REPORT

planetGOLD
Making a world of difference in small-scale gold mining.
A GEF Initiative

Minahang Bayan Artisanal Operations

Barangay Casalugan, Municipality of Paracale, Philippines

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About the Author

The Artisanal Gold Council (AGC) is a charitable non-profit NGO dedicated to improving the opportunities, environment, and health of millions of people involved in artisanal and small-scale gold mining (ASGM) in the developing world. Based in Canada, AGC has worked in over 30 countries and with hundreds of artisanal and small-scale mining communities around the world on topics including but not limited to: community development, poverty reduction, formalization, mining policy, markets and supply chains, public health, environmental management, mining engineering, and human rights.

AGC operates from the principle that improving the global ASGM sector requires direct intervention at the community level. The AGC therefore has a long history of working with mining communities. Lessons learned, and knowledge gained from working with ASGM communities around the world, are embedded in the design of all AGC's teaching and learning materials.

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About This Report

This technical geological assessment report was developed by Jose Luis Barillas-Diaz, MSc, Exploration Geologist of the Artisanal Gold Council ("AGC"), with the support of the AGC Philippines team and Yancey Seve P. Guinto, Eng. Geol., Science Research Specialist II of the Mines and Geosciences Bureau ("MGB") Region V. This report presents the findings from the geological fieldwork conducted in the Minahang Bayan ("MBP") of Paracale in April 2022. The objective is to provide an outline of the artisanal exploitable mineral resources in the small-scale gold mining site in MBP, Camarines Norte. This document is designed to serve as the geological basis for the development of practical recommendations and strategies for the mining and processing of the mineral resources in MBP using mercury free technology.

This document has been developed for the use and benefit of the planetGOLD Philippine's project activities and to support business planning for the subject community of small-scale miners.

Disclaimer: Although this geological report and supporting data is intended to be accurate, new information will be uncovered that will have an impact on the conclusions of the report. The observations and conclusions provided herein are drawn as of the date of the report issuance and are subject to change without notice.

This report does meet National Instrument 43-101 standards of disclosure for mineral projects ("NI 43-101").

The planetGOLD Philippines project is working toward eliminating mercury in the artisanal and small-scale gold mining sector by using a bottom-up approach, involving members of the sector directly in the creation and implementation of policies and practices to sustainably improve mining operations and livelihoods. The planetGOLD Philippines' project is implemented by the UN Environment Programme (UNEP), UN Industrial Development Organization (UNIDO), Department of Environment and Natural Resources (DENR), and executed by the Artisanal Gold Council (AGC), in partnership with the Mines and Geosciences Bureau (MGB). This report was funded by the Global Environment Facility, implemented by the NRDC and executed by the AGC.

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ARTISANAL GOLD COUNCIL

Table of Contents

List of Tables

List of Figures

Abbreviations/Acronyms

Abbreviation/Acronym	Definition
ASGM	Artisanal and small-scale mining
AGC	Artisanal Gold Council
MBP	Minahang Bayan
GEF	Global Environment Facility.
UNIDO	United Nations Industrial Development Organization
UNEP	United Nations Environment Program
DENR	Department of Environment and Natural Resources
MGB	Mines and Geosciences Bureau
SMBC	Samahan ng mga Minero sa Barangay Casalugan
MFPS	Mercury Free Processing System
PMRB	Provincial Mining Regulatory Board
JSM	Junior Scale Mining
LSM	Large Scale Mining
SSMC	Sall Scale Mining Contract
COC	Cadig Ophiolitic Complex

VMS	Vulanogenic Massive Sulphides
PG	Paracale Granodiorite

Introduction

The Minahang Bayan of Paracale ("MBP") is one of two pilot sites of the planetGOLD Philippine's project (the project) being executed by the Artisanal Gold Council ("AGC"). The project's objectives are to:

- Eliminate mercury in small-scale mining operations within MBP;
- Assist the small-scale miners with improvements in ore processing, and.
- Implement Artisanal and Small-scale Gold Mining ("ASGM") best practices.

A small-scale gold extraction operation exists within the Minahang Bayan area in Barangay Casalugan, Paracale, Camarines Norte, Region V, declared by the Mines and Geosciences Bureau ("MGB") of the Philippines. The project is situated in the Paracale Gold District, one of the most prolific gold regions in the Philippines.

