Agencia
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Mining Round for Copper, Gold,

Polymetallic and Associated Minerals

Strategic Mining Areas

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STRATEGIC MINING AREAS

ÁREAS ESTRATÉGICAS MINERAS – AEM

Mining Round for Copper, Gold, Polymetallic and Associated Minerals

The development of the Colombian economy has been characterized, with a few exceptions, by an approach that prioritizes the extraction of primary commodities aimed at meeting international demand. As a result, the mining sector has specialized in the extraction of coal, gold, and ferronickel, among others, which are subsequently exported to global consumption centers without any significant national productive linkages or value-added processing.

Extracting mineral wealth from our subsoil only to export it in raw form, thereby missing the opportunity to add value through industrial processes and thus generate greater wealth, employment, income, and well-being for the country, became the supreme rule of the nation’s economic and sectoral policy.

The result is a re-primarized economy, dependent on extraction volumes and international prices. Our revenues fluctuate with the ups and downs of commodity prices, with the added problem that when prices fall, not only the mining sector is affected, but the entire economy suffers due to its excessive dependence on income generated by mineral exports, tax payments, royalties, and other related revenues.

For the above reasons, one of the main objectives of this Government has been to transition from an extractivist economy to a productive economy. In that direction, the first step from the mining sector was taken with the issuance of ANM Resolution 1006 of 2023, which updated the list of minerals deemed strategic for the country's social and economic development. This administrative act defined 17 groups of strategic minerals, including metals such as copper, gold, nickel, zinc, platinum-group metals, iron, manganese, magnesium, bauxite, chromium, and their associated minerals, derivatives or concentrates, all of which are essential for the energy transition and the country's reindustrialization.

Based on this definition and using available geoscientific information, the National Mining Agency (ANM) delineates Strategic Mining Reserve Areas (Áreas de Reserva Estratégica Minera – AEM) for evaluation and subsequent awarding through objective selection processe, whose terms of reference establish the minimum participation requirements, as well as the special obligations of the concessionaire and the additional considerations beyond royalties that they must pay to the State.

In this way, the Strategic Mining Reserve Areas (AEM) mechanism has become a valuable tool to foster the development of a mining sector oriented toward extracting the primary commodities that domestic industry needs in order to grow and thrive, thereby transforming and adding value to our minerals and contributing to the construction of infrastructure, agricultural development, the energy transition, and the reindustrialization of the country.

In the current context of energy transition and growing global demand for critical and strategic minerals, Colombia is positioned as a country with high potential for the exploration and development of copper projects and polymetallic deposits that include minerals such as silver, gold, zinc, molybdenum, and nickel. These mineral resources are essential for the development of clean technologies, electrical infrastructure, and advanced industrial processes, and they represent a key opportunity to drive reindustrialization through modern mining that is aligned with the country's environmental, climate, and social challenges.

Accordingly, following the designation of copper as a strategic mineral, the National Mining Agency (ANM) began in 2021 to structure an objective selection process to award Strategic Mining Areas focused on copper and polymetallics.

This process seeks to select the most favorable offer for the granting of special contracts for exploration and exploitation, ensuring transparency, legal certainty, and promoting responsible and sustainable projects that generate added value for the mining sector, the regions, and the country as a whole.

In the Metallogenic Map of Colombia (2016–2022), published by the Colombian Geological Service (SGC in Spanish), 142 copper deposits, occurrences, and prospects are identified, primarily iron oxide–copper–gold deposits and sediment-hosted or stratabound deposits, located especially in the Serranía de Perijá and the Western Cordillera. Likewise, the SGC has established that Colombia possesses favorable geological settings for the existence of copper deposits, particularly in the departments of Córdoba, Chocó, Nariño, Antioquia, La Guajira, and Cesar.

Currently, copper exploration projects are being developed in various zones of the country, mainly in the departments of Córdoba, Antioquia, Cesar, La Guajira, and Chocó, with positive results that have allowed for the identification of more than eight projects with information on mineral resources and reserves under international standards. Among them, one project in the exploitation and exploration phase has reported average grades of up to 2.47% Cu in proven reserves.

Copper is primarily used in the electricity sector (due to its high conductivity), construction (pipes and wiring), telecommunications (data and voice transmission), renewable energy (solar panels, batteries, wind turbines), and healthcare (medical implants and surgical instruments), among others.

As for gold, Colombia has identified various favorable geological settings, with mineral occurrences of vein and alluvial types distributed across almost the entire national territory. These deposits are grouped into districts associated with metallogenic belts in the departments of Antioquia, Santander, Tolima, Huila, Caldas, Nariño, Cauca, and Bolívar, as well as in areas formed by erosion of the western branches of the Andes along the Colombian Pacific coast, and in the Vaupés and Guainía regions.

In addition to its traditional role as a safe-haven asset in international markets and in jewelry, gold is an important input in sectors such as medicine (injection of gold nanoparticles for cancer therapy and rheumatoid arthritis treatment), space exploration (components in satellites and spacecraft), technology (microprocessors, sensors, and electronic devices), the textile industry (high-fashion garments), and others.

During the 2021–2024 period, gold production in Colombia has remained close to 70 tonnes per year, positioning the country as the fourth-largest gold producer in Latin America and the seventeenth-largest worldwide. This output has been driven largely by high international gold prices, fueled by its role as a safe-haven asset.

Undoubtedly, the development of copper and gold projects, together with their associated minerals, represents a strategic opportunity to reduce dependence on imports, generate employment, and drive the country’s reindustrialization by providing the raw materials needed for industrial development in key sectors linked to the energy transition. This can be achieved while promoting investment and ensuring high technical, social, and environmental standards that guarantee innovative, transparent mining with substantial benefits for communities and the nation as a whole.

02

MINING FOR ECONOMIC DEVELOPMENT AND NATIONAL REINDUSTRIALIZATION

Colombia has a commitment to sustainable development through policies that promote the use of renewable energies, environmental conservation, and sustainable business practices, seeking a balance between development and social responsibility. Additionally, the country benefits from a strategic location in South America, with access to both the Caribbean Sea and the Pacific Ocean, as well as a clean energy matrix primarily based on hydropower. This has enabled a significant reduction in greenhouse gas emissions, positioning Colombia as a key focal point in Latin America for the development of various industries. In the mining sector, according to the Colombian Geological Service, the country has high potential for the exploitation of copper, gold, and other metals.

In line with the above, the Just Energy Transition, linked to the increased extraction of strategic minerals and the development of related industries as part of a global strategy, represents a tremendous opportunity for economic growth in Colombia's regions. According to international projections, the clean technology market could triple in size by 2035[1], with wind, hydroelectric, and solar photovoltaic technologies standing out as key pillars for decarbonization and compliance with the Paris Agreement goals. To enable the widespread adoption of these technologies, the International Energy Agency (IEA, 2022) has identified a group of minerals essential for the energy transition, including: copper, lithium, nickel, manganese, cobalt, graphite, chromium, molybdenum, zinc, rare earth elements, and silicon.

For this reason, the National Mining Agency (ANM), with the firm objective of strengthening the value chains of strategic minerals for the energy transition, and in accordance with ANM Resolution No. 1006 of November 30, 2023, has promoted productive linkages for these minerals through engagement spaces with key sector stakeholders, including mining and industrial businesses, academia, and local communities. Additionally, the ANM has developed and published specialized value chain documents for strategic minerals on its microsite Mining en Colombia[2] from de ANM.

1. World Energy Outllok, Energy International Agency, 2024 (https://www.iea.org/reports/world-energy-outlook-2024)2.
2. Micrositio Grupo de Promoción, Vicepresidencia de Promoción y Fomento, ANM, (https://mineriaencolombia.anm.gov.co/)

All these efforts will materialize with the availability of areas where mining can be developed with high social and environmental responsibility, respecting the principles of coordination and concurrence, in addition to prior consultation. This is why this document provides information on the different geological-technical variables of 17 blocks of Strategic Mining Areas, which are made available to the country and citizens through the mining round for copper, gold and polymetallic minerals, with a value aggregation approach. To this end, some relevant data on copper ore are presented below, highlighting the different steps in its value chain. It is important to note that these areas not only have high mineral potential identified by the Colombian Geological Survey but also for gold, silver and other associated polymetallic minerals; however, the development of copper refining plants in the country is necessary to make this important mineral input available to the national industry.

Copper mineral production chain.

Copper is one of the main minerals necessary for the energy transition, due to its participation in all non-conventional renewable energy source technologies (FNCER in Spanish). Additionally, it is widely used in industries related to construction, mine copper, construction, electronics and electrical, among others. In 2023, global copper production was 22.41 million tons, of which 37,30% was produced in South America[3]; however, it is estimated that approximately 28 million tons of copper are used annually worldwide[4]. Additionally, to implement global energy transition policies, it is estimated that copper supply will need to increase significantly starting in 2025 (approximately 30% according to the Energy Transition Commission, 2023)[5]. However, this scenario is concerning due to the decrease in production from existing mines, caused by declining ore grades, which is reflected in rising prices. In line with the above, and according to data published by the Chilean Copper Commission - Cochilco and the London Metal Exchange - LME, the annual international price per ton of copper increased by 47.97% (+USD 2,964.97) during the period 2020 – 2024. The largest increase was recorded in 2021 compared to 2020, with an increase of 33.67%, reaching USD 9,317.60 per ton.

Colombia has copper and polymetallic exploration and exploitation projects, in which polymetallic copper concentrates are exploited and exported for refining primarily in China. According to data from the National Administrative Department of Statistics - DANE, between 2020 and 2024 the average price per ton exported from Colombia of polymetallic copper concentrates increased by USD 540 per ton (+40.38%), rising from USD 1,337 per ton in 2020 to USD 1,877 per ton in 2024.

According to information published by the company Atico Mining, which owns the main copper exploitation project in the country, "El Roble," in 2024 they produced and exported 33,922 tons of polymetallic copper concentrates, of which 18.3% corresponds to copper[6], which is approximately equivalent to 6,221 tons of the mineral.

3. Anuario de Estadísticas del Cobre y Otros Minerales 2004-2023 – COCHILCO
4. https://internationalcopper.org/sustainable-copper/copper-pathways-map/ 10/03/2025.
5. Material and Resources Requirements for the Energy Transition
6. https://aticomining.com/investors/news/index.php?content_id=268

The copper mineral production chain has different steps to reach refining percentages above 95%, achieving intermediate products, the most representative case being copper cathodes with purity percentages of up to 99.9%; which through various processes are manufactured and drawn, being a fundamental input for the production of value-added products such as pipes, cables, sheets, among others.

Copper minerals, depending on their genesis, are found in different types of deposits, where the copper element is associated with sulfide minerals (copper sulfides, which contain sulfur) or oxidized copper minerals (copper oxides, which contain oxygen). Depending on the type of deposit, the type of processing is carried out to obtain the final product, refined copper (more than 99% copper or Cu by its symbol).

Sulfide minerals: in most cases the ore enters a concentrator plant that uses unit processes or operations of crushing/primary crushing, grinding, flotation, and treatment of products and residues (transport and filtration of concentrates; and thickening and final disposal of tailings in dams and reservoirs or deposits).

Oxidized minerals: the ore enters a hydrometallurgical plant that uses unit processes or operations of primary, secondary and tertiary crushing, heap leaching, solvent extraction and electrowinning.

7. Análisis estratégico del desarrollo de capacidades de producción de cobre refinado en Colombia, Banco interamericano de Desarrollo- BID, 2024

Figure 1: Copper mineral beneficiation diagram.

Copper concentrate contains between 20 and 35% purity, while ** copper anodes reach between 98 and 99.5%.

(https://publications.iadb.org/es/publications/spanish/viewer/Analisis-estrategico-del-desarrollo-de-capacidades-de-produccion-de-cobre-refinado-en-Colombia.pdf)

03

WHAT ARE STRATEGIC MINING AREAS

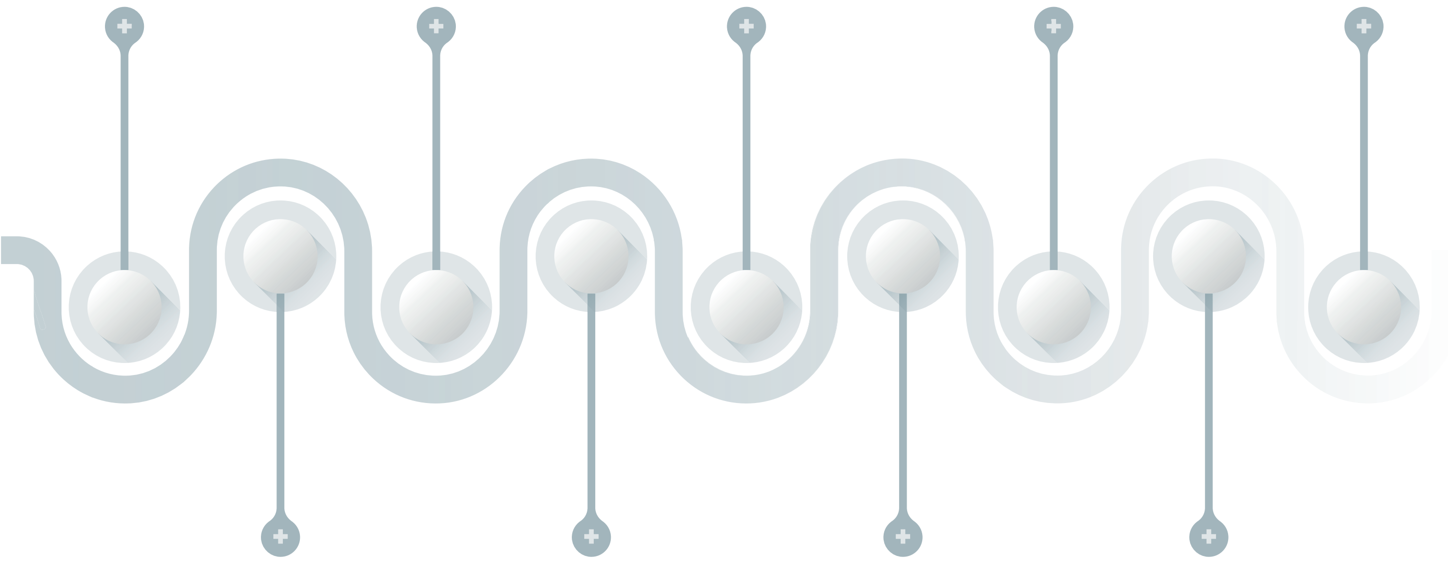
ÁREAS ESTRATÉGICAS MINERAS – AEM

The Strategic Mining Areas (AEM) are free areas with high potential for strategic minerals for the country, in which, once delimited by the Mining Authority, it is not possible to receive new proposals or enter into contracts, but rather they must be awarded through special exploration and exploitation contracts, through objective selection processes.

With the awarding of the AEM through objective selection processes to those who offer the best technical, economic, social and environmental conditions for the utilization of mining resources, the aim is to achieve the growth of the Colombian mining sector and obtain better conditions and benefits for the State and the communities located in areas with potential for strategic minerals, than those established in the ordinary regime of the Mining Code.

04

HOW ARE STRATEGIC MINING AREAS DELIMITED AND DECLARED?



GEOSCIENTIFIC KNOWLEDGE STUDIES

RESERVE OF POTENTIAL AREAS*

Geological evaluation of strategic minerals and administrative act of reserve

EVALUATION AND CATEGORIZATION OF MINERAL POTENTIAL

Categorization of high, medium, low potential of the strategic mineral by the Colombian Geological Service - SGC for area selection

CHARACTERIZATION OF THE TERRITORY AND FINAL DELIMITATION

Characterization report of the territory on environmental, social, economic, infrastructure and territorial planning variables

CONSULTATION WITH MAYORS AND DIALOGUE WITH COMMUNITIES

Approach meeting with Mayor in the form of dialogue, and participation with communities and subscription of consultation minutes

PRIOR CONSULTATION

Resolution of the Ministry of Interior on the procedence and opportunity of prior consultation

IDENTIFICATION OF MINERS

EXPEDITION AND PUBLICATION OF ADMINISTRATIVE ACT AREM/ARF

Delimitation and declaration of the Strategic Mining Areas through administrative act

OBJECTIVE SELECTION PROCESS OF AEM

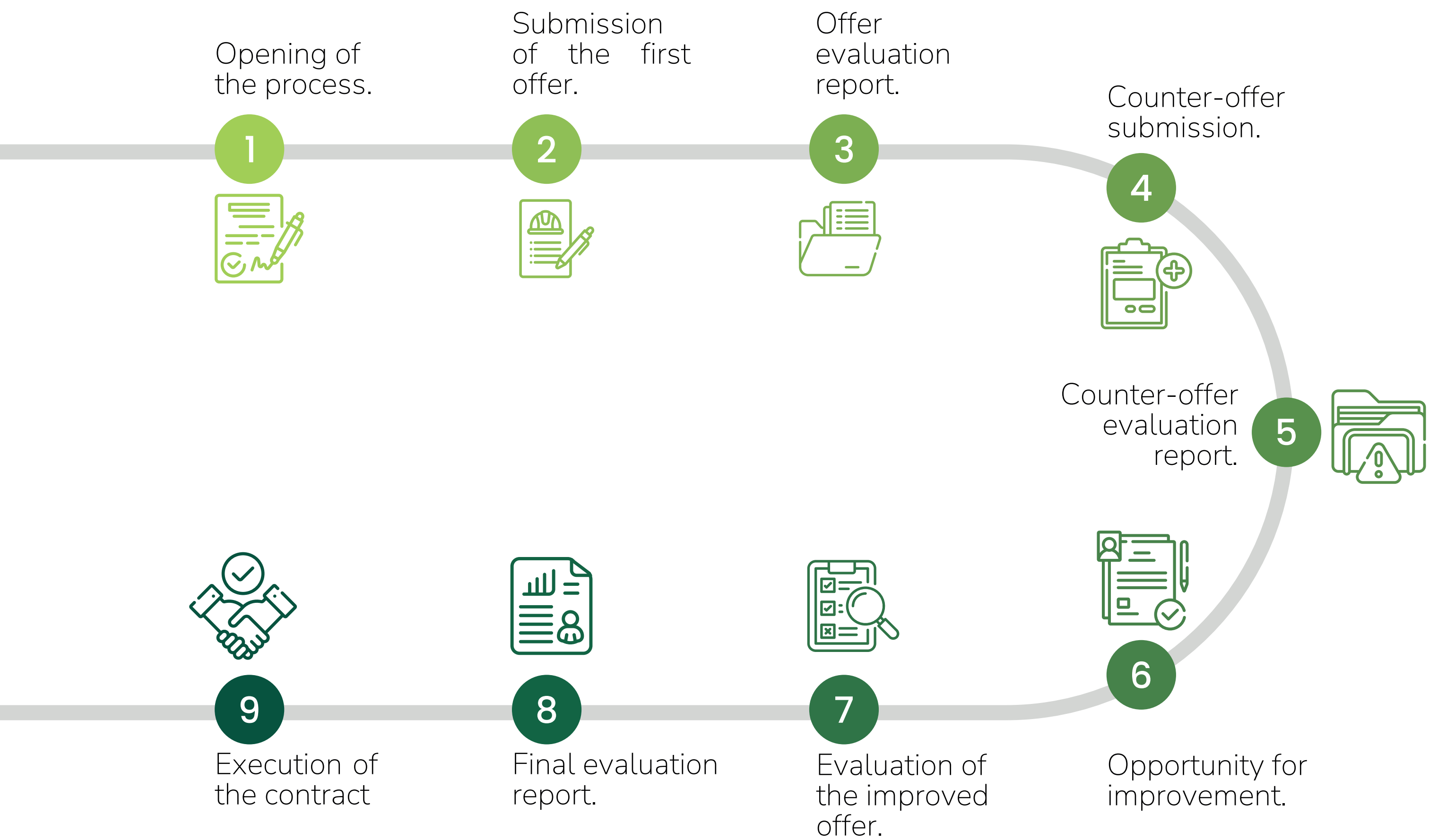
Eligibility requirements to participate and General Terms of Reference according to the type of mineral

The process of delimitation, declaration and awarding of Strategic Mining Areas is composed of four major stages:

1. Reserve of areas with potential.
2. Delimitation and declaration of Strategic Mining Areas.
3. Eligibility of interested parties – Resolution 695 of 2024 – Comprehensive Mining Management System.
4. Submission and evaluation of offers.

