVAR	08-14-47N	062-46-37W	DIA	DIAMOND PLACERS, ALL	DIAMOND PLACERS	QUARTZ GRAVELS	CEN
TC20008	MOROCOTA	VE	DELTA AMACURO	08-34-09N	062-10-20W	FE MN	BANDED IRON FORMATIO	ALGOMA (?) FE	GRANULITE	ARCH
TC20007	PIACOA	VE	DELTA AMACURO	08-32-36N	062-08-02W	FE MN	BANDED IRON FORMATIO	ALGOMA (?) FE	GRANITIC GNEISSES AN	ARCH
TC20006	MANOA	VE	DELTA AMACURO	08-24-31N	061-19-57W	FE	BEDDED, BANDED IRON	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
TC20005	RIO AROI	VE	DELTA AMACURO	08-26-27N	061-23-26W	AL1	LATERITE, RESIDUAL	LATERITE TYPE BAUXITE		
TC20004	RIO ACURE	VE	DELTA AMACURO	08-12-47N	060-53-59W	AL CLY	SEDIMENTARY (?), ALL			
TC20003	SAN JUAN DE AMACURO	VE	DELTA AMACURO	08-22-38N	060-44-25W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	QUARTZITE, GRANULITE	ARCH
TC20002	LA LINEA	VE	DELTA AMACURO	08-20-24N	060-19-19W	FE	BANDED IRON FORMATIO	ALGOMA (?) FE	GRANULITE	ARCH
TC20001	WAUSA	VE	DELTA AMACURO	08-18-58N	060-04-14W	AU AL1	ALLUVIAL, RESIDUAL,			

Compiled using Republica de Venezuela Ministerio del Ambiente y de los Recursos Naturales Renovables, 1979, "Atlas de Venezuela," Dirección de Cartografía Nacional, 331 p.

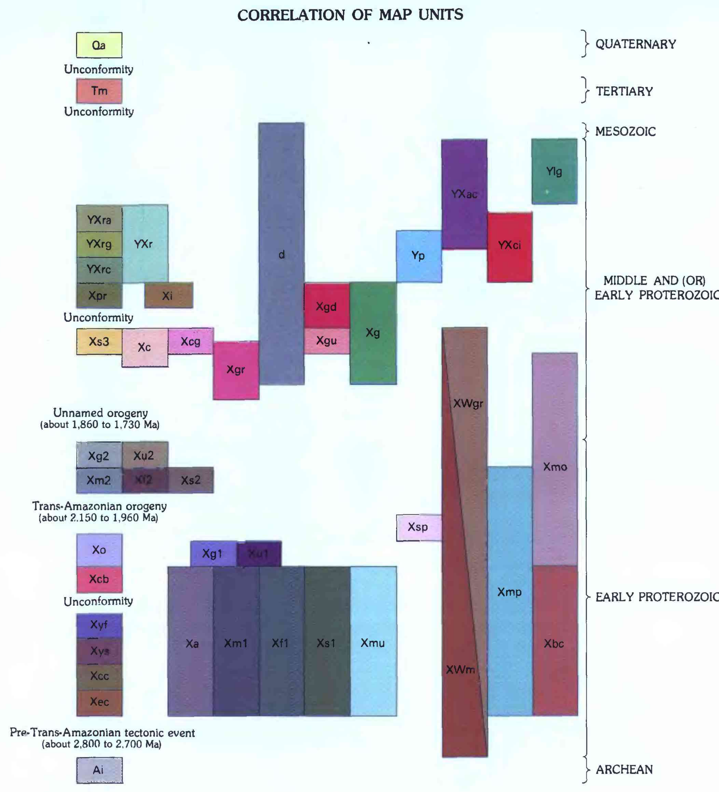
SELECTED GEOGRAPHIC FEATURES OF THE VENEZUELAN GUAYANA SHIELD

By
Paul G. Schruben, Floyd Gray, and Jeffrey C. Wynn
1993





CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SEDIMENTARY, METASEDIMENTARY, AND VOLCANIC ROCKS

Qa — **Alluvial deposits (Quaternary)**—Sand, gravel, and silt

Tm — **Mesa Formation (Pleistocene and Pliocene)**—Siltstone, sandy siltstone, and claystone. Unconsolidated gravel and sand in upper part

Roraima Group (Middle and Early Proterozoic)

YXr — **Roraima Group, undivided**

YXra — **Auyantepuy Formation of Yánez (1985)**—Mainly quartzarenite and minor arkose. Forms steep cliffs and flat-topped mesas. Equivalent to Mataui Formation of Reid and Bisque (1975)

YXrg — **Guaiquinima Formation of Yánez (1985)**—Fine-grained quartzarenite and arkose that are cross stratified, laminated, and massive; siltstone and graywacke; red, green, and greenish-gray jasper composed of devitrified and (or) silicified ash and small crystals of quartz and feldspar. Weathers to form flat or gently sloping topography. Upper part is mostly covered with debris from overlying Auyantepuy Formation. Several hundreds of meters thick. Equivalent to all but the lowermost part of the Uaimapué Formation of Reid and Bisque (1975)