The study area consists of a designated Minahang Bayan permit in Barangay Casalugan, Paracale, sanctioned by the Provincial Government and implemented by the Camarines Norte Provincial Mining Regulatory Board (PMRB) (Resolution Nº. 09-2019). The southern part of the MBP is being operated by Samahan ng mga Minero sa Barangay Casalugan ("SMBC"), an association of small-scale miners and the largest gold producer in the area. SMBC also owns and operates the central processing plant. Previous environmental studies have shown that SMBC is the largest mercury user and generates the most mine waste and tailings in the area. Other groups of small-scale miners operate informally outside the MBP generally grouped along the south border of the permit. These groups toll mill a small percentage of their ore at the central SMBC processing plant with most of their ore processed independently outside of the MBP area. Throughout the region, underground mining is the primary ore extraction practice guided by rudimentary assaying techniques for ore quantification.

This assessment report is intended to delineate the geological potential of the Minahang Bayan through the surface and underground geological mapping supported by a limited geochemical sampling programme. planetGOLD primary goal is to construct a new mercury-free processing system ("MFPS") to replace current mercury-based techniques. The mercury-free processing plant, currently under construction, is undersized relative to mine production. Therefore, outside investment is necessary to expand the plant to match mining rates. This report's objective is to provide geological information which supports an investment case for plant expansion.

The MBP area is within the "Casalugan" zone associated with the gold districts of Paracale, Sta Elena-Tabas, and Nalesbitan in Camarines Norte. Paracale is typical and one of the main gold districts of the Philippines arc (Fig. 1). The USGS mineral resources data classified the gold region type as porphyry Cu-Mo-Au from the Early-Mid Miocene Philippine Arc.

Figure 1: Major gold districts, deposits, and prospects of the Philippines (Garwin et al., 2005)

Paracale is in the Bicol region, which is known as one of the most important gold production areas in the Philippines. This region ranks second in gold production, in the Philippines, having produced more than 5.1Moz (Mitchell and Leach, 1991). Most of the gold deposits in the area were developed prior to the late 1930's, and most of the mines closed by the end of the 1950's.

In the Paracale MBP, mineral exploration and development proceeded slowly during the 1980s and 1990s. SMBC's operations are centered around a 90 m deep exploration shaft developed by a

Chinese junior-scale mining (JSM) venture constructed over this period. This shaft represents the primary source of ore production for small-scale miners in MBP. There has been a marked increase in geological exploration of the area from the early 2000s onward focused on diamond drilling; evidenced by abandoned drill core throughout the permit area. Over the last five years, foreign large-scale mining ("LSM") companies have left the area, due to social issues, but artisanal miners and small-scale miners remain active in the MBP. These miners have been particularly active in and around the Barangay Casalugan mining area, which covers approximately 26.4 ha. The MGB Region V Office has an inventory of 47 underground mine works identified in the Paracale MBP. However, it was observed during the fieldwork for the present study, that there were a greater number of abandoned shafts in the area. Of these underground workings, only 12 remain active.

The scope of this geological study covers 26.4 ha of the MBP area. The mapping and sampling programme focused on the SMBC area with an extension of 4.7 ha to cover the informal artisanal mining area. These areas house most of the bedrock outcrops and mining activities.

The sampling programme consisted of representative rock chip samples from surface outcrops, trenches, underground mines, shaft waste rock; and historical drill core samples from previous exploration programmes (provided by SMBC management). The MGB Metallurgical Technology Division conducted the geochemical sample analysis by fire assay for gold and silver content (Lab. Nº. MSS- 2022-39). This study analyzed and interpreted the geological, geochemical, and structural data, acquired during fieldwork, to estimate the gold potential of the MGB area. Geostatistical analysis was based on recommendations developed by Hans Erasmus, MSc, P. Geo for the AGC (Erasmus, 2021). This report does meet National Instrument 43-101 standards of disclosure for mineral projects ("NI 43-101").

Property Description and Location

The Paracale MBP permit is in Sitio Maning, Barangay Casalugan near the town of Paracale. The MBP permit was granted by the PMRB; after an application process of almost four years, which started in 2015 with securing consent from Golden River Mining Corp. (a large-scale mining company) (Appendix 1).