To participate in the objective selection process, interested parties must initially register with the ANM and once they have the elegibility resolution, they may submit an offer for the area of their interest.

Through the objective selection process, the ANM seeks to award the Strategic Mining Areas by selecting the most favorable offer for the awarding of special exploration and exploitation contracts for strategic minerals, which contains the following stages:



All information about mining rounds at:
mineriaencolombia.anm.gov.co

05

STRATEGIC MINING AREAS

General location of AEM – Perijá Norte, Perijá Sur, Buriticá, El Vapor, Maceo 1, Chaparral, Rioblanco Norte.

The Strategic Mining Reserve Areas - AEM are free areas with high potential evaluated by the Colombian Geological Service - SGC in reports resulting from prospecting carried out in the area for strategic minerals for the country. Once the AEM are delimited and declared by the Mining Authority, it is not possible to receive new proposals or enter into mining concession contracts in these areas, and they must be awarded through a special exploration and exploitation contract by means of objective selection processes.

On this occasion, 16 blocks have been defined in the departments of La Guajira, Cesar, Antioquia and Tolima, which in addition to having high potential for strategic minerals of copper, gold and their associated minerals, derivatives or concentrates, also have a high probability for the occurrence of undiscovered deposits in said areas.

In the areas defined for these blocks, the Ministry of Interior has been consulted regarding the procedence or not of carrying out the prior consultation process and obtaining the prior, free and informed consent of ethnic communities, and the consultation processes with the corresponding territorial authorities. The areas correspond to the following AEM blocks:

BLOCK	ÁREA (ha)	DEPARTAMENT	MUNICIPALY	DISTRICT	MINERALS DEFINED IN THE RESOLUTION
Block 5	892,7058	La Guajira	Urumita, La Jagua del Pilar	Perijá Norte	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 25	675,8937	La Guajira	La Jagua del Pilar	Perijá Norte	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 1	4.940,01	Cesar	San Diego	Perijá Sur	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 2	6.057,19	Cesar	San Diego	Perijá Sur	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 3	155,0976	Cesar	San Diego, La Paz	Perijá Sur	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 15	920,3870	Cesar	La Paz	Perijá Sur	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 17	1.733,38	Antioquia	Santa Fe de Antioquia	Santa Fe de Antioquia	Gold (Au), copper (Cu), and their associated minerals, derivatives, or concentrates
Block 18	1.156,92	Antioquia	Santa Fe de Antioquia	Santa Fe de Antioquia	Gold (Au), copper (Cu), and their associated minerals, derivatives, or concentrates
Block 24	321,8594	Antioquia	Buriticá	Buriticá	Gold (Au), copper (Cu), and their associated minerals, derivatives, or concentrates
Block 31	412,0031	Antioquia	Puerto Berrío	Vapor	Gold (Au), copper (Cu), and their associated minerals, derivatives, or concentrates
Block 32	464,5174	Antioquia	Maceo	Maceo 1	Gold (Au), copper (Cu), and their associated minerals, derivatives, or concentrates
Block 33	1.195,71	Antioquia	San Roque, Caracolí	Maceo 1	Gold (Au), copper (Cu), and their associated minerals, derivatives, or concentrates
Block 39	1.614,72	Tolima	Chaparral	Chaparral	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 41	441,3643	Tolima	Ataco	Rioblanco Norte	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates
Block 58	707,0426	Tolima	Valle de San Juan	Valle San Juan y Buenavista	Copper (Cu) minerals and their associated minerals, derivatives, or concentrates

METALLOGENIC DISTRICT OF THE SERRANÍA DEL PERIJÁ

The Perijá Mountain Range Metallogenic District belongs to the Sierra Nevada de Santa Marta-Perijá-Guajira Sur subprovince, which in turn is part of the Central Andean Province. This district has been defined as being of mineral interest for copper in systems hosted in confined sediments and volcanic rocks.8

The Perijá mountain range is located in the northwestern part of South America, north of Colombia. It corresponds to an indigenous block accreted at the end of the Paleozoic era with superimposed Jurassic magmatism and covered by Cretaceous-Cenozoic sediments.

During the Paleozoic era, sedimentary rocks of continental origin with transgressive tendencies overlie a metamorphic complex in discordant to erosive contact. At the end of the period, evidence of tidal and coastal processes can be seen, ending in shallow to medium shelf environments belonging to the Manaure Formation.8

During the Triassic-Jurassic period, volcanic-sedimentary successions (La Quinta Formation) were deposited as a result of a rift or convergent event.

During the Cretaceous period, there was a change from continental conditions to shallow marine environments—the Río Negro Formation, Cogollo Group, and the Colón and Hato Nuevo formations. At the end of this period, the Maracaibo subplate migrated northwestward through the Santa Marta-Bucaramanga and Oca-El Pilar fault systems in a process that led to the formation of the Sierra de Mérida, El Macizo de Santander, the Perijá Belt, and the Sierra Nevada de Santa Marta.8, 9
Shallowing processes in the basin and orogenic events favored the deposition of the Cerrejón Formation. During the Early Eocene-Miocene, the Santander-Perijá block began to rise through the development of reverse faults with northwest vergency.8

The volcano-sedimentary sequences deposited during the Triassic-Jurassic period correspond to the La Quinta formation, composed of sequences of red sandstones and siltstones of continental origin, with intercalations of tuffs, basaltic lavas, and rhyolites, where copper mineralization is found. The sandstones and the andesitic and microgabbroic intercalations contain disseminated copper mineralization (native copper, cuprite, carbonates, and chalcocite).8

8. Evaluación del potencial mineral para cobre y otros metales proyectos la Paz, San Diego y Codazzi "Serranía del Perijá". SGC, 2019 Evaluación de potencial mineral para cobre y otros
9. Distrito Metalogénico San Diego, Serranía del Perijá. SGC, 2019

Figure 2: General location – Serranía del Perijá / departments of Cesar and La Guajira

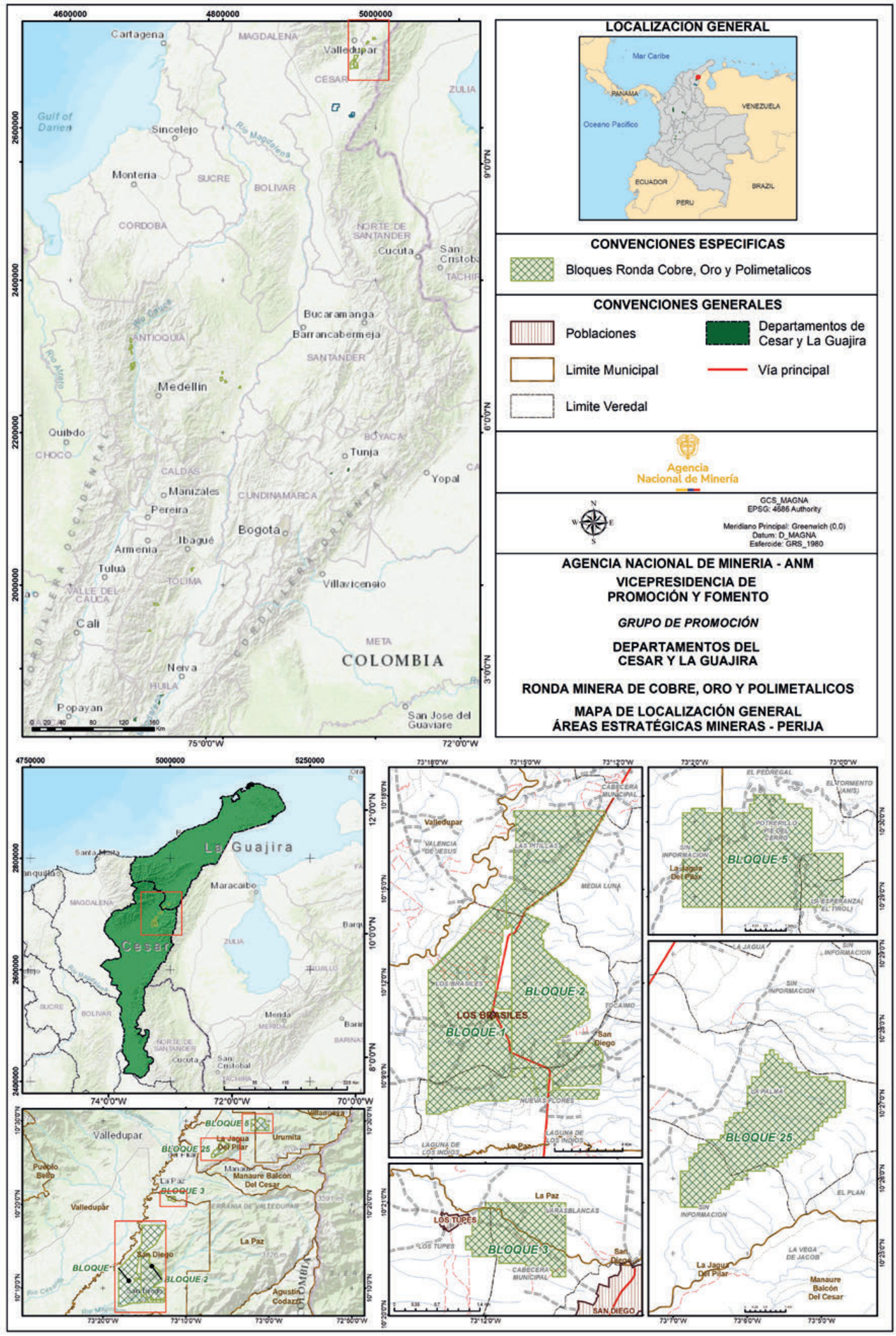
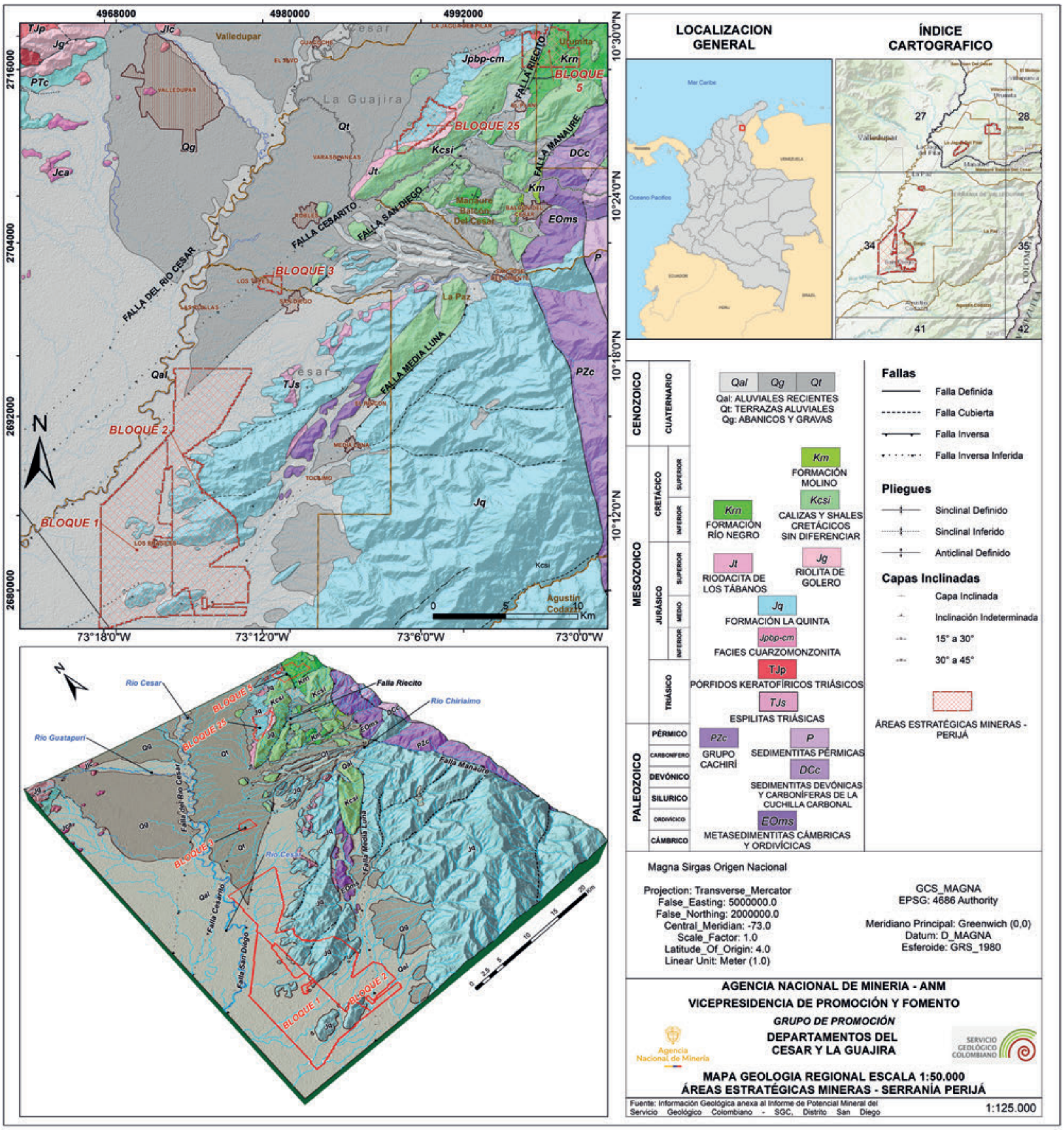


Figure 3: Regional geology and block diagram – Serranía del Perijá / departments of Cesar and La Guajira



PERIJÁ NORTE

BLOCKS 5 and 25

The Perija Norte district is located on the western flank of the Serrania del Perija, and the blocks are located in the municipalities of La Jagua del Pilar and Urumita. The geology of the studied sector of the Serranía del Perijá consists of sedimentary, igneous, and volcanic sedimentary rocks ranging in age from the Paleozoic to the Cretaceous. Within these rock units, the La Quinta Formation stands out, a sequence of volcanic sedimentary rocks with some intrusive bodies. 10

In the Perijá Norte District, the structural features coincide with magnetic lines and fractures in the direction of the main compressional stresses in the basin. At a depth of approximately 300 meters, there is a magnetic anomaly that could be associated with hydrothermal processes. This evidence suggests that the observed alterations correspond to the most distal portion of a deep hydrothermal system, whose surface manifestation coincides with this anomaly. Uranium and thorium anomalies were also identified between the La Quinta Formation and the Cretaceous units. 10

The mineralization corresponds mainly to native copper, malachite, azurite, cuprite, and occasionally tenorite, associated with structures (veins) containing abundant epidote. 10

From a geochemical point of view, the active fine sediments show high concentrations of copper, low concentrations of silver, antimony, and arsenic, and a relatively high association with cadmium and low association with molybdenum in the sectors that coincide with the high potassium anomaly. 10

10. Actualización evaluación de potencial mineral bloques 315, 316,321, 345, 335 resolución 135 de junio de 2017 y bloques 201, 202 resolución 180241 de 2012. SGC, 2018