YXrc — **Canaima Formation of Yánez (1985)**—Quartzarenite and arkose, conglomeratic arenite, conglomerate, siltstone, and shale. Abundant cross-strata in arenite and arkose units. Weathers to forms cliffs on resistant arenite, arkose, and conglomerate units and slopes on relatively nonresistant siltstone, shale, and silty arenite units. About 1,100–2,000 m thick (Yánez, 1985). Equivalent to Uairén and Coquenán Formations and lowermost part of Uaimapué Formation of Reid and Bisque (1975)

Xi — **Ichún Formation of Briceño and others (1989) (Early Proterozoic)**—Well-stratified ignimbrite, sandstone, and andesite flows

Xpr — **Pre-Roraima Group sedimentary rocks (Early Proterozoic)**—Fine-grained to very fine grained, clay-rich sandstone, locally containing granule-size quartz grains, interbedded with red shale and sandy shale (Briceño, 1982). Includes Urico Formation. Probably is unconformabe below Roraima Group

Xs3 — **Los Caribes Formation (Early Proterozoic)**—Weakly metamorphosed to unmetamorphosed sequences of reddish arkose and polymictic conglomerate and minor felsic tuff

Xc — **Caicara Formation of the Cuchivero Group (Early Proterozoic)**—Rhyodacitic to rhyolitic tuff, some of which is crystal and lithic rich; rhyodacite porphyry; andesite and dacite lava flows that commonly are hydrothermally altered; andesite to basalt dike; rhyodacite granophyre; local mylonite. Only slightly metamorphosed

Xo — **Metasedimentary rocks of Río Oris (Early Proterozoic)**—Hematitic quartzarenite; reddish phyllitic siltstone; feldspathic arenite; conglomeratic arenite; quartz-sericite phyllite; red, laminated, fine-grained meta-arenite showing graded bedding and erosional channels

Xmo — **Moriche Formation and correlative rocks (Early Proterozoic)**—Mainly metaconglomerate, quartzite, and mica schist. Includes Cinaruco and Esmeralda Formations

DEEP-SEATED METAMORPHIC AND PLUTONIC ROCKS AND BASEMENT ROCKS IN TERRITORIO FEDERAL AMAZONAS (EARLY PROTEROZOIC)

Xmu — **Greenstone-belt rocks**

Xmp — **Metamorphic-plutonic terrane of San Carlos**—Granite, granite gneiss, and augen gneiss and relatively abundant pegmatite

Xbc — **Basement complex**—Well-foliated granite to granodiorite gneiss

EUGEOSYNCLINAL METAMORPHIC ROCKS OF NORTHEASTERN ESTADO BOLIVAR (EARLY PROTEROZOIC)

Xg2 — **Metagabbro**

Xu2 — **Ultramafic rocks**—Mainly metaperidotite, metapyroxenite, serpentinite, and talc schist. Cumulus texture is locally preserved

Xs2 — **Mica schist and phyllite**—Quartz + muscovite ± chlorite ± chloritoid ± ankerite schist and phyllite and subordinate quartzite or metachert derived from sedimentary and felsic volcanic rocks. Ankeritic rocks weather to ferruginous schist and phyllite

Xf2 — **Felsic metatuff and flows**—Quartz + muscovite ± chloritoid schist containing relict phenocrysts of partially resorbed quartz and broken plagioclase replaced by albite. Groundmass is mainly devitrified glass. Traces of relict lapilli are locally abundant

Xm2 — **Mafic to intermediate metalava and metatuff**—Chlorite + epidote ± actinolite schist and phyllite and greenstone, commonly containing relict pyroxene phenocrysts. Relict textures suggest amygdaloidal flows and lithic- and crystal-rich tuff

GREENSTONE-BELT ROCKS OF EL CALLAO AREA (EARLY PROTEROZOIC)

Xcb — **Caballape Formation**—Mainly felsic metatuff and phyllite derived from laminated volcaniclastic siltstone and graywacke. Metatuff contains plagioclase phenocrysts, resorbed phenocrysts of quartz, wisps of pumice, and minor lithic clasts

Pastora Supergroup

Yuruari Formation

Xyf — **Felsic metatuff**—Quartz ± muscovite ± calcite schist containing relict quartz and feldspar phenocrysts and traces of lapilli and breccia clasts. Minor greenstone

Xys — **Schist and phyllite**—Finely laminated quartz + muscovite ± chloritoid ± biotite ± andalusite ± sillimanite schist locally containing volcaniclastic metasandstone and felsic metatuff and breccia

Carichapo Group

Xcc — **Cicapra Formation**—Mafic to intermediate metatuff. Mainly albite ± epidote ± biotite amphibolite. Relict textures suggest interlayering of tuff and volcaniclastic sandstone

Xec — **El Callao Formation**—Greenstone, greenschist, and minor talc-schist and amphibolite. Relict pillow structures are common. Flow rocks are commonly intercalated with flow breccia. Fine-grained quartz-hematite rocks are present in uppermost part. Minor chert

ROCKS OF OTHER GREENSTONE BELTS (EARLY PROTEROZOIC)