Table 1: MBP legal status

Region	Location	Area (ha)	Petitioner	Status

Region V	Barangay Casalugan, Paracale, Camarines Norte	26.4319	Provincial Government of Camarines Norte	Approved through Camarines Norte PMRB Resolution No. 09-2019

The MBP is approximately 345 km east-south-east of Manila by road. The mining permit can be reached overland in roughly nine-hours from the MGB offices in Quezon City, Metro Manila. The Paracale Minahang Bayan corner coordinates are tabulated in Table 2 and plotted on the map in Figure 2.

Table 2: Geographic and UTM Coordinates of MPB

	Geographic coordinates										UTM 51 N	
Corner	Latitude				Longitude				Latitude	Longitude	East (X)	North (Y)
1	14°	18'	0''	N	122°	45'	13.777''	E	14.300	122.754	473450.36	1580919.31
2	14°	18'	17.691''	N	122°	45'	13.777''	E	14.305	122.754	473450.93	1581462.81
3	14°	18'	17.691''	N	122°	45'	30''	E	14.305	122.758	473936.94	1581462.30
4	14°	18'	0''	N	122°	45'	30''	E	14.300	122.758	473936.37	1580918.80

SMBC's Small-Scale Mining Contract (SSMC) covers a 5.0 ha area within the MBP limits. Table 3 outlines the SSMC's corner coordinates:

Table 3: Geographic Coordinates of SSBC

	Geographic coordinates	
Corner	Latitude	Longitude
1	14.30000000 N	122.75382500 E
2	14.30086944 N	122.75382500 E
3	14.30086944 N	122.75833333 E
4	14.30000000 N	122.75833333 E

In total, four associations have approved SSMCs within the Paracale MNP, and an additional two applications are pending. One cooperative is in the process of applying for their SSMC (Table 4).

Table 4: SSMC legal and operational status

SSM Association	Area (ha)	SSMC Status	Operation Status
Lexington Small-Scale Miners Association	5.0	7 April 2021	Inactive
Samahan ng mga Minero sa Barangay Casalugan (SMBC)	5.0	13 April 2021	Active
Tugos Small-Scale Miners Association (TSSMA)	5.0	7 April 2021	Active (outside the MBP)
Samahan ng mga Minero sa Paracale Federation (SMPF)	5.0	7 April 2021	Inactive
Samahan ng Maralitang Magkakabod ng Camarines Norte (SMMCN)	1.7	Pending approval	Active
Small-Scale Mining Casalugan Paracale Association (SSMCPA)	5.0	Pending approval	Inactive
Camarines Norte MB Consumers' Cooperative (CNMBCC)	5.0	No application yet	Inactive