Figure 4: Location of AEM Block 5 – La Guajira

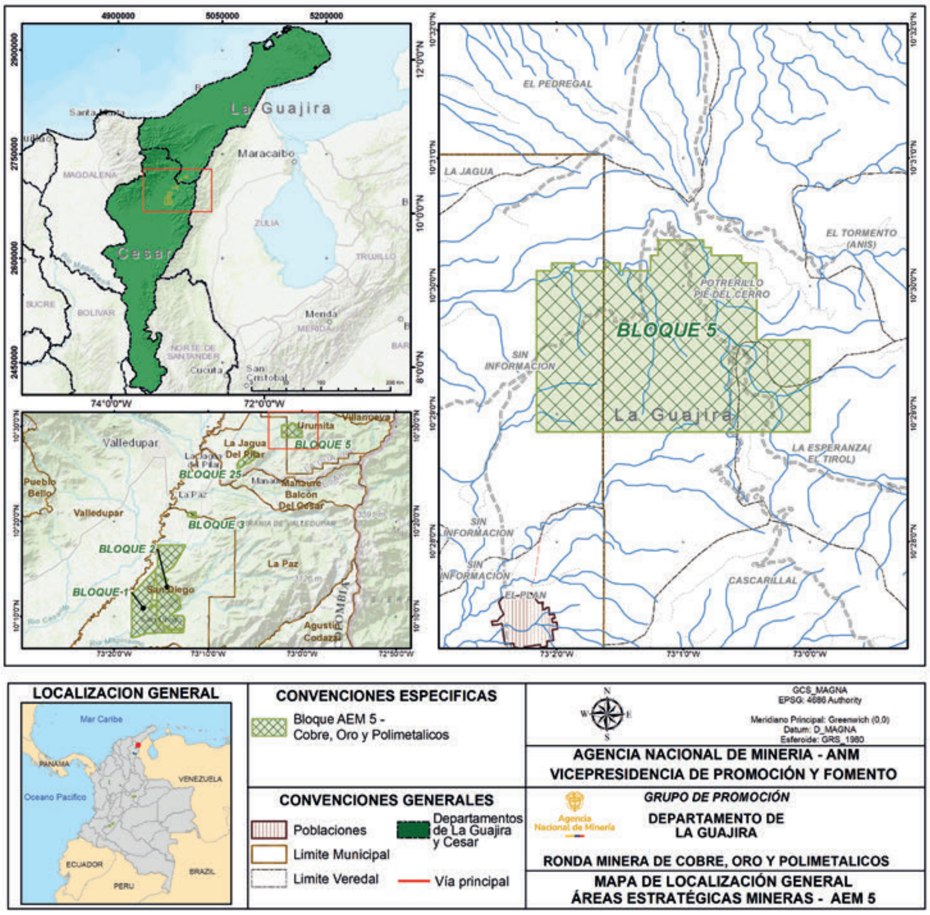


Figure 5: Regional geology of AEM Block 5 – La Guajira

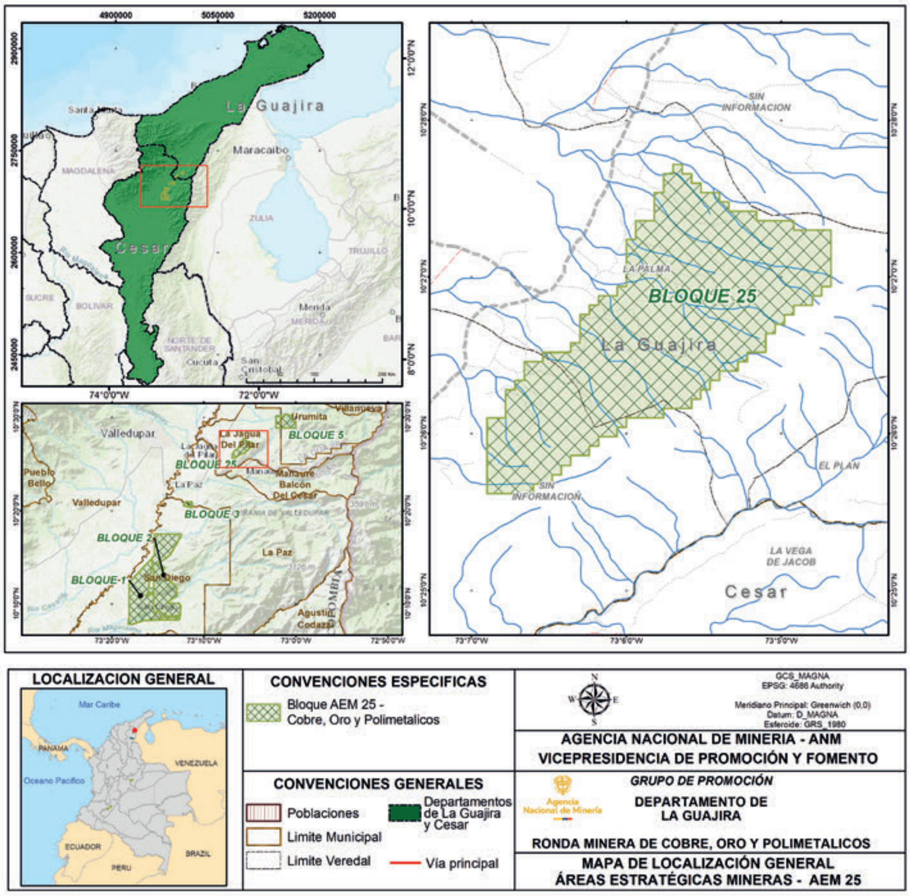
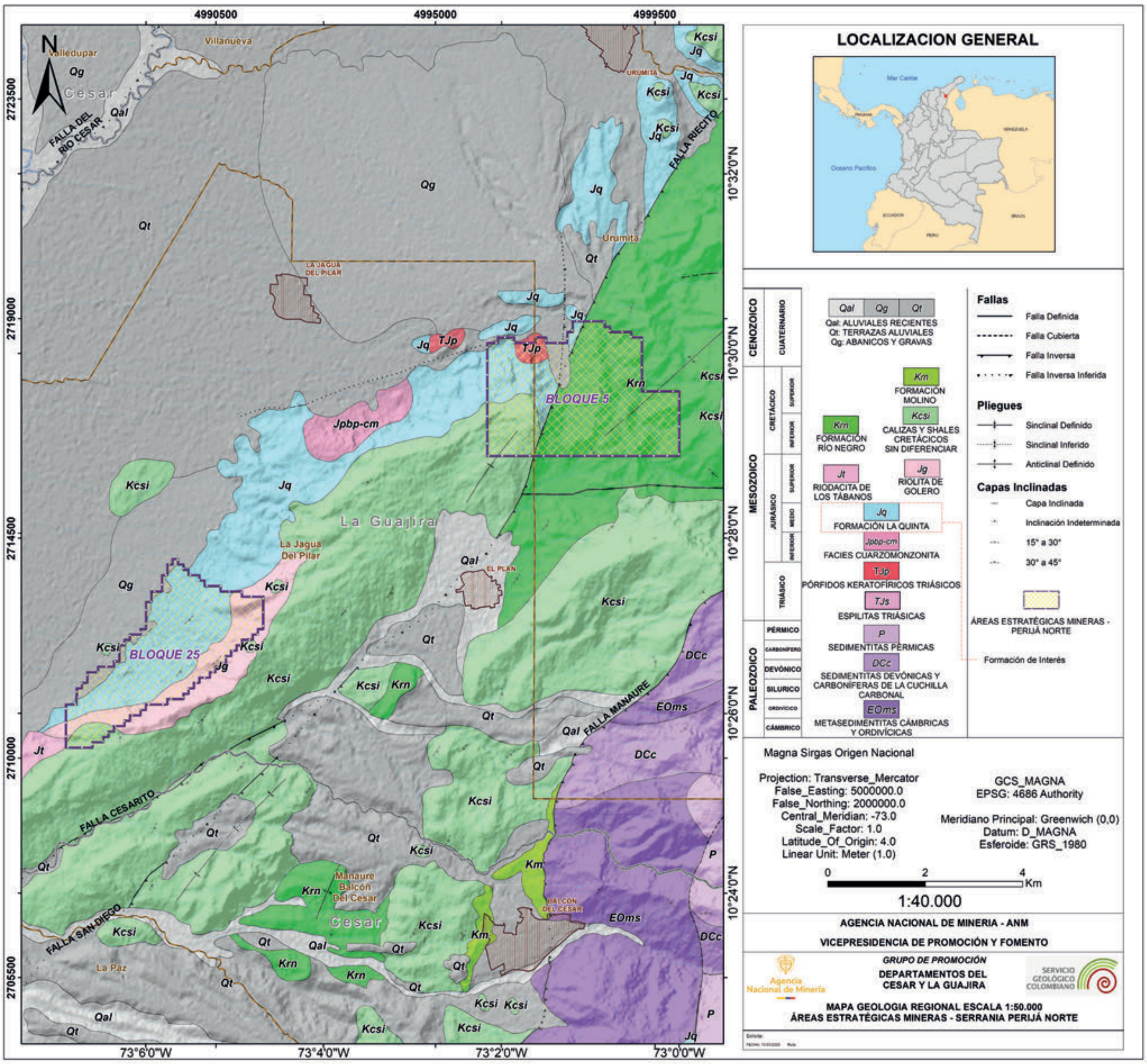


Figure 6: Regional geology AEM Perijá Sur – Blocks 1, 2 and 3



PERIJÁ SUR

BLOCKS 1, 2, 3 and 15

The Perija Sur district is located on the western flank of the Serranía del Perijá, particularly in the municipalities of San Diego, La Paz, and Agustin Codazzi. The sedimentary rocks of the La Quinta formation generate a structural and chemical environment favorable for the accumulation of copper and other metals that may have been remobilized in active continental margin tectonic environments, generating reducing environments due to their organic matter and carbonate content. Additionally, the favorable nature of the contacts with the sedimentary members is considered, as they allow new pathways for hydrothermal solutions and Fe-rich minerals (magnetite, hornblende, and pyroxenes), generating chemical potential for solutions loaded with sulfur and other metals. 11

The main fault system in the district runs southwest-northeast, consistent with the direction of continuous high magnetic susceptibility from 10 to 30 kilometers in the bearing. Additionally, regional (main) fault systems with a SE-NW (apparently tensional) and SSW-NNE regional (main) affect the main system, revealing uplift and subsidence of blocks and mineralization systems at different vertical levels with continuity of tens to hundreds of meters of apparent bodies with high magnetic susceptibility, consistent with the structures. 11

Native copper, copper oxides (cuprite, tenorite), and copper carbonate (azurite, malachite) are scattered and vein-like in rock fractures. 11

Hypogene mineralization of hydrothermal origin located in the host rocks, related to possible deep-seated feeder systems, of supergene type accumulating in sandstones and tuffs as well as in some intrusive rocks, and of mixed type.11

From a geochemical point of view, average absolute values of copper (Cu in active sediments, in association with cobalt (Co), chromium (Cr), nickel (Ni), and vanadium (V), with partial overlap with gold (Au), molybdenum (Mo), zinc (Zn), lead (Pb), and silver (Ag) are evident. Likewise, high absolute values of copper (Cu) are recorded in surface rock samples, mainly associated with silver (Ag) and arsenic (As),in addition to a partial overlap with associations of silver (Ag), lead (Pb), mercury (Hg), and gold (Au), and a second partial overlap with cobalt (Co) and nickel (Ni).11

Figure 7: Location of AEM Blocks 1 and 2

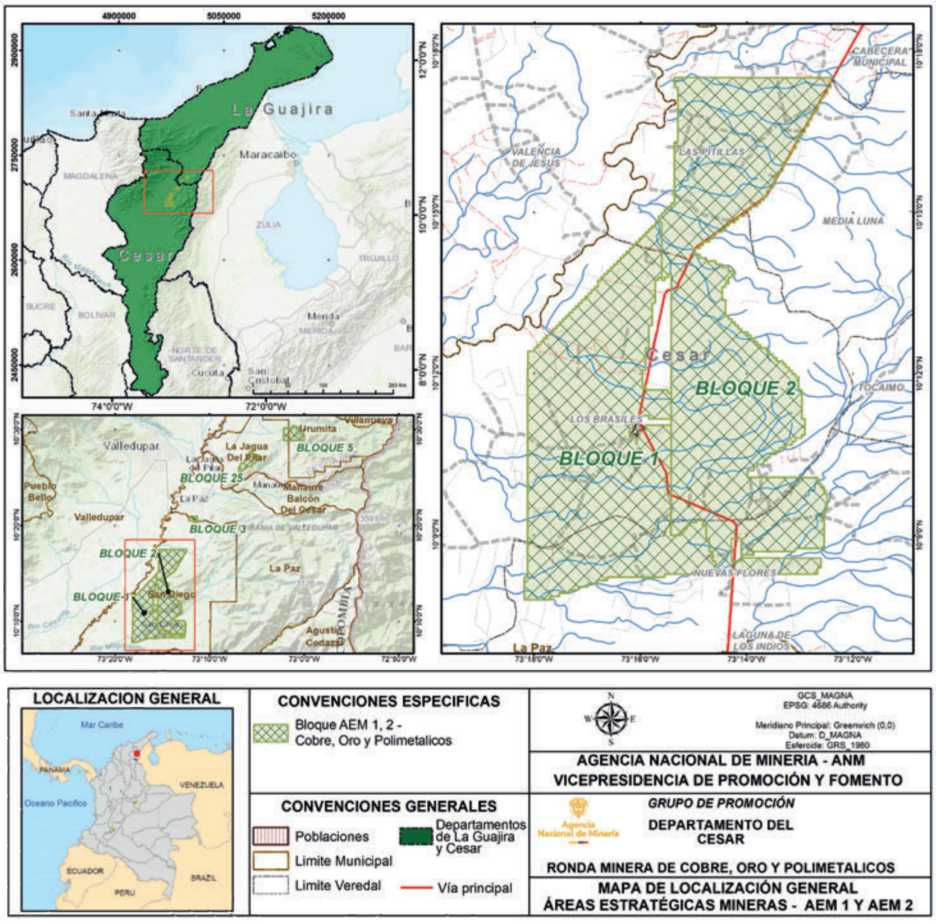


Figure 8: Location of AEM Block 3

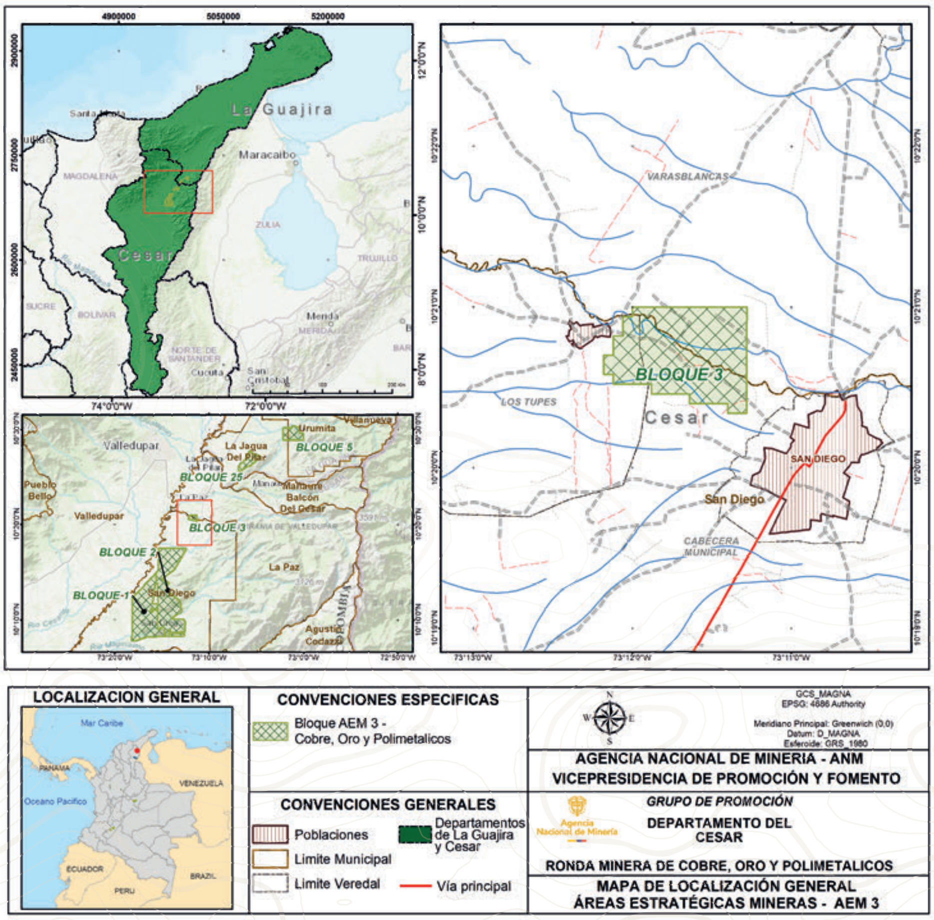
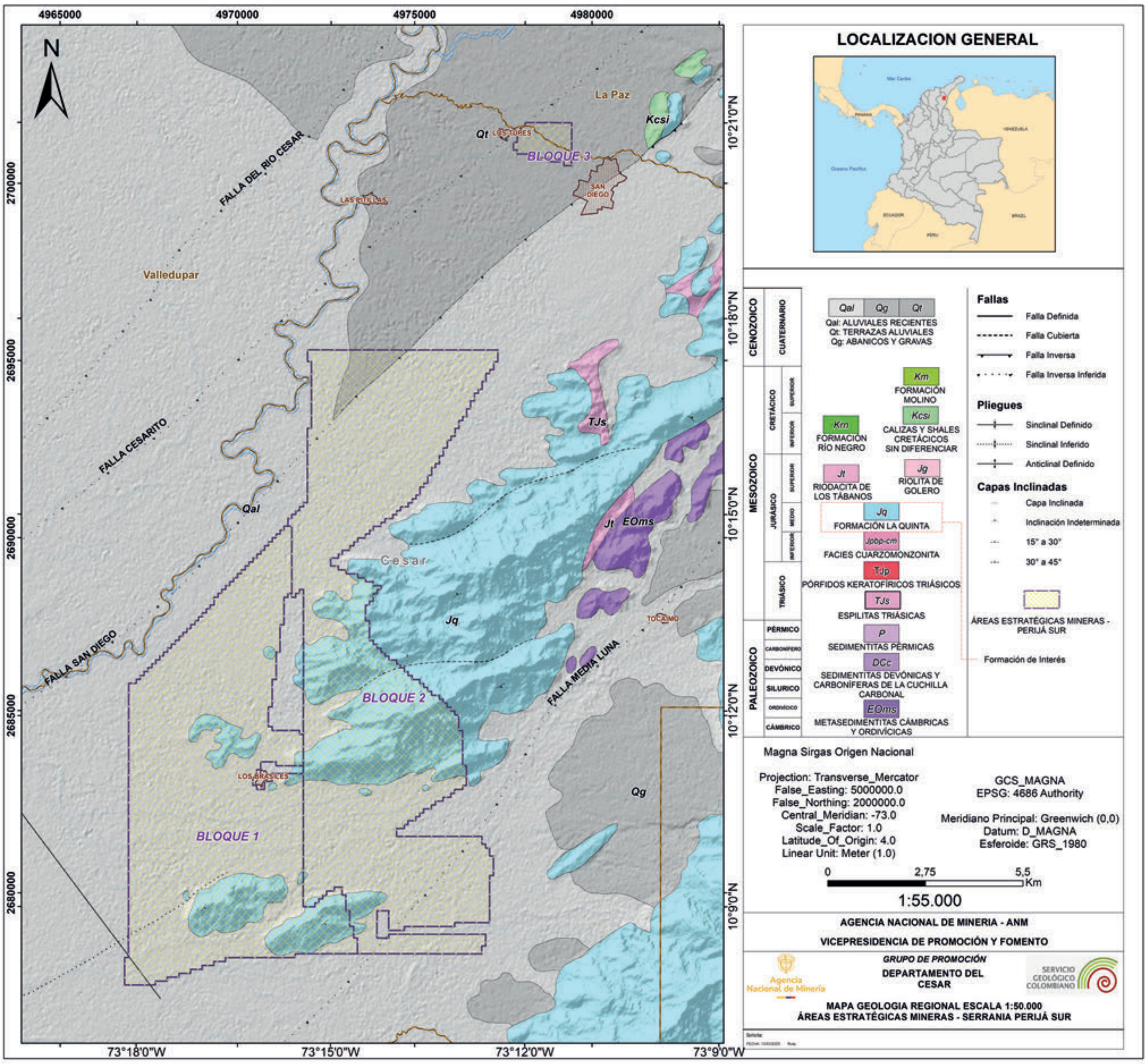


Figure 9: General location Buriticá / department of Antioquia



METALLOGENIC DISTRICT

SANTA FE DE ANTIOQUIA

The Santa Fe de Antioquia district is located in the western region of the department of Antioquia, within the Cauca River basin, and includes part of the eastern flank of the Western Cordillera and the western flank of the Central Cordillera of Colombia.