Xg1 — **Metagabbro**—Saussuritized and locally amphibolitized. Cumulus texture is locally present

Ultramafic rocks—Mainly metaperidotite, metapyroxenite, serpentinite, and talc schist. Relict cumulus texture is locally present

Xs1 — **Mica schist and phyllite**—Quartz + muscovite ± chlorite ± ankerite schist and phyllite and subordinate quartzite or metachert derived from sedimentary and felsic volcanic rocks. Ankeritic rocks weather to ferruginous schist and phyllite

Xf1 — **Felsic metatuff and flows**—Quartz + muscovite ± chlorite schist containing relict phenocrysts of partially resorbed quartz and broken feldspar

Xm1 — **Mafic to intermediate metalava and metatuff**—Chlorite + albite + epidote ± actinolite schist, phyllite, and greenstone that are locally amygdaloidal. Subordinate albite-epidote amphibolite and minor amphibolite. Minor chert

Xa — **Amphibolite**—Mainly highly deformed hornblende schist containing plagioclase. Locally shows outlines of original phenocrysts replaced by hornblende

ROCKS OF IMATACA TERRANE

Ai — **Imataca Complex (Archean)**—Amphibolite- to granulite-facies quartz-feldspar orthogneiss and paragneiss, commonly garnet bearing, and felsic granulite. Subordinate pyroxene granulite and charnockite. Dashes indicate metamorphosed iron formation and ferruginous quartzite. Protolith may be as old as 3,700–3,400 Ma (Montgomery, 1979) and age of metamorphism is 2,150–2,000 Ma (Onstott and others, 1989)

XWm — **Migmatite and gneiss (Early Proterozoic and (or) Archean)**—Granitic migmatite and lineated gneiss

INTRUSIVE ROCKS

d — **Diabase (Mesozoic to Early Proterozoic)**—Dark-gray to greenish-gray, fine- to coarse-grained diabase of tholeiitic composition. Present as dikes, sills, and laccoliths

Ylg — **Late granite (Middle Proterozoic)**—Typically penetrating through, and doming, Roraima sediments

YXac — **Alkaline complexes (Middle to Early Proterozoic)**—Riebeckite- and aegerine-bearing granite, gabbro

YXci — **Carbonatite intrusion of Cerro Impacto (probably Middle to Early Proterozoic)**

Yp — **Parguaza Granite (Middle Proterozoic)**—Rapakivi-textured granite

Xgd — **Silicic to intermediate intrusive rocks (Early Proterozoic)**—Forms small domes intruding and folding Ichún Formation rocks

Xgu — **Intrusive rocks, undivided (Early Proterozoic)**—Underlies water-flooded plains and jungle in southeastern Territorio Federal Amazonas

Xg — **Calc-alkaline granite (Early Proterozoic)**—Massive, coarse-grained, gray, equigranular biotite granite that has rapakivi texture similar to rocks of the Parguaza Granite

Xcg — **Granitic rocks of the Cuchivero Group (Early Proterozoic)**—Includes Santa Rosalía granite

Xgr — **Granitic rocks of post-Supamo age (Early Proterozoic)**—Mostly monzogranite and granite. Porphyritic, medium to coarse grained. Includes some granodiorite and tourmaline-rich rocks

Xsp — **Supamo Complex (Early Proterozoic)**—Sodic granodiorite and trondhjemite, paragneiss, and migmatite commonly in dome-shaped intrusions. Rare pegmatite. About 2,230–2,050 Ma (Sidder and Mendoza, in press)

XWgr — **Granitic rocks of Imataca Complex (Early Proterozoic and (or) Archean)**—Granite and granodiorite

Geologic contact—Approximately located. Dashed where concealed

Area underlain by intrusive magnetic rocks

Area of iron formation

Major deep-penetrating shear zone inferred from geologic mapping and radar imagery

Graben-bounding fault—Dashed where inferred; ticks point toward graben

Fracture or fault determined from geologic mapping, magnetic data, or airborne radar imagery—Direction of movement, where shown, is based on ground mapping. Dashed where inferred; dotted where implied

Anticline

Syncline

Structural trend

Magnetic source—Number, where shown, indicates depth (in kilometers) to top of source; s, shallow; d, deep

2 **Positively polarized**

s **Negatively polarized**

Deep dense mass

Circular feature of unknown origin identified using geophysical or side-looking radar imagery data—In some cases may represent caldera

Axis of strong magnetic gradient—May represent major hidden fault or suture between different geologic terranes

DISCUSSION

The geologic map of the Venezuelan Guayana Shield was produced digitally from 12 1:500,000-scale geologic maps that were compiled by geologists of the U.S. Geological Survey and Corporacion Venezolana de Guayana, Técnica Minera, C.A., between 1990 and 1992 using geologic (Sidder and Martinez, 1990; Sidder and Mendoza, 1991, in press) and geophysical (Graterol, 1988; Herrero and Navarro, 1989; this report, pls. 3, 4) data and interpretations and numerous published and unpublished larger scale maps. The information on the 1:500,000-scale maps was digitized and reprojected to 1:1,000,000 scale using GSMAP (Selner and Taylor, 1991). The projection used is Proyeccíon Cónico Secante Compensada, an equidistant conic projection using lat 4° and 9° N. as standard parallels and long 66° W. as the central meridian. The 1:1,000,000-scale map was then transformed into ARC-INFO files for further refinement and compilation and for preparation of the materials from which this map was created.