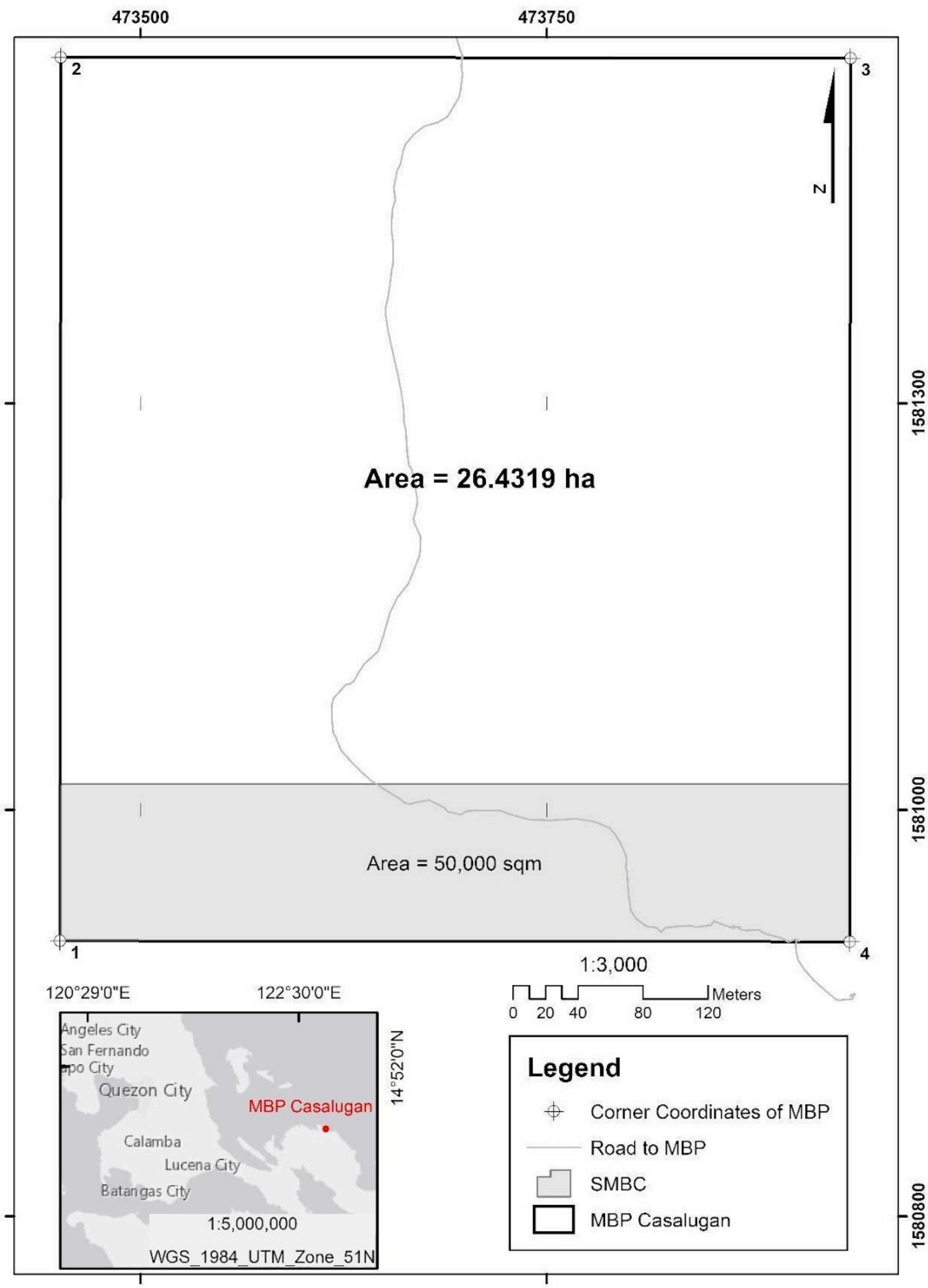

Figure 2: Paracale MBP Map, Barangay Casalugan, Camarines Norte

Accessibility, Climate, Local Resources, Infrastructure and Physiography

Accessibility

Paracale is a 9-hour drive from Manila over first-class roads and secondary provincial roads. The MNP and mine site in Barangay Casalugan is accessed via unpaved roads.

Paved roads are the primary means of transporting people, goods, and services from the barangay to Paracale. The municipality is connected to its different barangays by the national Maharlika Highway. A secondary paved road runs the 8.0 km from Paracale to within 1.8km of the MBP. Final access is provided by an unfinished, seasonal gravel road. (Figure 3).