It lies within the Andean metallogenic domain, forming part of the Middle Cauca Miocene porphyry–epithermal belt, which extends from the La Colosa gold deposit, covers the Quinchía area and the Marmato deposit, and continues through the Anzá District up to the Buriticá deposit at its northernmost end.

The genesis of mineralization in western Colombia is associated with calc-alkaline magmatic activity during the Paleogene and Neogene periods, generated in active magmatic arc environments along the western boundary of the South American Plate, influenced by the accretion of oceanic-crust blocks.
The tectonic framework of this portion of Colombia favors the development of diverse environments conducive to the formation of porphyry-type, epithermal, and intrusive-related gold deposits.

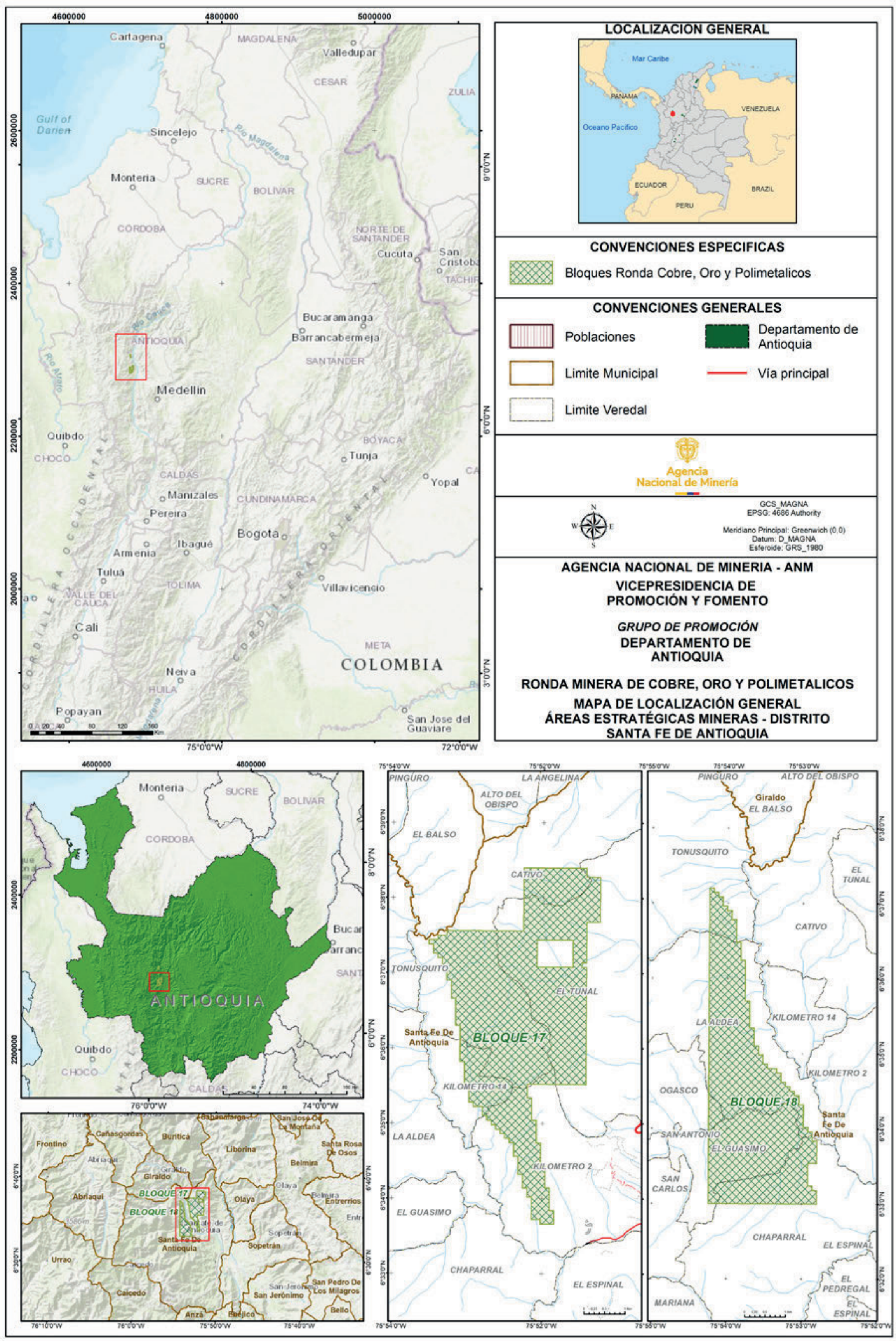
The structural control of the region is dominated by the Cauca–Romeral Fault System, one of the most active and continuous fault systems in Colombia, which includes several individual fault structures within the district.

The Cauca–Almaguer Fault follows the trace of the Cauca River, forms the eastern boundary of the Cañasgordas terrane, and corresponds to the suture marking the limit between continental crust to the east and oceanic crust to the west.

On both sides of this paleosuture, Cretaceous and some Miocene plutons have been identified, related to hydrothermal systems capable of generating and hosting economically significant mineralization.

12. Evaluación del potencial mineral para cobre y otros metales en el distrito de Santa Fe de Antioquia. SGC 2021.

Figure 10: Regional geology and AEM Buriticá block diagram



SANTA FE DE ANTIOQUIA

BLOCKS 17 and AEM 18

The Santa Fe de Antioquia district is located in the western region of the department of Antioquia, covering a large part of the municipality of Santa Fe de Antioquia and smaller areas in the municipalities of Giraldo, Buriticá, Liborina, and Olaya. The assessment of potential included areas where structural, geological, geochemical, and geophysical conditions are favorable for mineral accumulation and the possible presence of metals of economic interest..13

The district features rocks of basic to intermediate composition of a bimodal nature, belonging to the Barroso Formation and the Sabanalarga and Santa Fe de Antioquia batholiths, which act as host rocks for vein-type mineralization. These veins are mainly composed of pyrite ± chalcopyrite ± covellite ± bornite, as well as pyrite ± galena ± sphalerite ± gold. 13

Mineralization is controlled by regional faults with a north–south orientation linked to the Romeral Fault System, together with secondary northwest–southeast, northeast–southwest, and local east–west systems. Deformational events associated with the uplift and exhumation of the Cordillera Central reactivated these faults, allowing the ascent of intrusive bodies and the circulation of hydrothermal fluids, which favored mineral concentration in structurally favorable areas.13

The magnetometric analysis reveals a regional magnetic body with a north–south orientation, overlaid by shallow magnetic sources linked to intrusions controlled by major faults. These anomalies coincide with areas where hydrothermal alterations and sulfide occurrences are recorded, attributable to subsequent magmatic events that continue the expression of mineralized systems within the district. 13

The district exhibits mineral occurrences and hydrothermal alterations characteristic of porphyry and epithermal systems, expressed through assemblages dominated by sericite, chlorite ± calcite ± epidote, chlorite ± smectite, and chlorite ± tremolite ± epidote. Geochemical analyses of rocks and sediments show representative anomalies in gold (Au), copper (Cu), and arsenic (As), as well as elevated gold (Au) values in active sediments, evidencing zones of metal enrichment linked to hydrothermal processes that affected the district. 13

Figure 11: Location AEM Buriticá – Blocks 17 and 18

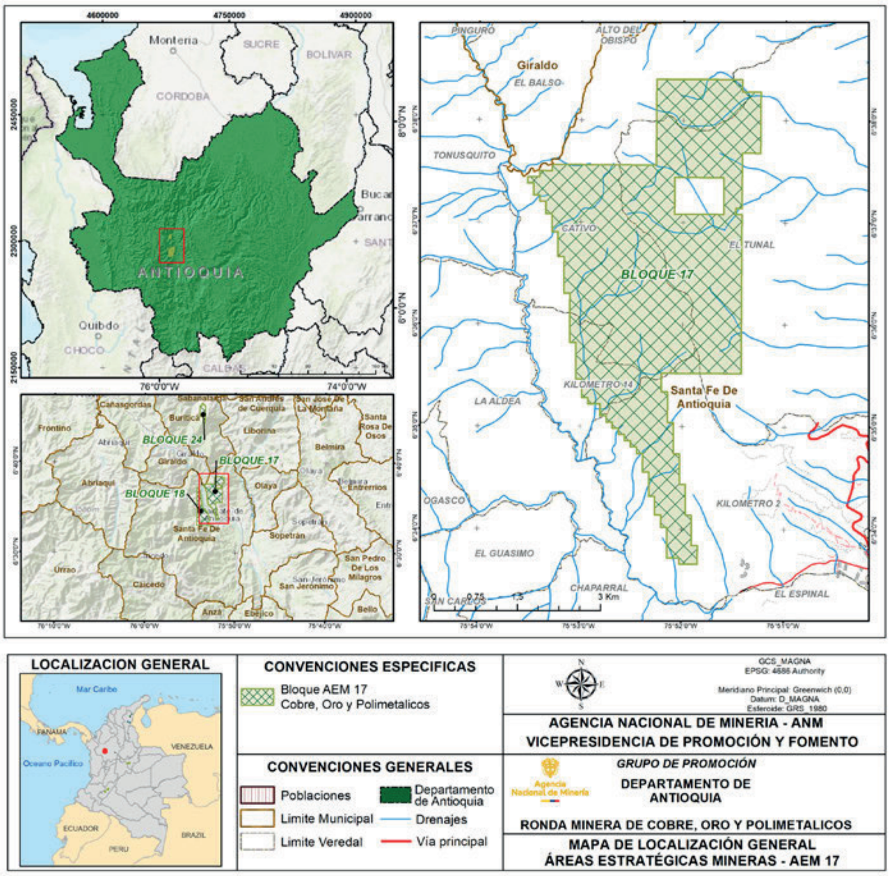


Figure 12: Location AEM Buriticá – Block 22

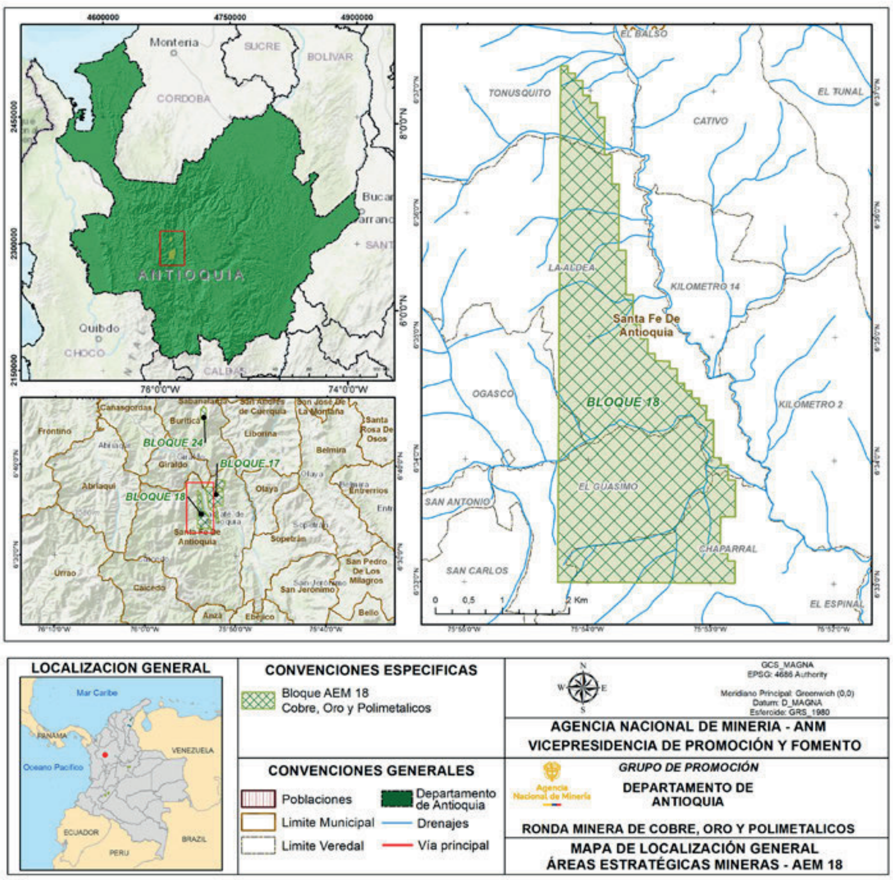
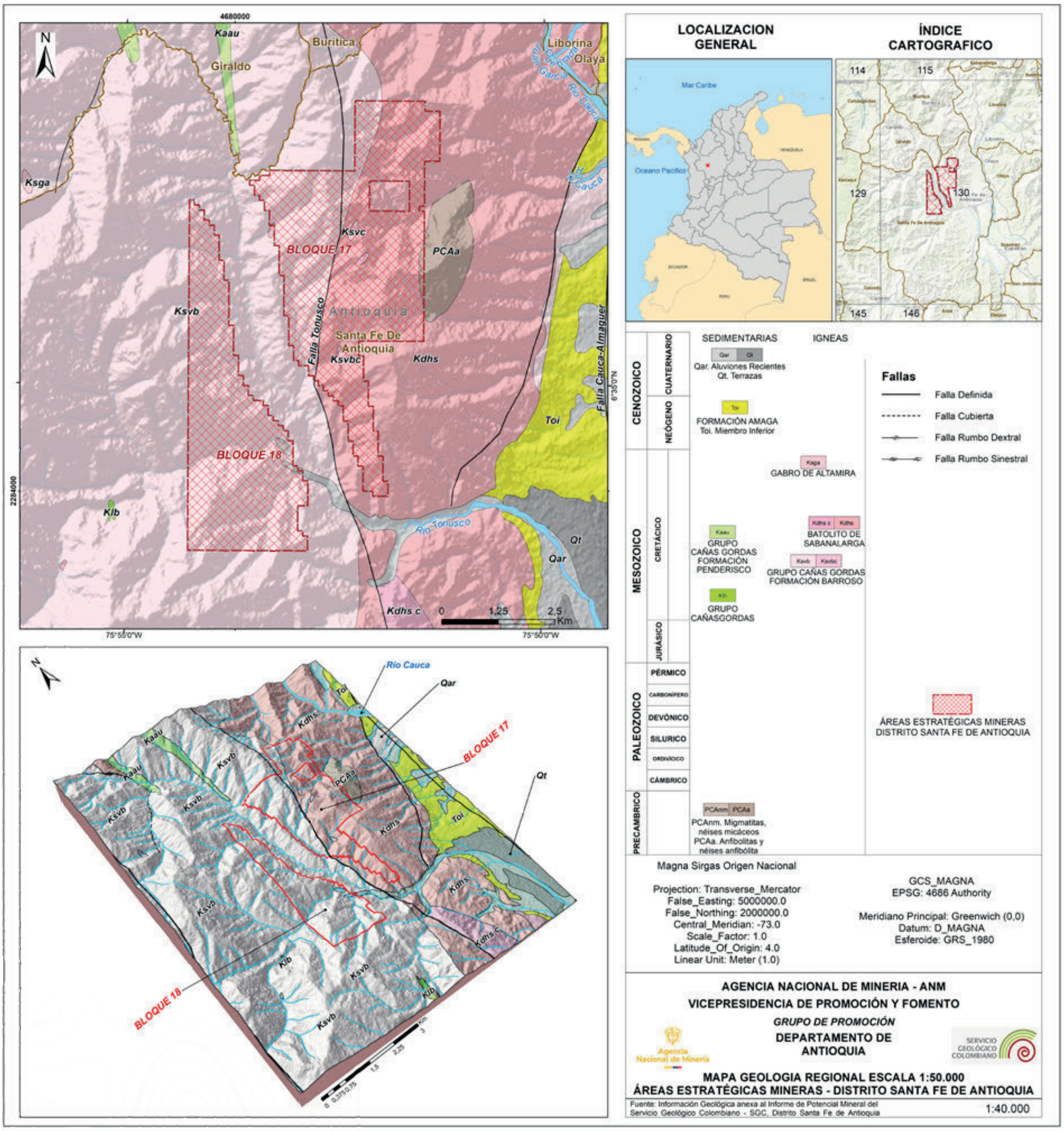