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CONTRIBUTORS

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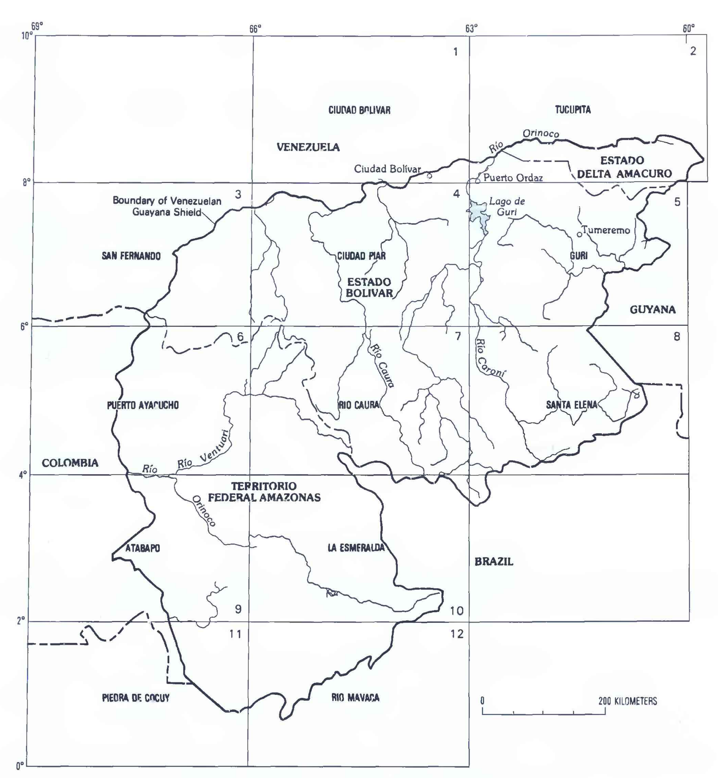

Names and locations of 2° × 3° 1:500,000-scale quadrangles are shown

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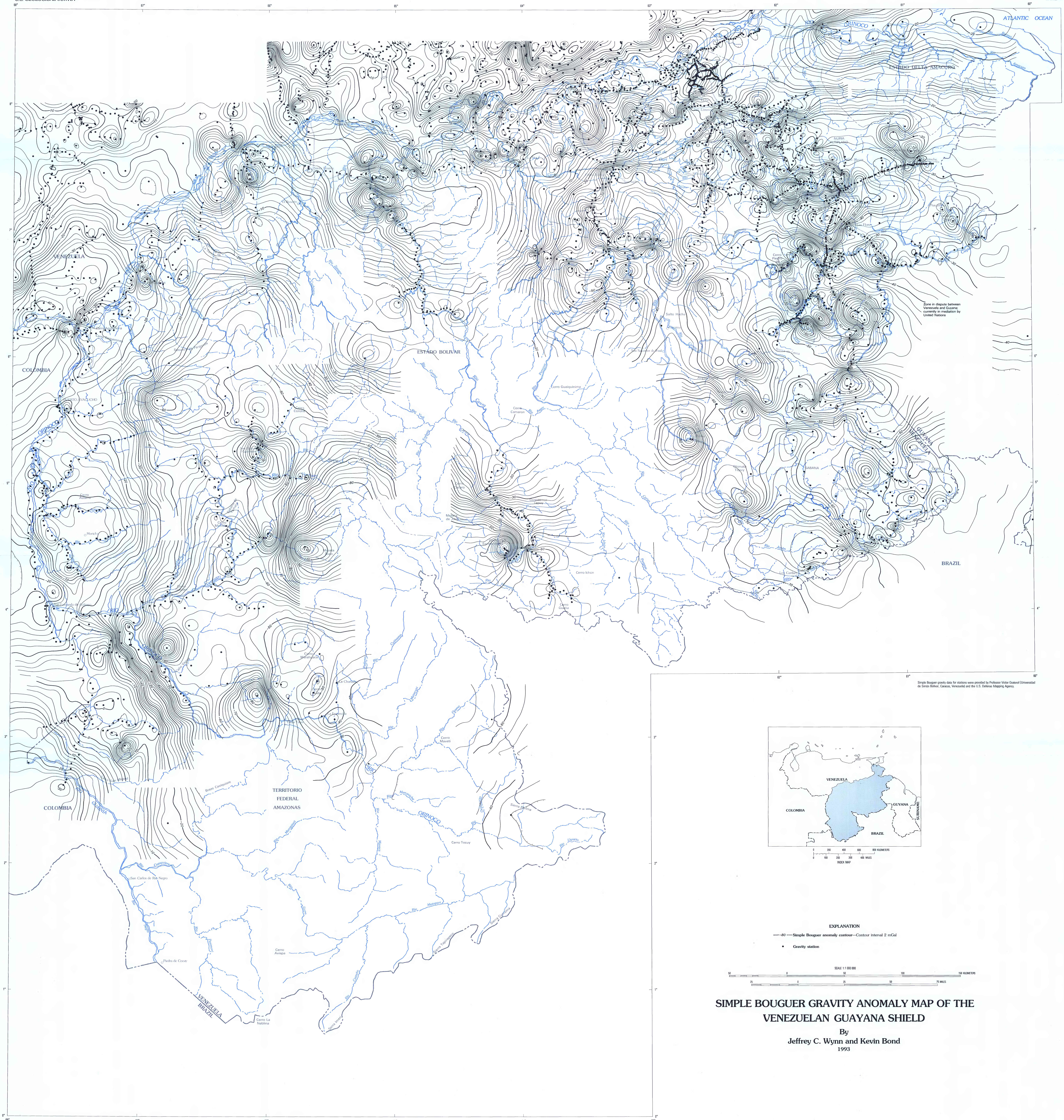
SCALE 1:1 000 000