Figure 13: Location AEM Buriticá – Block 24



METALLOGENIC DISTRICT BURITICÁ

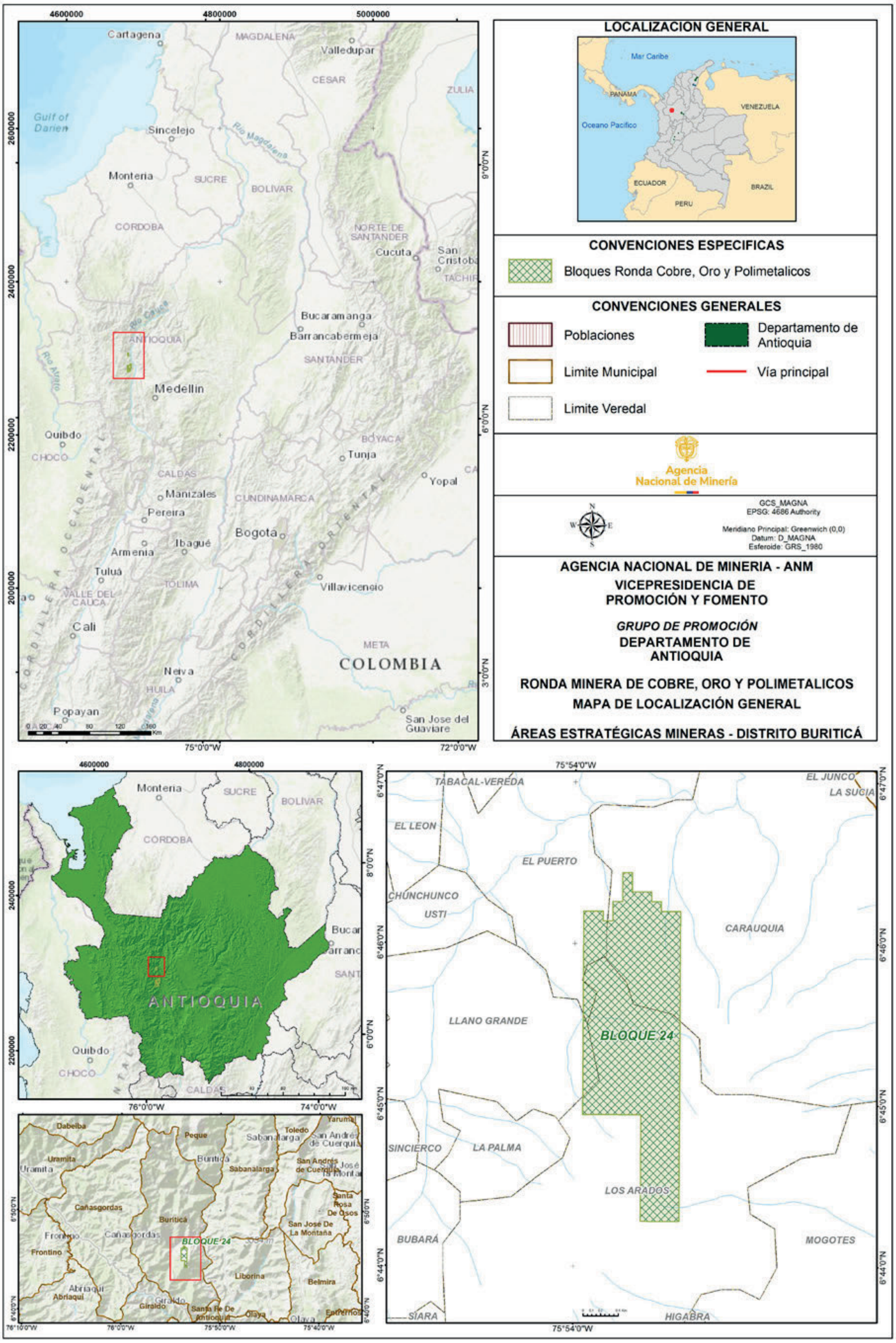
The Buriticá Metallogenic District is located on the eastern flank of the Western Cordillera of Colombia and belongs to the system of accreted allochthonous oceanic mafic terrains that make up the Western Cordillera and part of the Central Cordillera.14
The Au-Ag District is located in the Andean metallogenic domain and is part of the Middle Cauca Miocene Porphyry-Epithermal Belt, which starts in Quinchía and encompasses the La Colosa and Marmato gold deposits and the Anzá Metallogenic District. 14
The current geological configuration of this region is the result of regional and temporarily prolonged orogenic events resulting from the interaction of the Caribbean, Cocos, Nazca, North American, and South American plates from the Paleozoic to the Cenozoic, evidenced by the intensely deformed blocks. 14
Thus, the base of the Western Cordillera is composed of volcanic rocks that form part of the Caribbean oceanic plateau due to the subduction process beneath the eastern edge of the Caribbean plate. 14
Locally, during the Late Cretaceous-Paleocene, a portion of the plateau and the arc of islands accreted to the South American region, with the Cauca-Almaguer Fault as its eastern boundary and the Uramita Fault in the western sector.14

The contact between the continental and oceanic affinity units is determined by the Romeral fault system, in which the continental rocks are tectonically mixed with Cretaceous units of oceanic origin. 14

The rocks identified in the Buriticá District have a Cretaceous basement corresponding to the Cañasgordas Group, with sectors in which flakes of the sedimentary units of the Penderisco Formation (Urrao Member and Nutibara Member) and the volcanic rocks of the Barroso Formation are present. Intrusions from the Middle to Upper Cretaceous and Miocene bodies associated with the Sabanalarga Batholith and Buriticá Andesite, respectively, cut through the Cañasgordas Group sequence.14

14. Evaluación del potencial mineral para oro en el Distrito de Buriticá, departamento de Antioquia. SGC, 2021

Figure 14: Location AEM Buriticá – Blocks 23 and 42



AEM BURITICÁ

BLOCK 24

The Buriticá district is located in the Middle Cauca region, mainly in the Western Cordillera of Colombia. It encompasses the municipalities of Buriticá, Cañasgordas, and Peque to the west of the Cauca River and the municipalities of Liborina and Sabanalarga to the east of the Cauca River. The rock hosting the mineralization corresponds mainly to volcanic rocks of the Barroso Formation (basalts and diabase) and Penderisco Formation (sedimentary rocks).15

The magnetic anomalies identified coincide with lineaments, regional geological faults, and mineralized structures with NS and NE orientations. These anomalies are associated with small, shallow sources characterized by predominantly perpendicular magnetization. They exhibit continuity at depths greater than 4 km and show evidence of hydrothermal alteration at their periphery, as well as a semicircular arrangement. Taken together, these characteristics suggest the presence of an ancient magmatic system, where the anomalies would correspond to subvolcanic bodies located in a caldera-type structure.15

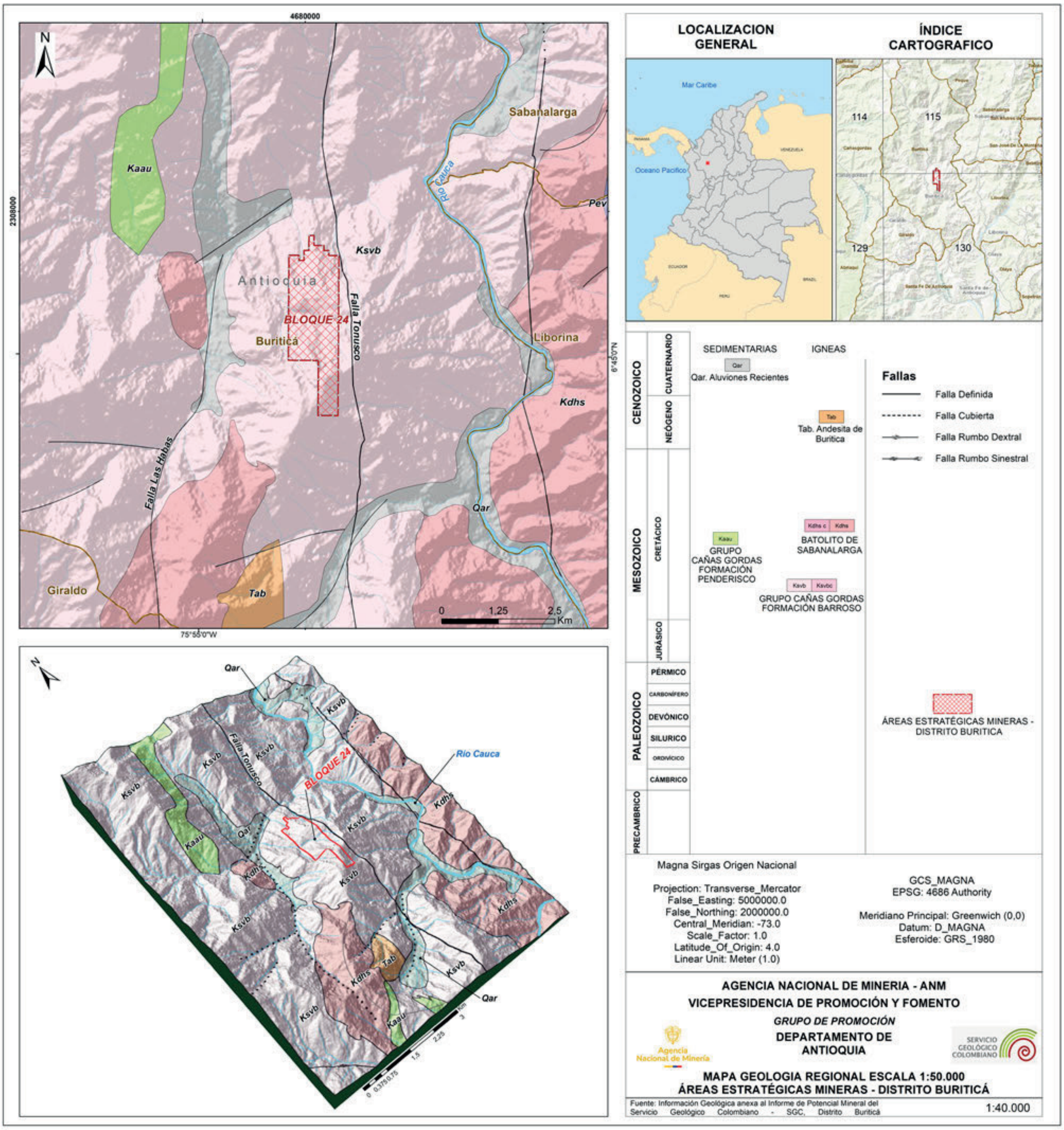
Low-to-intermediate temperature hydrothermal alteration assemblages are associated with quartz veins and veins with mineralization of pyrite, chalcopyrite, sphalerite, and secondary copper minerals. 15

The Buriticá Metallogenic District shows potential for the occurrence of gold, copper, and other mineral deposits, which could be associated with epithermal mineralization systems, without ruling out the possibility of finding a disseminated porphyry-type mineralized system and/or one related to deep intrusions. The mineralization is regionally controlled by N-S trending faults and a NE trending second-order system.15

Anomalous values of gold (Au), copper (Cu), lead (Pb), and zinc (Zn) were identified, and elements and/or geochemical associations of interest related to the presence of copper (Cu) and gold (Au) bearing minerals were defined. 15

The Buriticá deposit, which has been classified as an intermediate sulfidation epithermal system, is considered part of this district.15

Figure 15: General location – El Vapor and Maceo 1



METALLOGENIC DISTRICT
EL VAPOR and MACEO 1

The El Vapor and Maceo 1 metallogenic district forms part of the basement of the outer portion of the Colombian Andes and part of the South American continental plate. 16,17

The geological history of these districts begins in the Proterozoic-Lower Paleozoic with an event of accretion and high-grade metamorphism (Cajamarca-Valdivia terrain) represented by fragmented bodies of migmatites and quartz-feldspar gneisses of granulite facies, which includes the San Lucas Gneiss.16,17

Subsequently, the regional relaxation regime allowed the formation of grabens that gave rise to volcanism of varied composition, such as that of the Saldaña-Aulacógeno Bolívar Formation, which consisted of extensive sequences of aborted rifts. 16,17

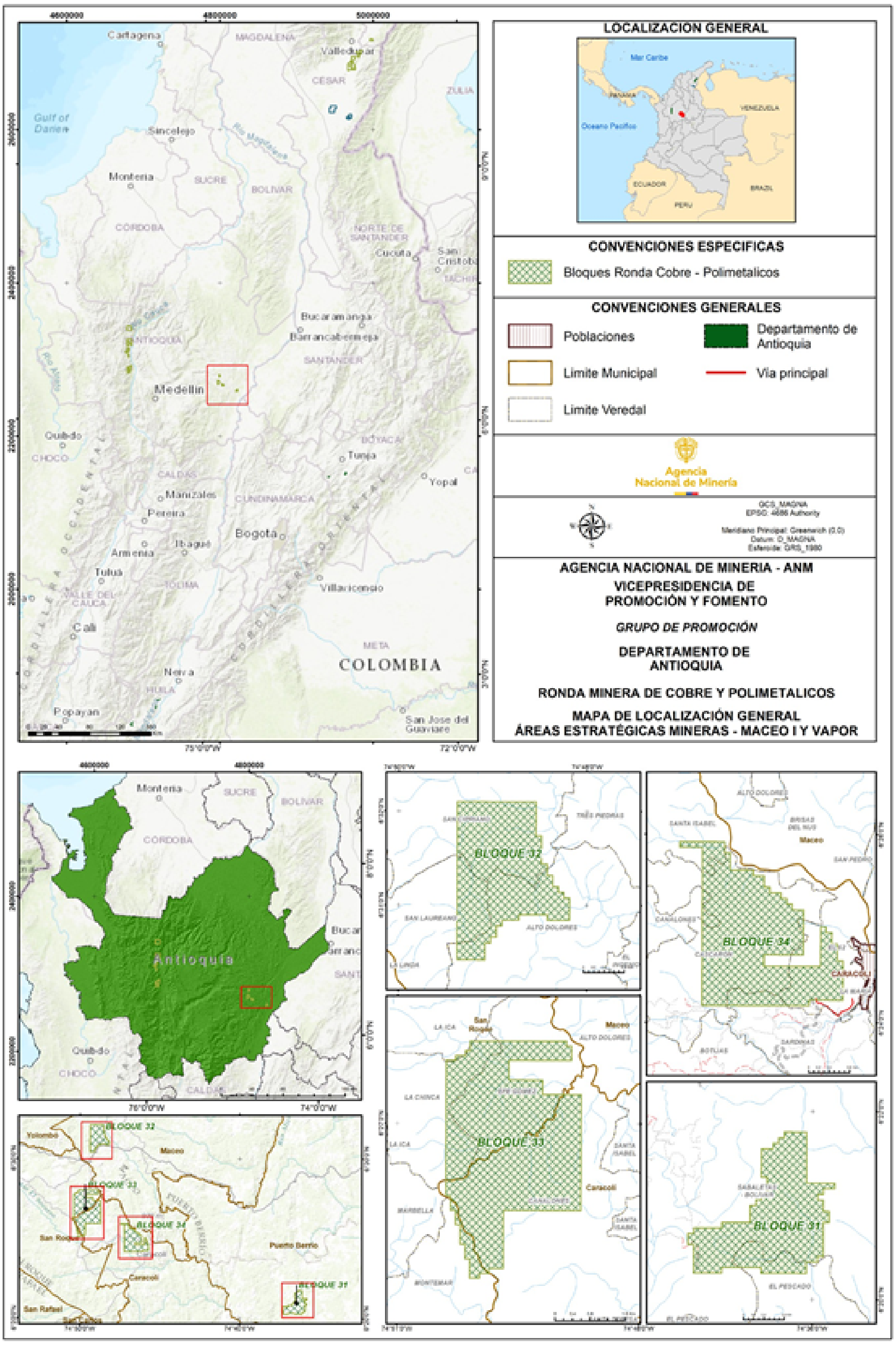
Rifting resumed during the Triassic (Payandé Formation) and continued during the Early Jurassic (Morrocoyal Formation) and Middle Jurassic (Siquisique Formation). In the Late Jurassic, rifting and the development of an extensional arc are marked by volcaniclastic and continental deposits of the Girón, La Quinta, Jordán, and Noreán Formations. 16,17

In the Early Cretaceous, the opening of the Valle Alto rift allowed the deposition of marine and transitional sequences of varying thickness. Subsequently, the transition to a transpressional regime favored the intrusion of plutons such as the Antioqueño Batholith (a multi-phase calc-alkaline plutonic complex that intrudes the Cajamarca-Valdivia Terrain) and the deposition of the Sedimentitas Formation of Segovia, which represents an erosional remnant of the sedimentation of this period. 16,17

Subsequently, intense transpression caused the exhumation and uplift of the Cajamarca-Valdivia Terrain, which forms the core of the Cordillera Central, as well as the tectonic inversion, exhumation, and uplift of much of the Cretaceous sedimentary basin related to rifts, now exposed in the Eastern Cordillera. 16,17

16. Evaluación del potencial mineral para cobre y otros minerales en el Distrito El Vapor, Departamento de Antioquia. SGC, 2022
17. Evaluación del potencial mineral en el distrito Maceo I. Departamento de Antioquia. SGC, 2022

Figure 16: General location – El Vapor and Maceo 1



EL VAPOR

BLOCK 31

The El Vapor District is located on the eastern flank of Colombia's Cordillera Central mountain range, between the municipalities of Caracolí and Puerto Berrio in the department of Antioquia. The mineralized structures in the district are mainly hosted in quartz-dioritic igneous rocks, carbonaceous sedimentary rocks, and metamorphic rocks associated with quartz-feldspar gneisses, conditioned by the Palestine Fault System and the carbonaceous sedimentary rocks, and metamorphic rocks associated with quartz-feldspar gneisses, conditioned by the Palestina Fault System and parallel regional faults such as the El Nus and El Bagre faults with NS, NNE, and NW directions. The veins and veinlets of variable thickness (cm - m) are continuous and discontinuous, sigmoidal and stockwork. In addition, there are hydrothermal breccias that constitute a mineralization train approximately 2 km long, along the line of the Palestina and Nus Faults. 18

The magnetometric anomalies in the El Vapor District are associated with deep lithological bodies (Segovia Batholith) along the NS faults and to possible Paleocene bodies of dacitic, dioritic, and andesitic composition that are represented on the surface by small dikes (thicknesses <1 m) that intrude the Paleozoic sedimentary sequences, the Proterozoic metamorphic rocks, and the granodioritic rocks of the Segovia Batholith. 18

High levels of potassium (K), thorium (Th), and uranium (U) radioelements are evident in the quartz-feldspar neises of San Lucas, in areas where the veins have a higher quartz content. Potassium is an indicator of hydrothermal alterations of interest.18

Hydrothermal alteration zones that are prospective for copper (Cu) deposits are associated with magmatic events. Geochemical anomalies of gold (Au), silver (Ag), and copper (Cu) show a predominant mineral association of calcophile elements and are associated with geochemical signatures of orogenic gold (Au) deposits and gold-zinc (Au-Zn) anomalies. 18

18. Evaluación del potencial mineral para cobre y otros minerales en el Distrito El Vapor, Departamento de Antioquia. SGC, 2022

Figure 17: General location of AEM El Vapor – Block 31

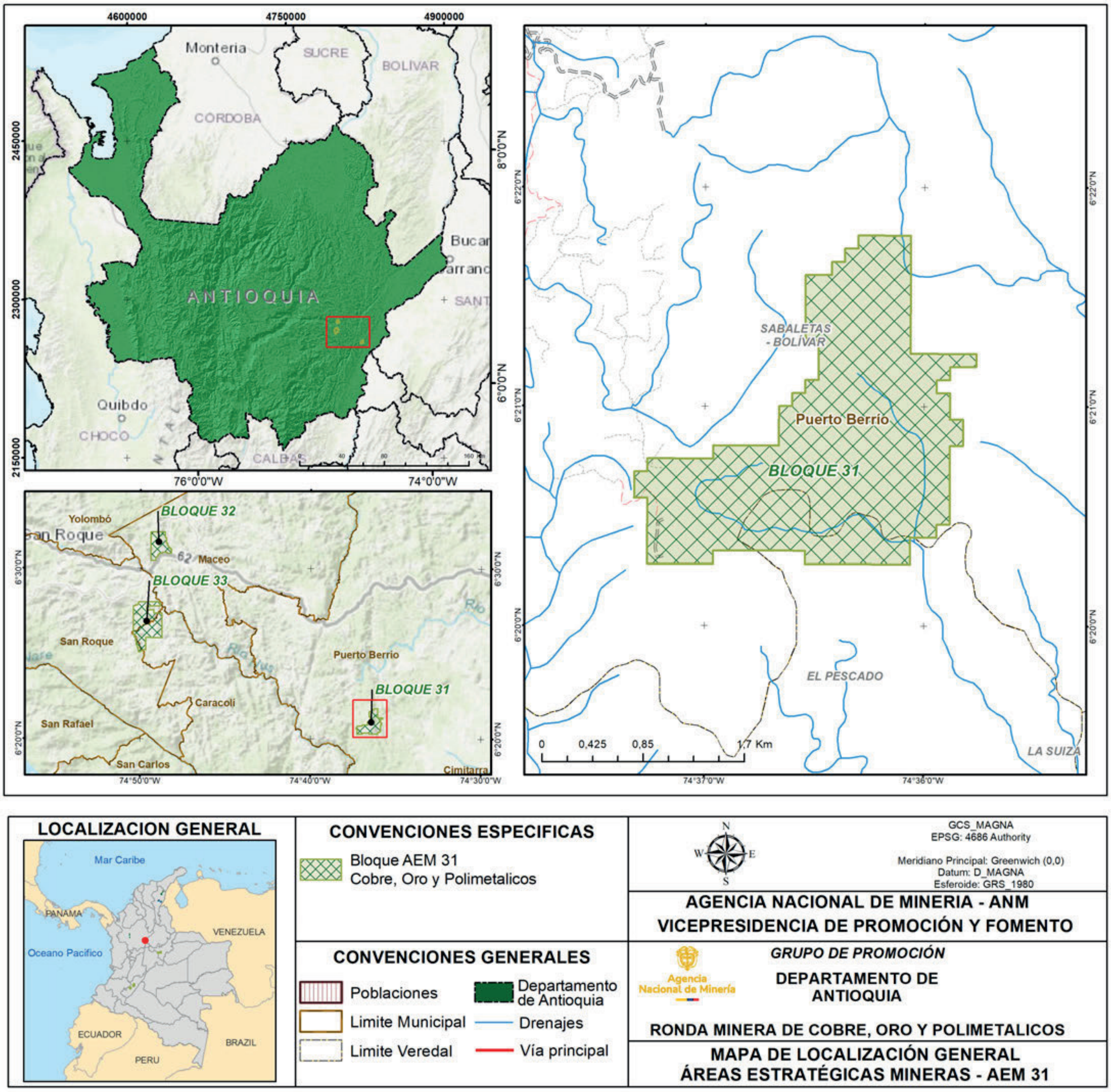
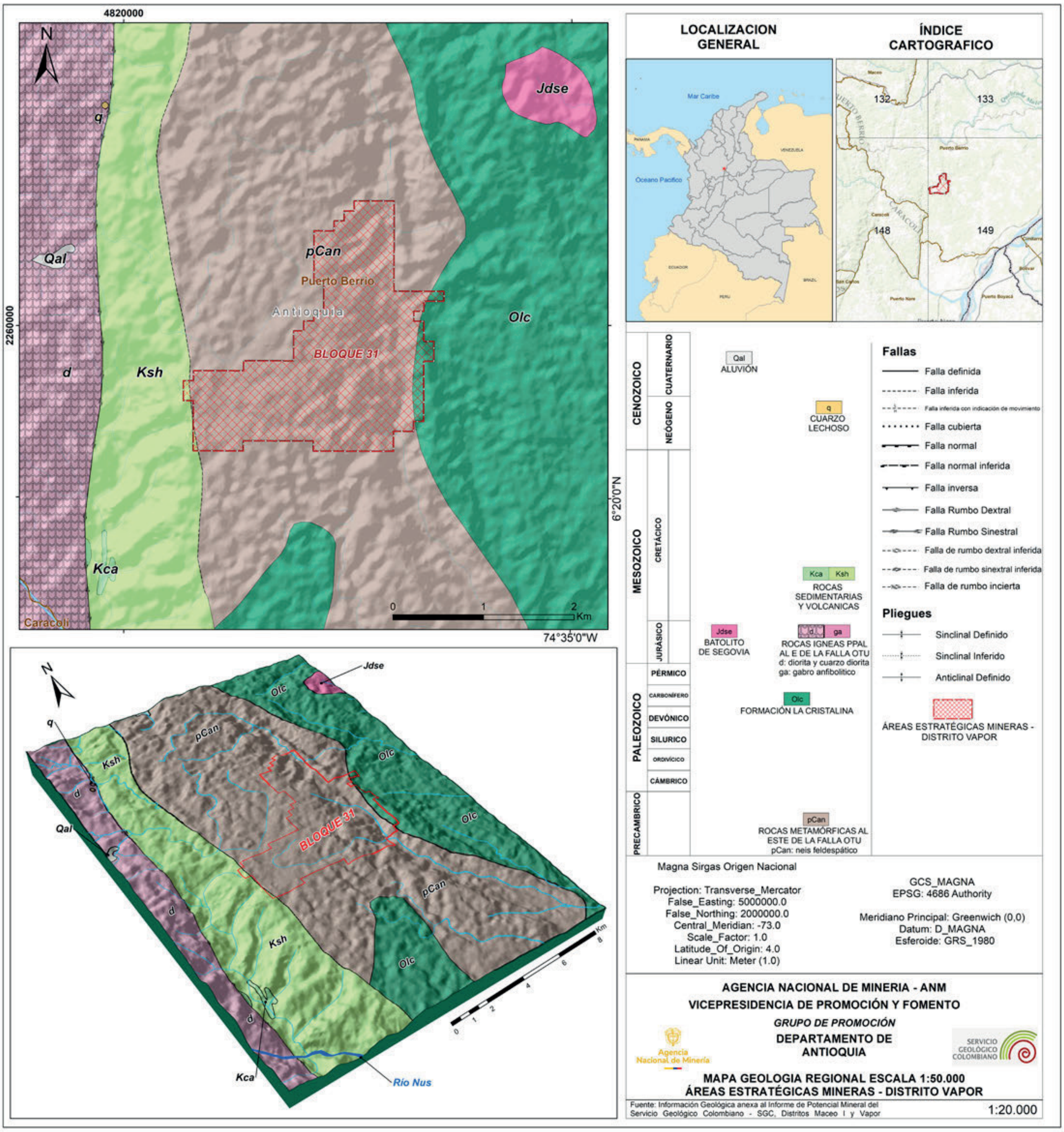


Figure 18: Geology and block diagram AEM El Vapor – Block 31



MACEO 1

BLOCKS 32 and 33

The Maceo I District, is located in the eastern part of the department of Antioquia, within the jurisdiction of the municipalities of Maceo, San Roque, and Caracolí. The unit of interest corresponds to the Antioquia Batholith, which is predominantly composed of tonalite, granodiorite, and quartz diorite, which are directly related to the mineralizing fluids and hydrothermal alteration generators associated with their late magmatic phases..19

Large-scale E-W and NE-SW trending lines represented by the Caldera, Bizcocho, and Nare faults, the Cristales and Playa Rica shear zones, and the Nus River lineament control mineralization.16

The magnetic bodies are large and are associated with possible deep intrusions extending toward the surface at depths of up to 5.8 km, which could be related to hydrothermal processes and mineralization.19

The mineralization of magmatic origin, of the vein-type and disseminated, is consistent with a zoned system around the intrusions, framed within the metallogenic epoch of the Cretaceous (Antioquia Batholith), which gave rise to epigenetic mineralization in veins, veinlets, and stockworks of gold (Au), silver (Ag), copper (Cu), and molybdenum (Mo) along the lineaments.19

Patterns of enrichment in gold (Au), silver (Ag), arsenic (As), bismuth (Bi), lead (Pb), tellurium (Te), tungsten (W), molybdenum (Mo), and antimony (Sb), among other elements, are evident. The geochemical distribution suggests lateral zoning within the hydrothermal system, with differences in oxidation and reduction levels along the Nus River valley.19

19. Evaluación del potencial mineral en el Distrito Maceo I Departamento de Antioquia. SGC, 2022

Figure 19: General location AEM Maceo 1 - Block 32

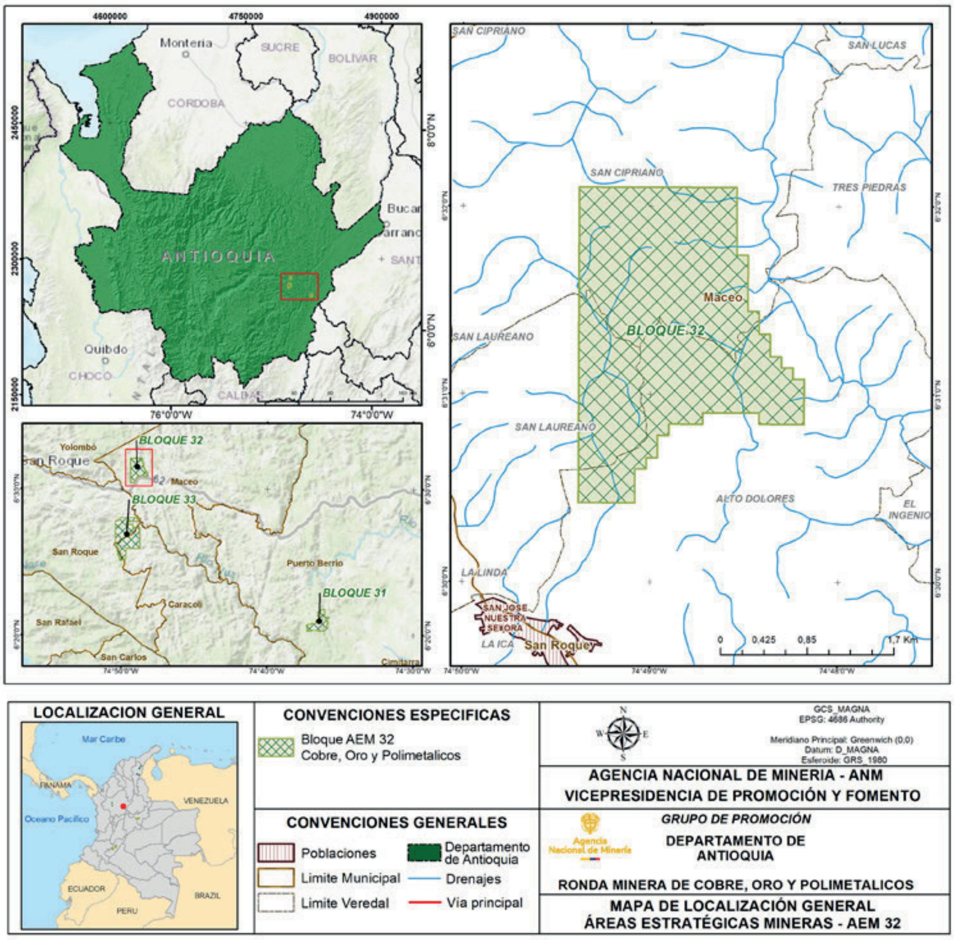


Figure 20, general location AEM Maceo 1 – Block 33

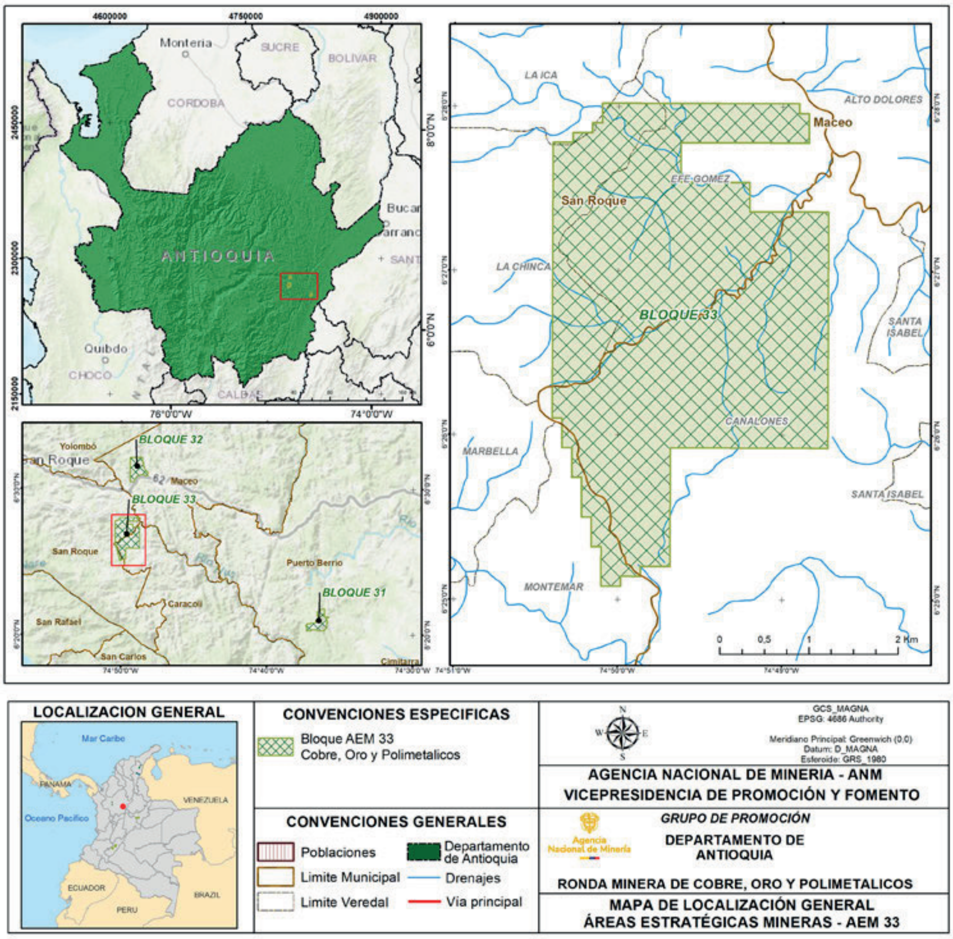
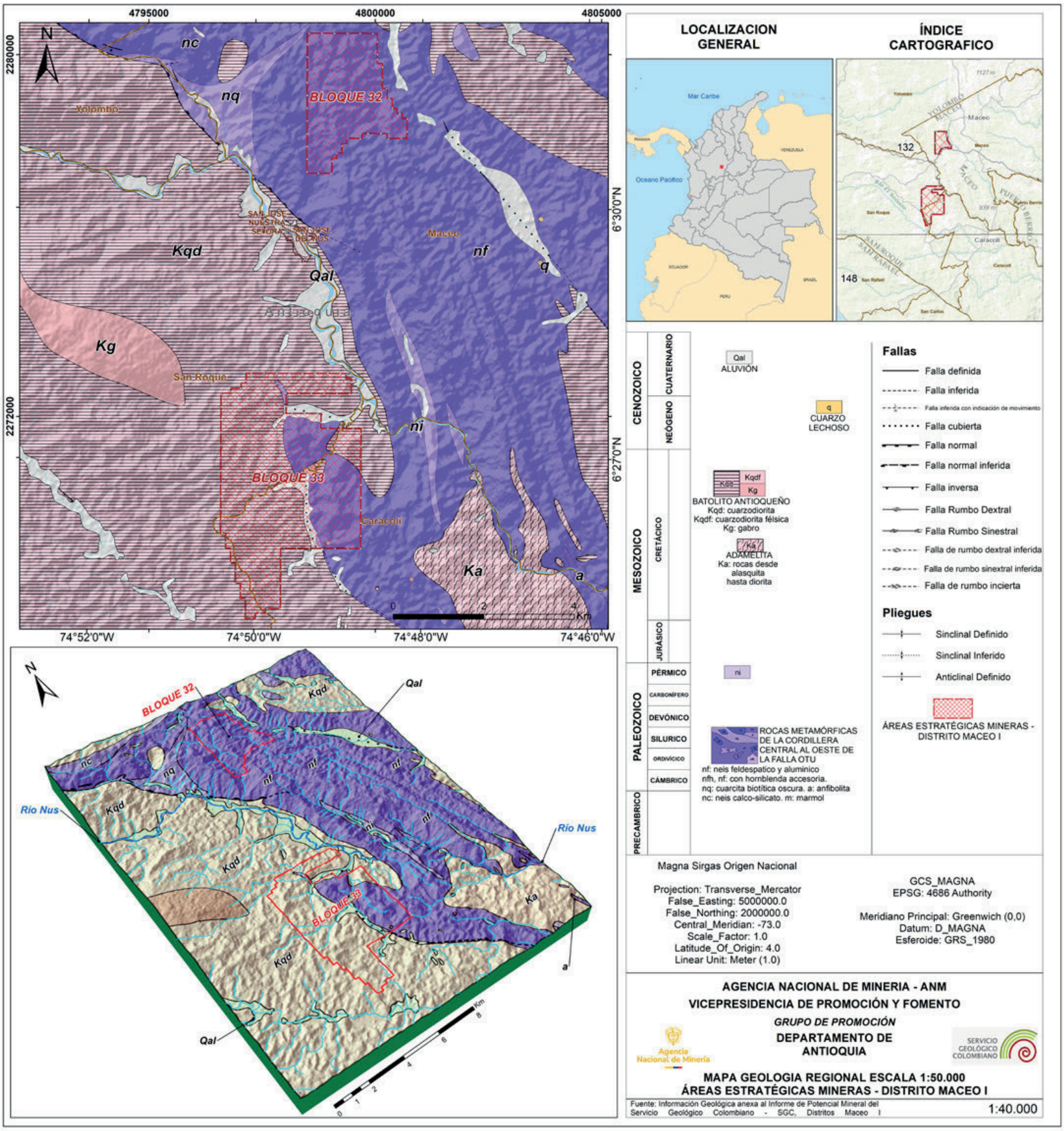