GEOLOGIC AND TECTONIC MAP OF THE VENEZUELAN GUAYANA SHIELD

Compiled by
Jeffrey C. Wynn, Dennis P. Cox, Floyd Gray, and Paul G. Schruben

1993



Simple Bouguer gravity data for stations were provided by Professor Victor Graterol (Universidad de Simón Bolívar, Caracas, Venezuela) and the U.S. Defense Mapping Agency.

EXPLANATION

—80— Simple Bouguer anomaly contour—Contour interval 2 mGal

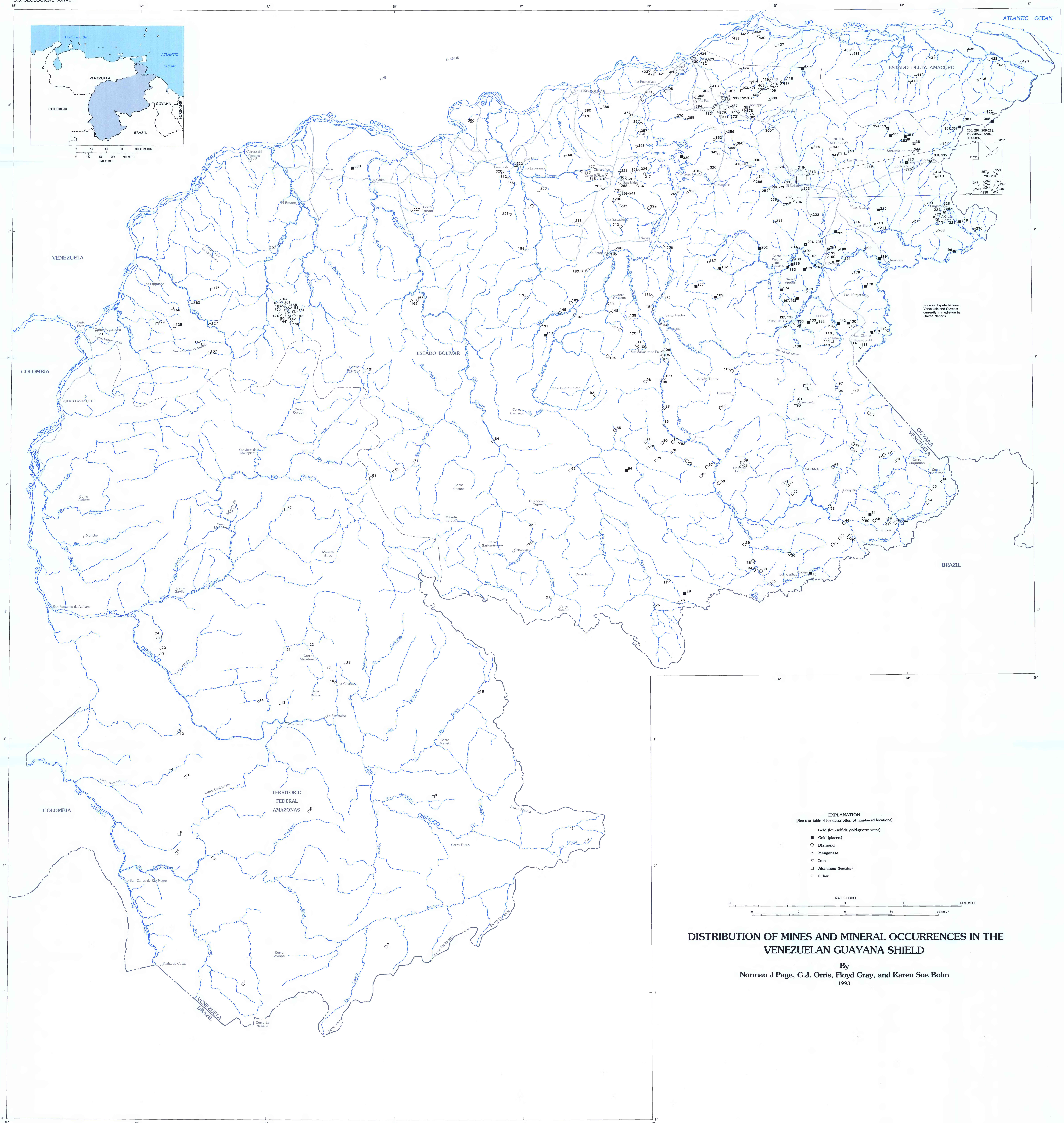
• Gravity station

SCALE 1:1 000 000

SIMPLE BOUGUER GRAVITY ANOMALY MAP OF THE VENEZUELAN GUAYANA SHIELD

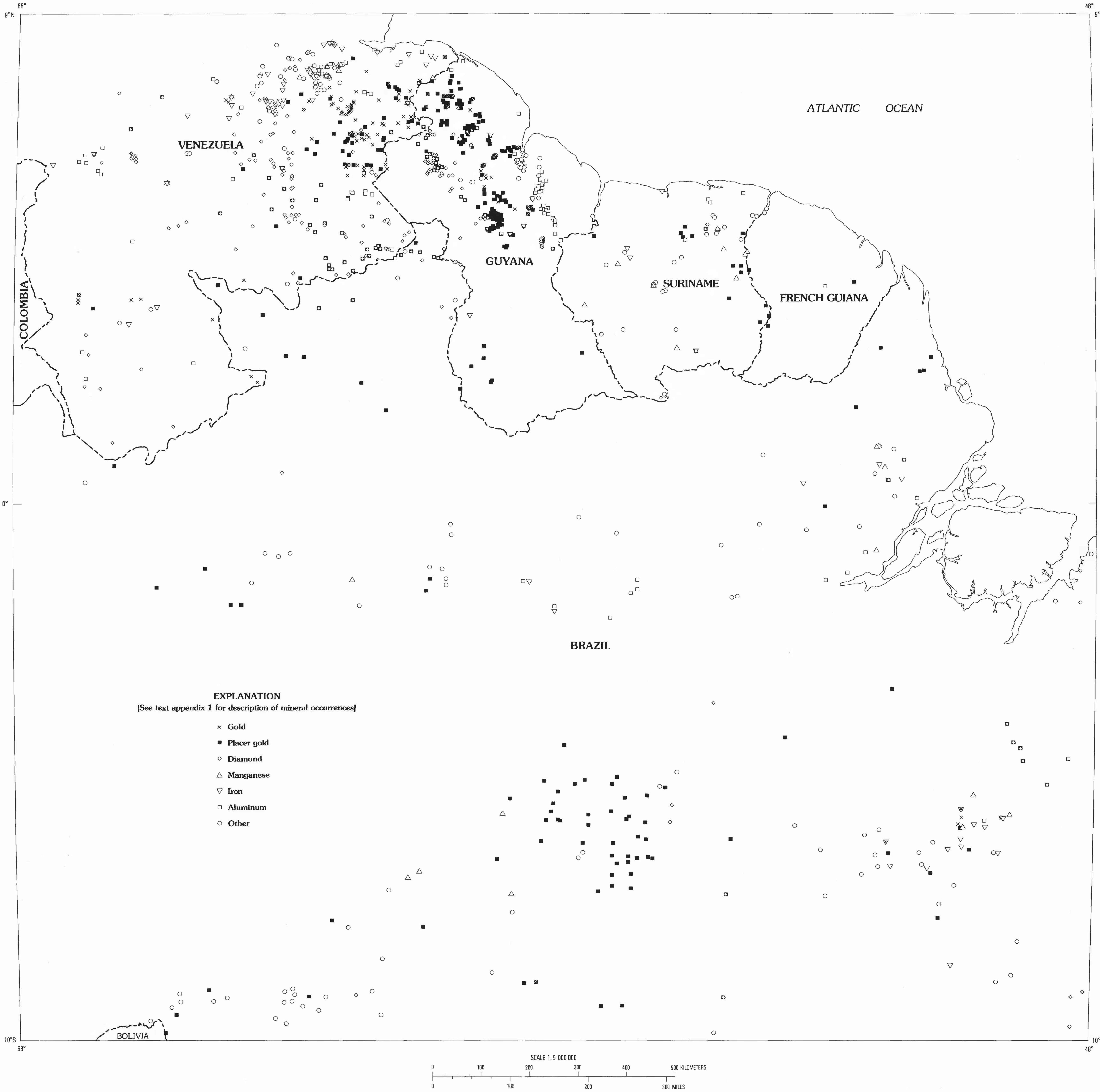
By
Jeffrey C. Wynn and Kevin Bond