Figure 21: Geology and block diagram AEM Maceo 1 – Blocks 32 and 33



METALLOGENIC DISTRICTS

CHAPARRAL

Y RIOBLANCO NORTE

The Rioblanco and Chaparral metallogenic districts are located in the Cordillera Central and form part of the Central Tectonic Realm (CTR), which consists of the Proterozoic metamorphic basement - Chicamocha Terrain (migmatites, granulite facies rocks, and quartz-feldspar neises) and the Cajamarca-Valdivia Terrain (amphibolites, graphitic schists, limestones, and green schists) from the early Paleozoic, forming part of a pericratonic island arc and an accretionary prism on the western margin of the Chicamocha Terrain; the suture between these two terrains is represented by the Palestine Fault System. 20,21

During the late Paleozoic, the extensional regime began with the opening of the intracontinental rift and the deposition of transgressive marine strata. Subsequently, the tectonic configuration briefly changed to transpressive at the end of the Permian. 20,21

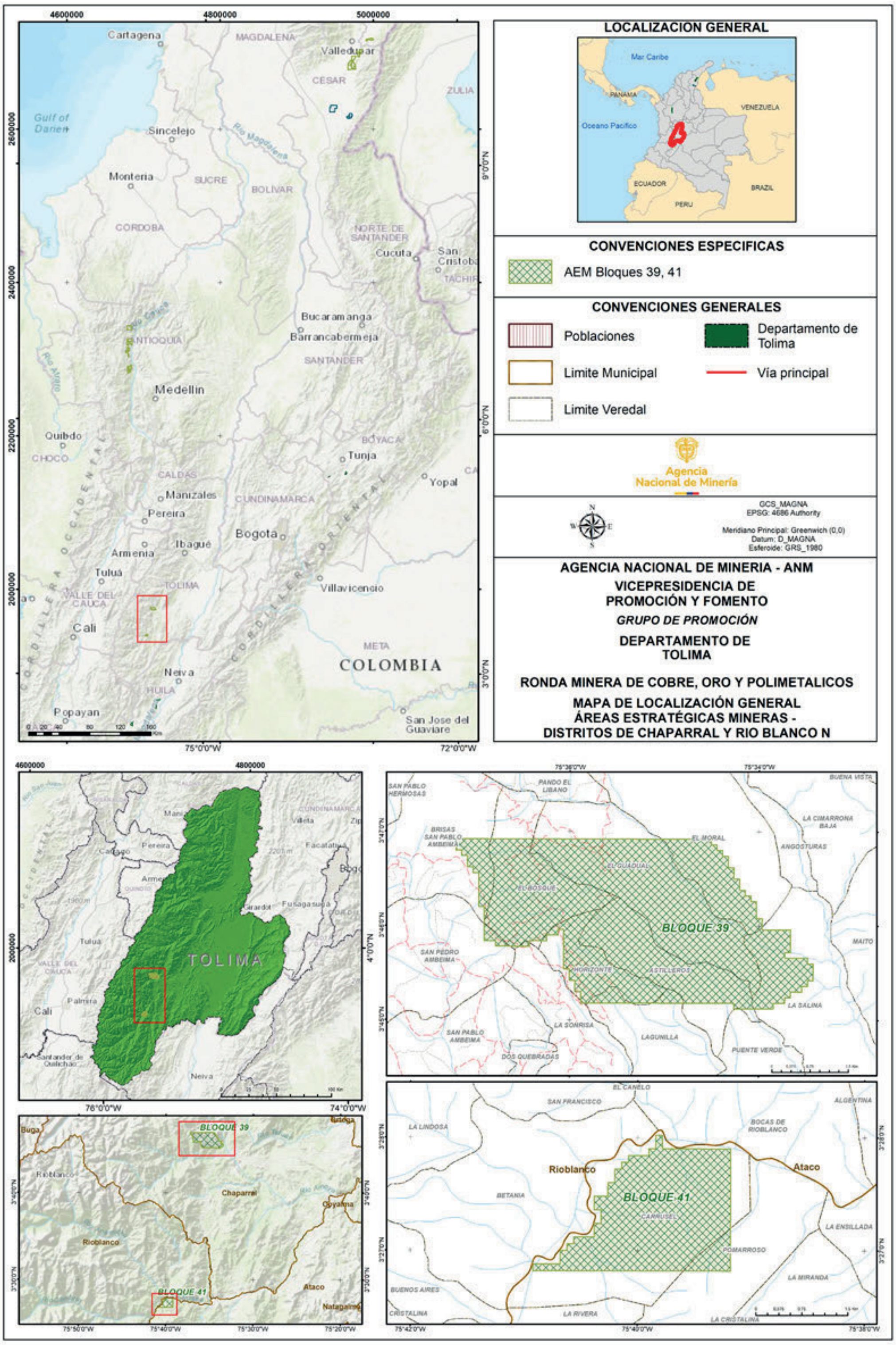
In the Triassic, rifting resumed, allowing for the deposition of the Luisa and Payandé Formations. Fragments of Late Triassic-Jurassic magmatic arcs accreted onto the metamorphic basement, including the San Lucas, Ibagué, and Segovia, the product of an intraplate graben system called the Bolívar Aulacogen, which culminated in the Early Cretaceous with the opening of the Valle Alto Rift. The arc-backarc environment gave rise to the volcano-sedimentary sequences of the Saldaña Formation associated with high-potassium to shoshonitic type I granitic magmatism in the southern part of the Ibagué Batholith.20,21

During the Lower Cretaceous, a deep rupture and an epicontinental marine transgression deposited the Yaví Formation. The basin continued to deepen, passing through coastal environments (El Ocal and Caballos formations), until it reached the middle and outer platform deposition environments of the Villeta Group.20,21

20-21 . Evaluación de potencial mineral en el distrito Ríoblanco Norte, departamento de Tolima. Bogotá: Servicio Geológico Colombiano, 2023 Evaluación del potencial mineral en el distrito Chaparral, departamento de Tolima. Servicio Geológico Colombiano, 2023

At the end of the Cretaceous period, periods of non-deposition and the onset of continental sedimentation gave rise to the Neogene units (Honda Group) and the emplacement of small dacitic and andesitic porphyritic bodies, the product of Andean-type magmatism along the western margin of the RTC due to the accretion of oceanic terrain west of the Romeral Fault System..22

Figure 22: General location – Chaparral and Rioblanco Norte



22. Evaluación del potencial mineral en el distrito Chaparral, departamento de Tolima. Servicio Geológico Colombiano, 2023

CHAPARRAL

BLOCK 39

The Chaparral district is located on the eastern flank of Colombia's Cordillera Central mountain range, in the southwestern part of the department of Tolima, within the jurisdiction of the municipality of Chaparral. The Chaparral district is located in the San Lucas and Ibagué blocks. These blocks form a discontinuous belt of Triassic-Jurassic age along the Chicamocha-Cajamarca-Valdivia suture and contain metaluminous, calc-alkaline, dioritic to granodioritic batholiths, as well as associated volcanic rocks, generated in a composite continental basement. 23

The Chaparral district mineralizations are represented by occurrences of sulfides such as pyrite, chalcopyrite, molybdenite, and sphalerite in the form of disseminations and micrometric to millimetric veins of quartz-carbonate and chlorite-actinolite-magnetite; hosted both in volcanic-sedimentary rocks of the Saldaña Formation, in granodiorites, quartz diorites, and tonalites of the Ibagué Batholith, and in hypabyssal dacitic rocks and andesites.23

Regional lines with NE and NW orientations delimit several of the structural blocks where mineral occurrences are concentrated. These orientations coincide with the arrangement of dikes and areas of intense shearing, suggesting structural control over mineralization. 23

The magnetic anomalies in the Chaparral District are deep, with vertical extensions greater than 1,500 m that coincide with apophyses of Jurassic intrusive bodies and hypabyssal dikes hosted in the Saldaña Formation. 23

Families of magnetic lines with a dominant NE and EW direction are found within the district, associated with possible fractures within the Ibagué Batholith, on which some minor intrusions could be located.23

Granitoid samples from the Chaparral district exhibit adakitic affinity, based on the values and proportions of trace elements such as strontium (Sr), vanadium (V), yttrium (Y), and scandium (Sc), whose enrichment and depletion are related to porphyry-type Cu (Au, Mo) mineral systems. 23

23. Evaluación del potencial mineral en el distrito Chaparral, departamento de Tolima. Servicio Geológico Colombiano, 2023

Figure 23: General location of AEM Chaparral

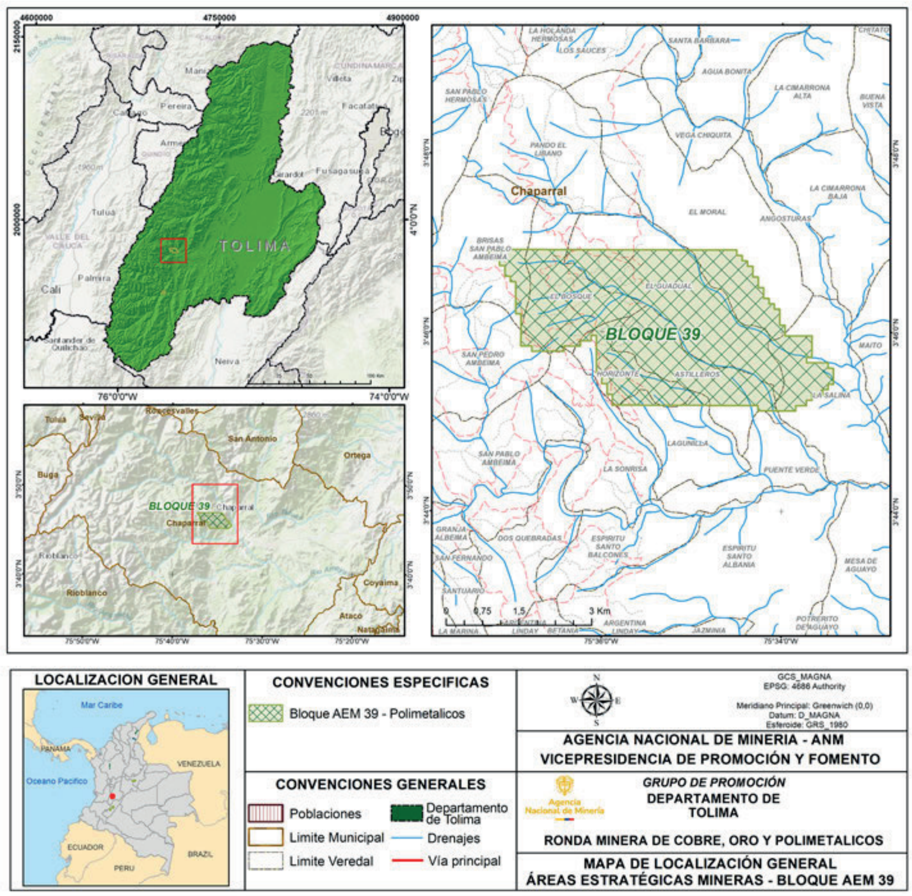
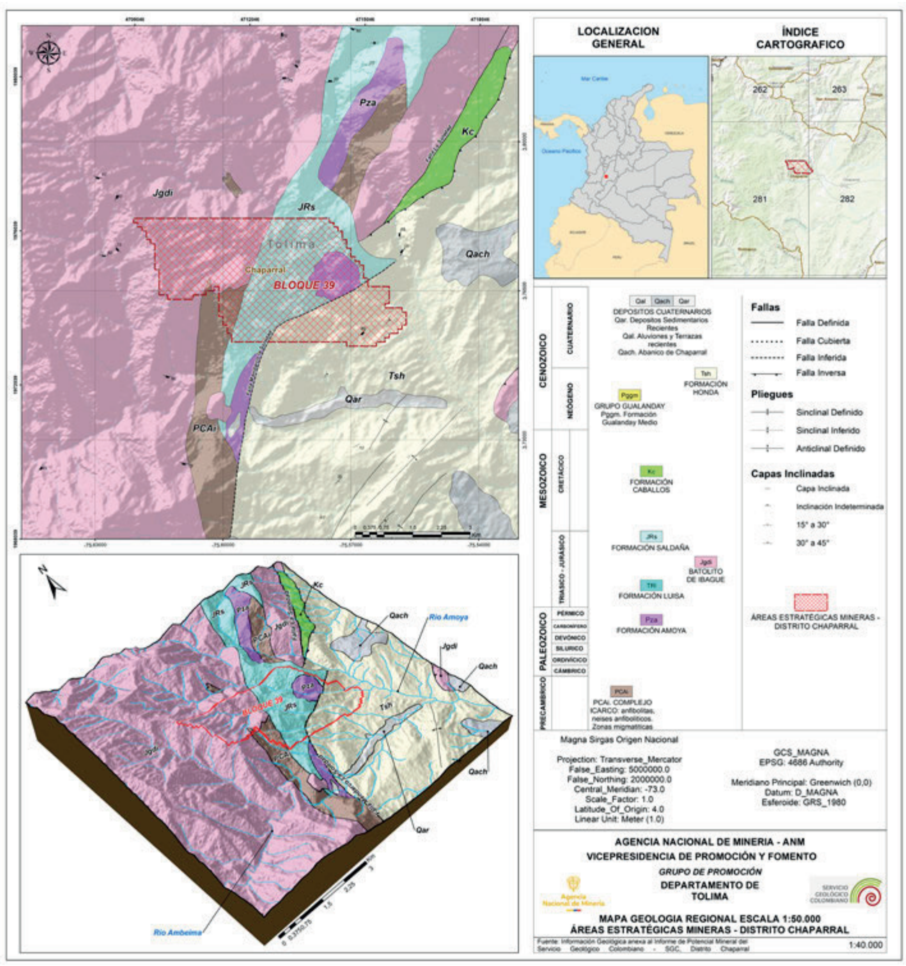


Figure 24: Regional geology and block diagram – Chaparral



RIO BLANCO NORTE

BLOCK 41

The Rioblanco Norte district is located on the eastern flank of the Cordillera Central mountain range, in the southwest of the department of Tolima, within the municipalities of Rioblanco and Ataco. This sector is located in a geological environment conducive to hosting mineral occurrences associated with porphyry systems, given its position relative to well-identified mineralized districts:

To the north, it borders the Rovira district, known for its porphyry and skarn copper (Cu)–molybdenum (Mo) mineralization.

To the east, it borders the Natagaima district, notable for its copper (Cu)-gold (Au)-molybdenum (Mo) porphyries.To the south is the Río Cahichí district, characterized by orogenic gold (Au) veins. 24

Studies of sodium-calcium (Na–Ca) and potassium (K) hydrothermal alterations, characterized by higher concentrations of copper sulfide (Cu_2S) and molybdenum (Mo), are directly linked to the intrusive units responsible for the different phases of the porphyry system: Granodiorite, associated with the early mineral phase, and Diorite, corresponding to the intermineral phase. 24

The interaction between these units and their respective alterations defines the architecture of a composite porphyry deposit located in the Ibagué Batholith, whose development and distribution are conditioned by the structural control of the Saldaña Formation. It is also observed that the content of bornite, chalcopyrite, chalcocite, and covellite is proportional to the contribution of magnetite in veins, while molybdenite shows a direct relationship with the quartz content in the same veins. Translated with DeepL.com (free version)24

Finally, the study of spatial distribution and geochemical assemblages in sediments and rocks yielded values for copper (Cu), gold (Au), silver (Ag), and molybdenum (Mo), allowing us to define areas with high geochemical potential and reinforcing the district's prospectivity. 24

24. Evaluación de potencial mineral en el distrito Ríoblanco Norte, departamento de Tolima. Bogotá: Servicio Geológico Colombiano, 2023

Figure 25: General location of AEM Rioblanco Norte

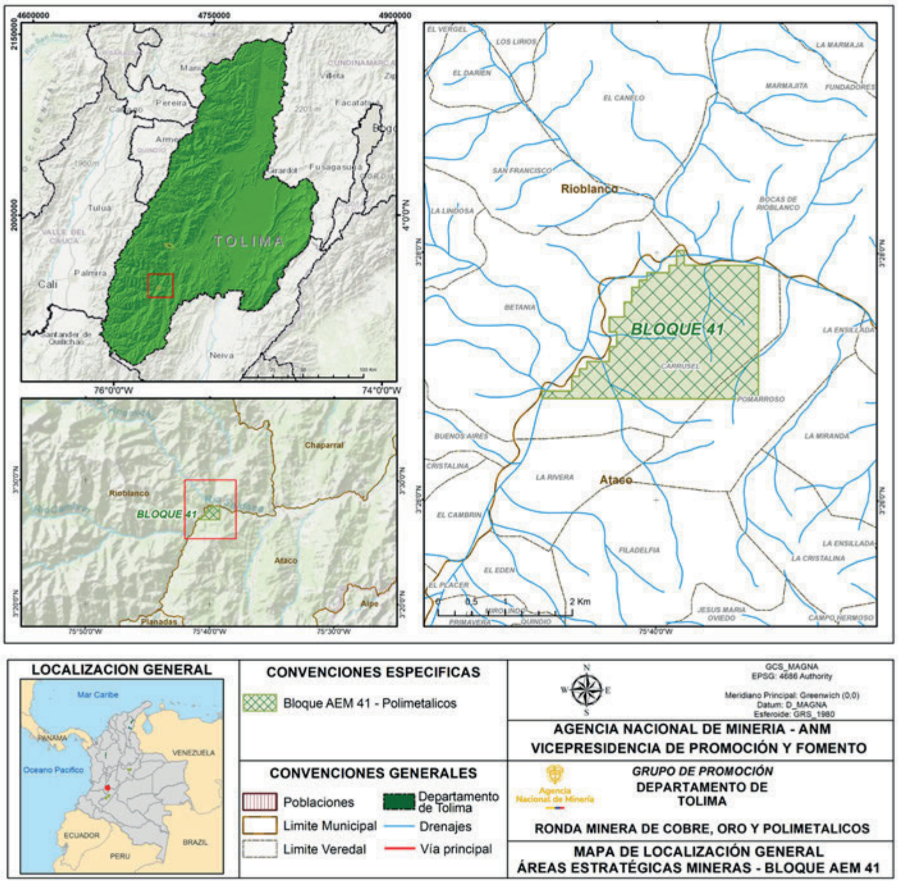
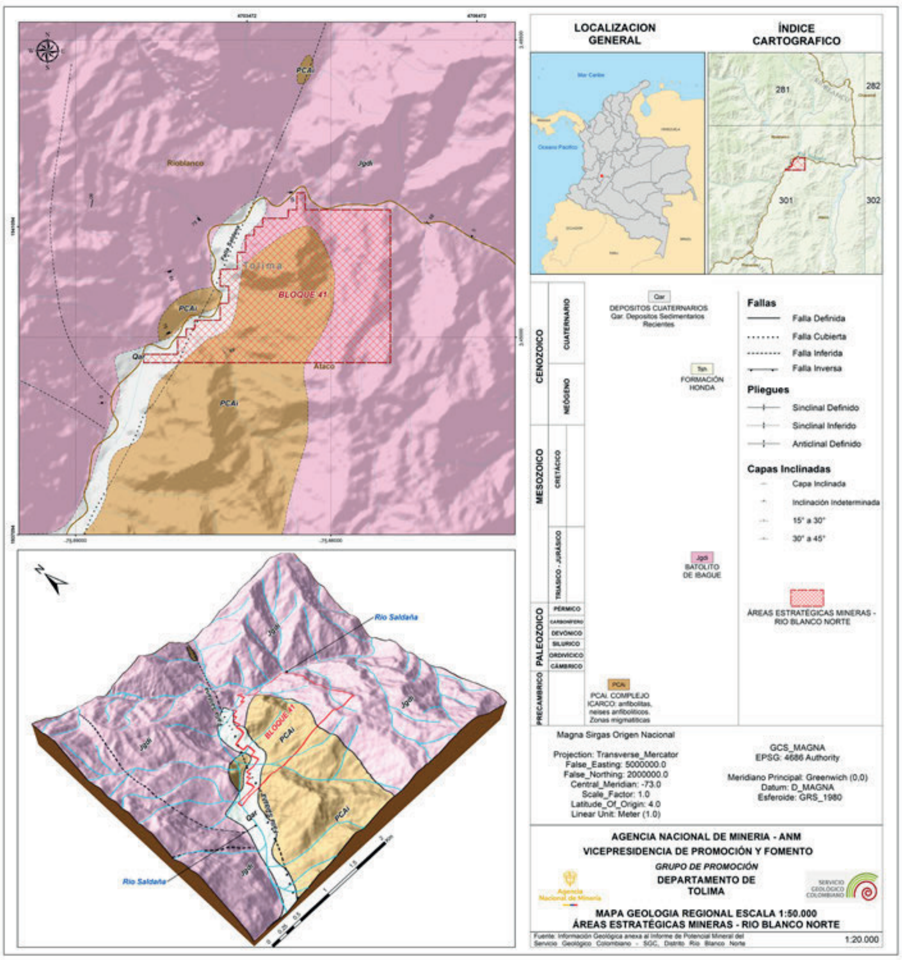


Figura 26: geología regional y bloque diagrama – Rioblanco Norte



METALLOGENIC DISTRICT

VALLE DE SAN JUAN Y BUENAVISTA

The Valle de San Juan and Buenavista Metallogenic District, is located on the eastern flank of the Cordillera Central mountain range, forms part of the central-western region of the department of Tolima, within the jurisdiction of the municipalities of Valle de San Juan, Rovira, and San Luis.25

The district is part of the Cajamarca–Valdivia terrain, composed of Paleozoic basement rocks and Jurassic-Cretaceous plutons linked to the subduction of the Farallones plate. These processes, together with the Paleocene accretion of allochthonous material from the Caribbean, led to the uplift, exhumation, and formation of the Middle Magdalena Valley basin, thus defining the complex structural and magmatic evolution of the Cordillera Central.25

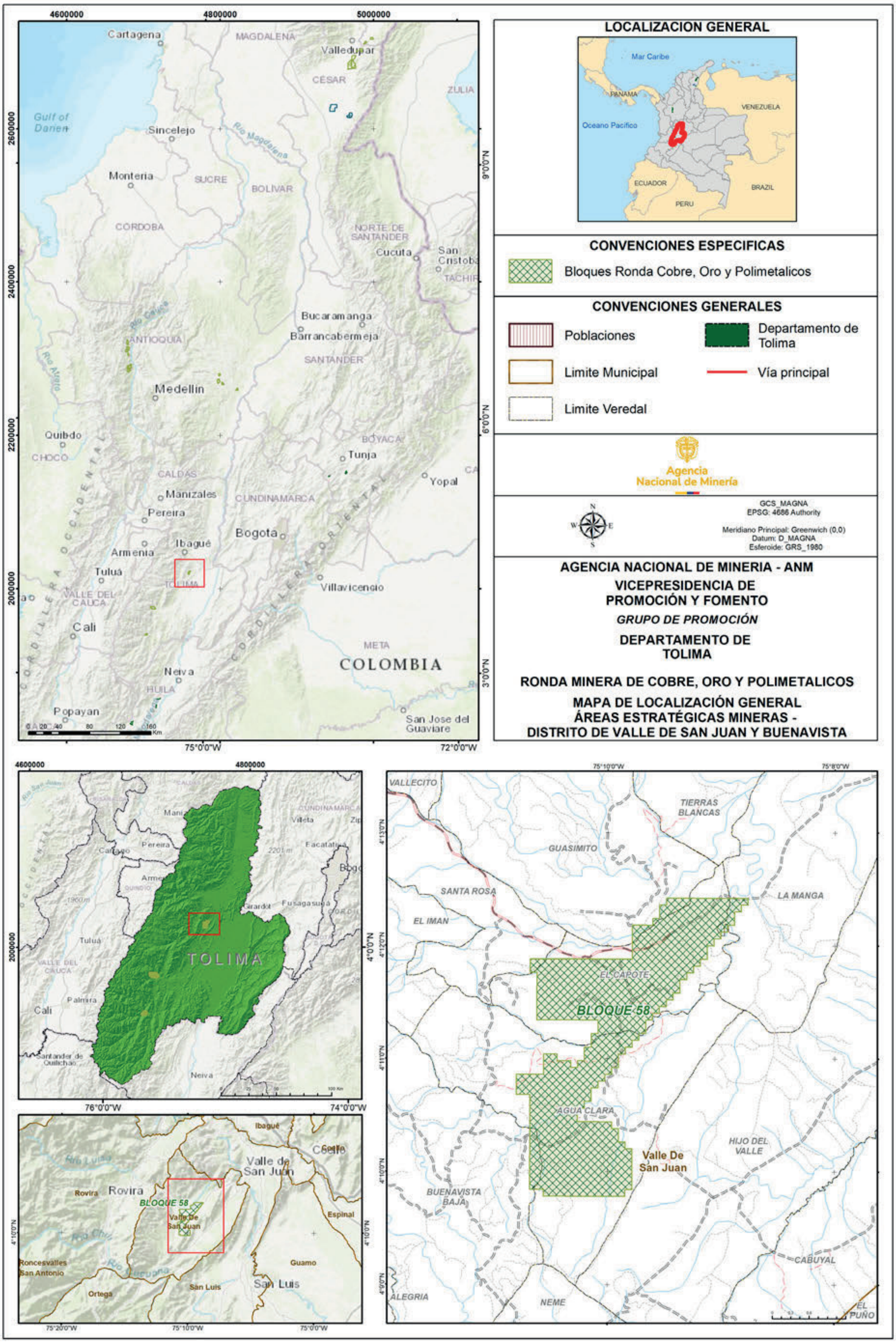
The districts of Valle de San Juan and Buenavista present a lithological diversity organized into six formal geological units, where the Luisa, Payandé, and Caballos sedimentary formations, the latter overlying all the others—contrast with intrusive igneous bodies such as the Payandé Stock and the Ibagué Batholith, and with volcanic and volcaniclastic rocks of the Saldaña Formation. Added to these are hornfels, granofels, and skarns generated by contact metamorphism, which do not belong to formal units despite having been described locally as “Payandé Skarn” or “La Mina Río Frío Skarn.” In addition, dikes of varied compositions are observed intruding and cutting through the aforementioned units. 25

At the scale of the Valle de San Juan and Buenavista metallogenic districts, NW–SE and E–W lineaments are identified, visible both in the geomorphology and in the SGC aeromagnetic data, whose traces spatially coincide with several mineral occurrences, suggesting that these structures functioned as conduits for the ascent of mineralizing fluids. Additionally, the aeromagnetic survey reveals magnetic anomalies covering several square kilometers, associated with the complex structural lineaments of the region. 25

At the regional level, the area is dominated by a NE–SW-trending fault system characterized by predominantly horizontal movements and recent activity, within which the Ibagué Fault stands out. The region also has numerous thrust faults that generally dip toward the east. 25

25. Evaluación del potencial mineral para cobre y otros metales de los distritos metalogénicos de Valle de San Juan y Buenavista, departamento del Tolima. SGC, 2019.

Figure 27: General location of the San Juan Valley / Tolima Department



VALLE DE SAN JUAN

BLOCK 58

Block 58 is located in the Valle de San Juan District, which comprises the municipalities of Valle de San Juan, San Luis, and Rovira. Hydrothermal alterations are observed mainly in the igneous rocks of the Saldaña Formation and the Payandé Stock. Other units show shearing and quartz veins with sulfides, although part of the mineralization appears to be associated with metasomatic processes, suggesting that the sources of heat and minerals have not yet surfaced. 26

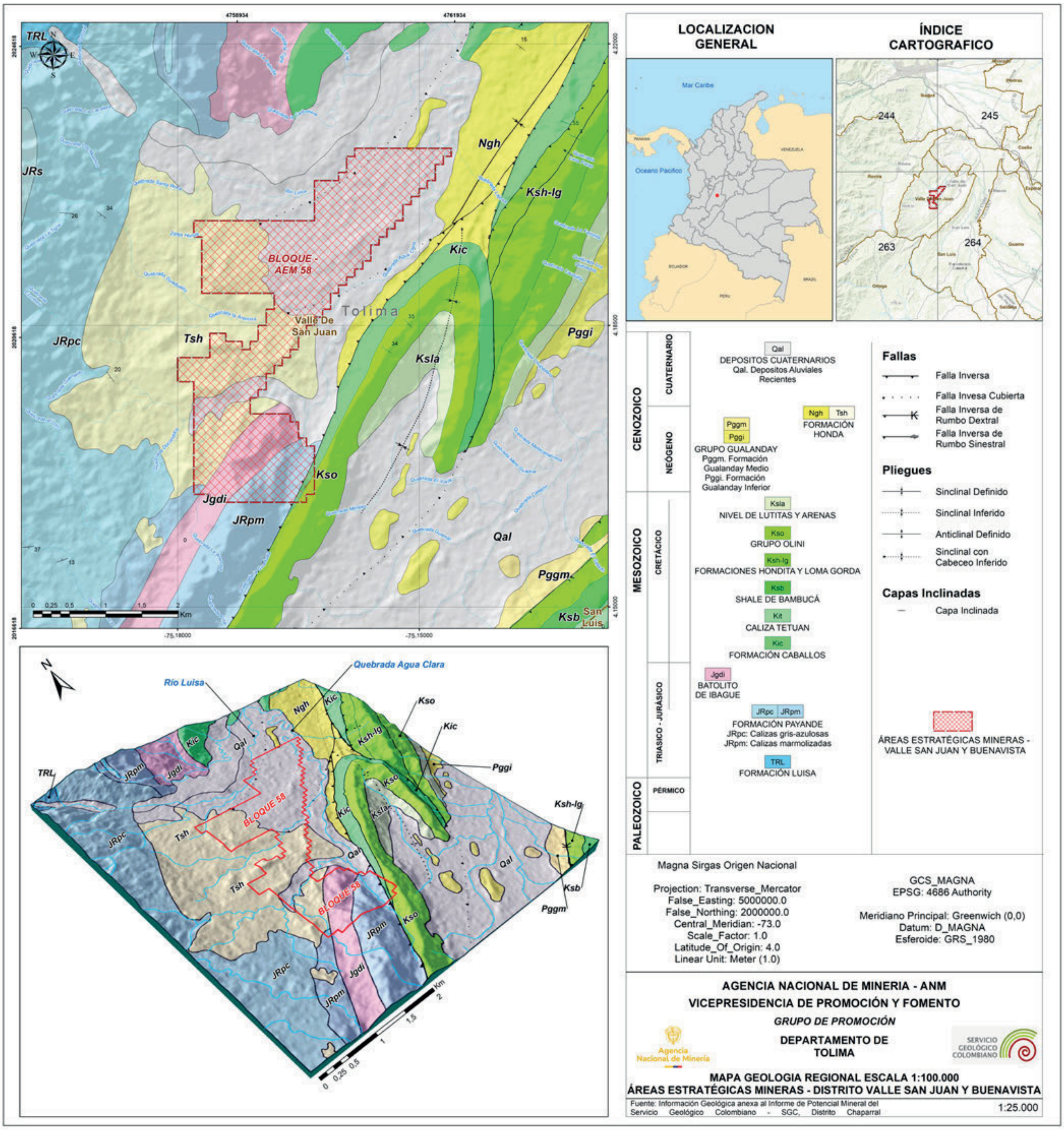
The area is controlled by regional structures oriented NNE–SSW and local NE–SW, NW–SE, and E–W lineaments, bounded by the Ibagué and Cucuana faults. These structures generate subrounded features with the potential to host intrusive flows and segregated magmas. The main mineralizations are located in NW–SE and E–W systems associated with tensional structures. 26

Regional magnetic lines were observed with a predominant SW-NE direction, extending continuously for up to 25 kilometers, and discontinuous tension systems with a NW-SE and W-E direction, with average lengths between 3 and 8 kilometers in that direction. Similarly, second- and third-order structures with E-W trends were also observed. Associated with these structures are samples with hypogenic copper mineralization. 26

Geochemical analysis identifies two main associations: Cu (copper), Ag (silver), Bi (bismuth), Sb (antimony), Mo (molybdenum) suggestive of epithermal systems; and Au (gold), Ag (silver), Cu (copper), Zn (zinc), Pb (lead) compatible with porphyry and skarn systems. 26

26. Evaluación del potencial mineral para cobre y otros metales de los distritos metalogénicos de Valle de San Juan y Buenavista, departamento del Tolima. SGC, 2019.

Figura 28: geología regional y bloque diagrama AEM Valle de San Juan



Disclaimer: El contenido de la información geocientífica se construyó a partir de múltiples estudios realizados por el Servicio Geológico Colombiano, desarrollados a partir de la construcción de investigaciones y estudios técnicos, así como la información de levantamientos de campo y análisis de los diferentes componentes para la evaluación de potencial.

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