1993



DISTRIBUTION OF MINES AND MINERAL OCCURRENCES IN THE VENEZUELAN GUAYANA SHIELD

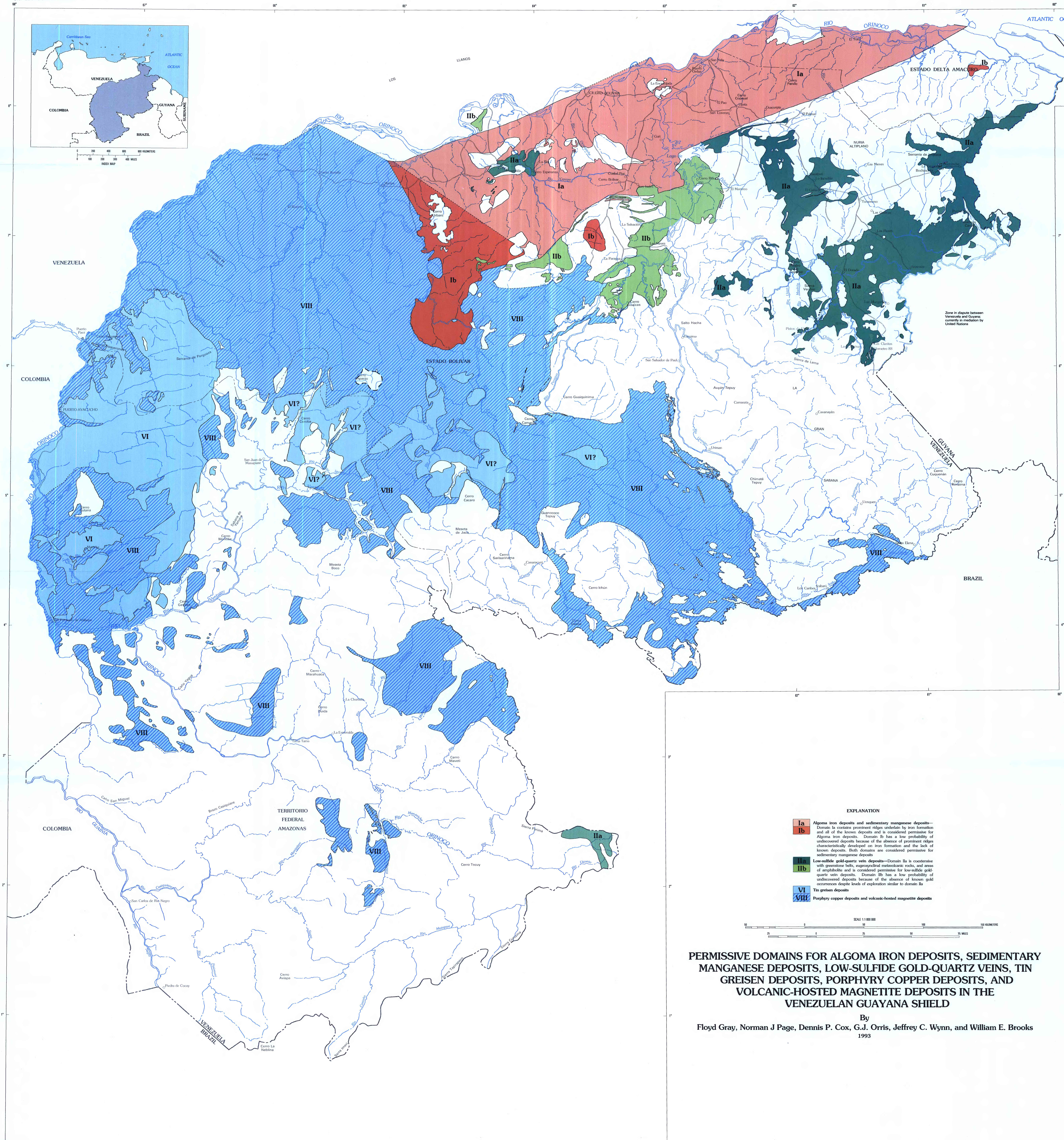
By
Norman J Page, G.J. Orris, Floyd Gray, and Karen Sue Bolm
1993



DISTRIBUTION OF MINERAL OCCURRENCES IN NORTHEASTERN SOUTH AMERICA

By
Norman J Page, Floyd Gray, and Karen Sue Bolm

1993



EXPLANATION

Ia / Ib — **Algoma iron deposits and sedimentary manganese deposits**—Domain Ia contains prominent ridges underlain by iron formation and all of the known deposits and is considered permissive for Algoma iron deposits. Domain Ib has a low probability of undiscovered deposits because of the absence of prominent ridges characteristically developed on iron formation and the lack of known deposits. Both domains are considered permissive for sedimentary manganese deposits

IIa / IIb — **Low-sulfide gold-quartz vein deposits**—Domain IIa is coextensive with greenstone belts, eugeosynclinal metavolcanic rocks, and areas of amphibolite and is considered permissive for low-sulfide gold-quartz vein deposits. Domain IIb has a low probability of undiscovered deposits because of the absence of known gold occurrences despite levels of exploration similar to domain IIa

VI — **Tin greisen deposits**

VIII — **Porphyry copper deposits and volcanic-hosted magnetite deposits**

SCALE 1:1 000 000

0 50 100 150 KILOMETERS

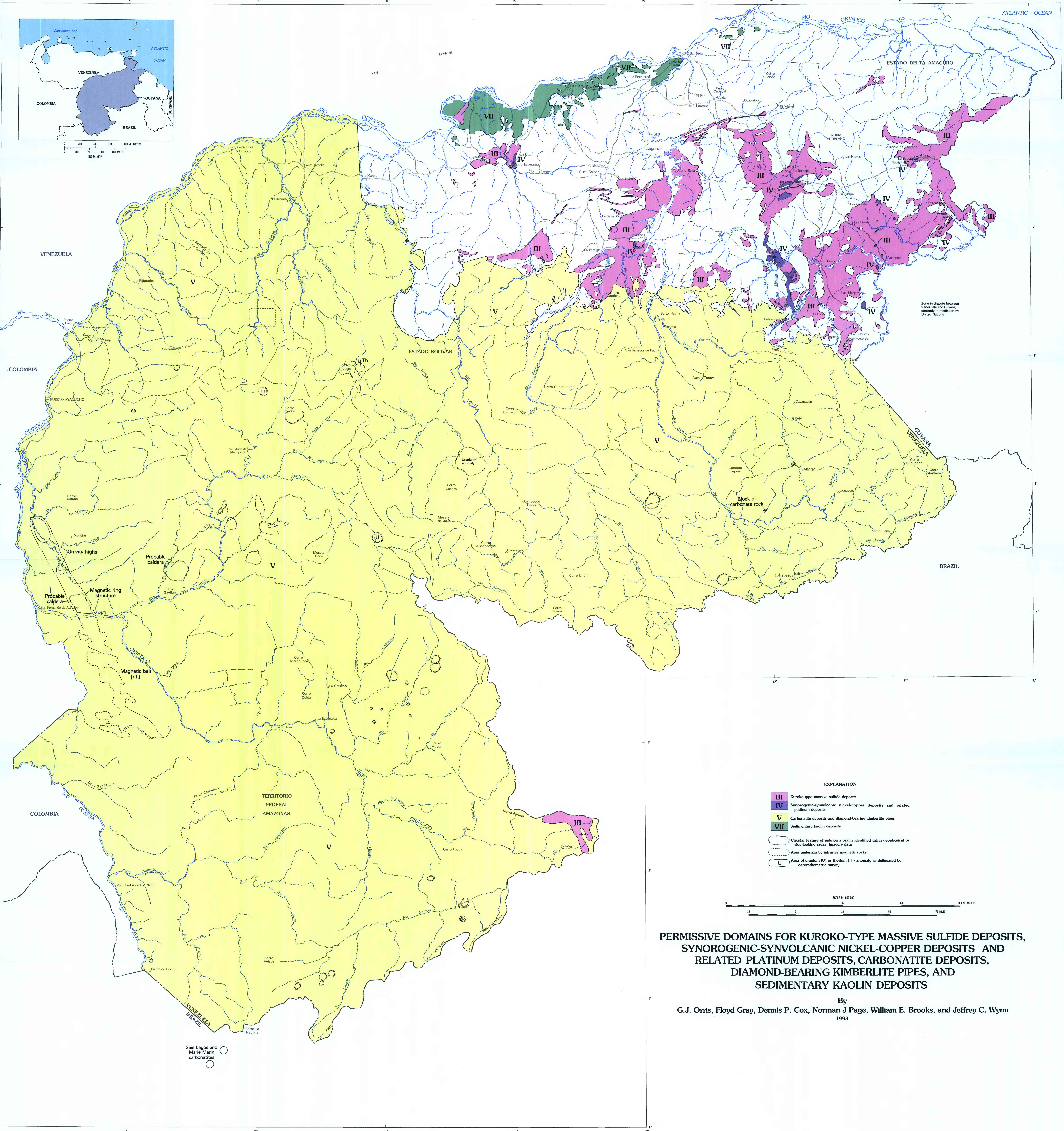
25 0 25 50 75 MILES

PERMISSIVE DOMAINS FOR ALGOMA IRON DEPOSITS, SEDIMENTARY MANGANESE DEPOSITS, LOW-SULFIDE GOLD-QUARTZ VEINS, TIN GREISEN DEPOSITS, PORPHYRY COPPER DEPOSITS, AND VOLCANIC-HOSTED MAGNETITE DEPOSITS IN THE VENEZUELAN GUAYANA SHIELD

By

Floyd Gray, Norman J Page, Dennis P. Cox, G.J. Orris, Jeffrey C. Wynn, and William E. Brooks

1993



EXPLANATION

III	Kuroko-type massive sulfide deposits
IV	Synorogenic-synvolcanic nickel-copper deposits and related platinum deposits
V	Carbonatite deposits and diamond-bearing kimberlite pipes
VII	Sedimentary kaolin deposits

Circular feature of unknown origin identified using geophysical or side-looking radar imagery data

Area underlain by intrusive magnetic rocks

U — Area of uranium (U) or thorium (Th) anomaly as delineated by aeroradiometric survey

SCALE 1:1 000 000

PERMISSIVE DOMAINS FOR KUROKO-TYPE MASSIVE SULFIDE DEPOSITS, SYNOROGENIC-SYNVOLCANIC NICKEL-COPPER DEPOSITS AND RELATED PLATINUM DEPOSITS, CARBONATITE DEPOSITS, DIAMOND-BEARING KIMBERLITE PIPES, AND SEDIMENTARY KAOLIN DEPOSITS

By
G.J. Orris, Floyd Gray, Dennis P. Cox, Norman J Page, William E. Brooks, and Jeffrey C. Wynn
1993