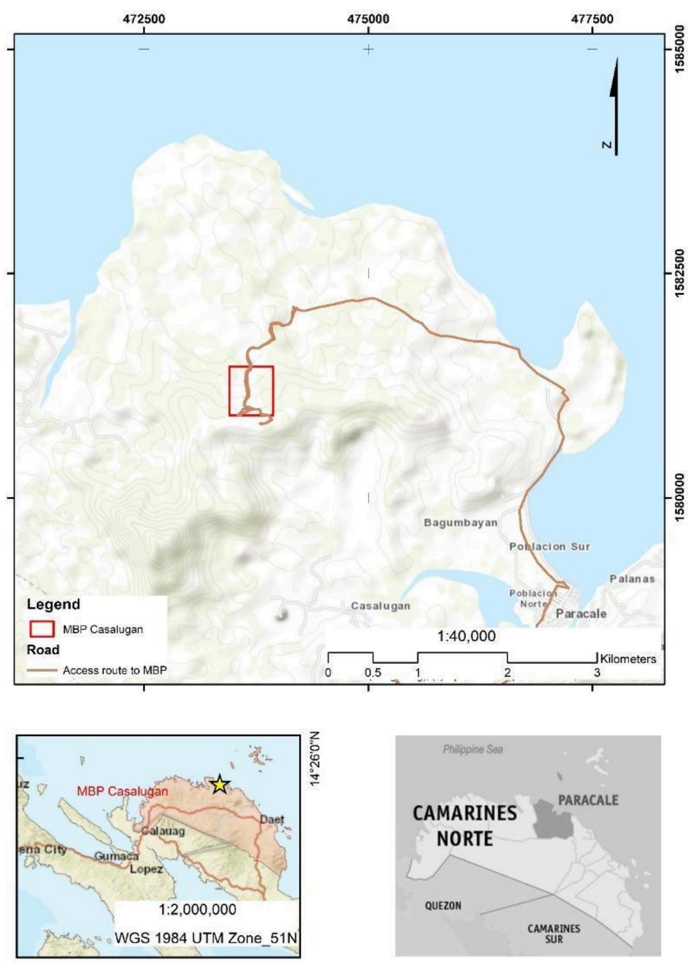

Figure 3: Map with the detailed location and Access

Climate

Paracale is designated as “tropical rainforest climate, Af” based on the Köppen climate classification system (Arnfield 2020). The area experiences short, hot summers that are overcast; whereas, winters tend to be brief, warm, extremely windy, and are often partly cloudy. In general, precipitation is high year-round. The temperature typically varies from 24 °C to 32 °C over the course of a year; and is rarely below 23 °C, or above 33 °C (Figure 4). The weather is ideal for mining in early January through to mid-March, and February is generally the best month.

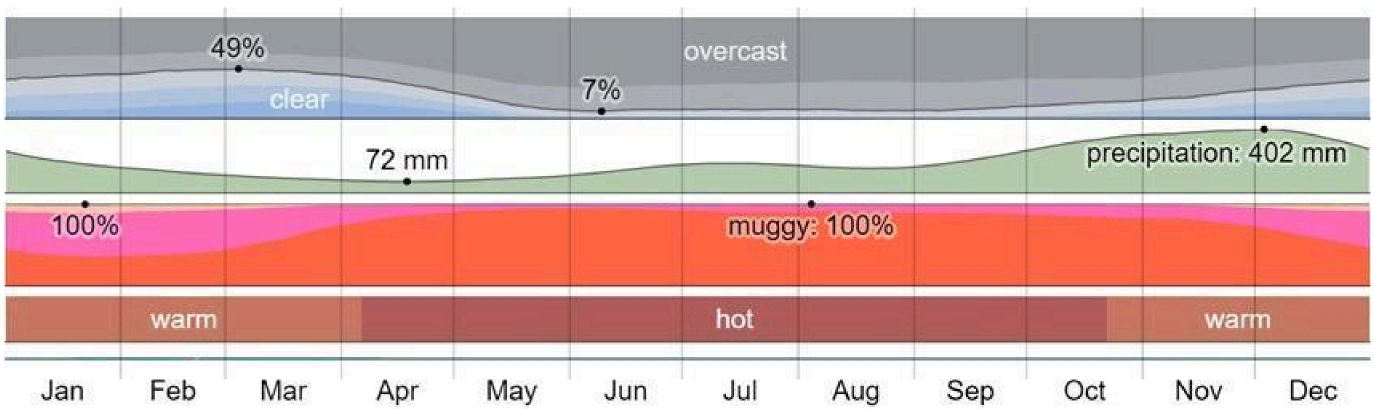

Figure 4: Chart of the yearly average weather in Paracale

The hot season lasts roughly two to three months, from May to July, with an average daily high temperature above 31 °C. The hottest month of the year in Paracale is May, which has an average high of 31 °C and a low of 26 °C. The cold season usually lasts for four-months; December, January, February, and March, with average daily high temperatures below 28°C. The coldest month of the year in Paracale is January with an average low of 24 °C and a high of 27 °C.

Cloud cover in Paracale has large seasonal variations; and the area is overcast for most of the year. The wet season usually lasts seven to eight months (mid-June to late January) when the probability of precipitation is greater than 51%. The wettest month is November, which has an average 23 days with at least 1 mm of precipitation.

The dry season is usually five months (late January to mid-June). The driest month is April, when an average of eight days have at least 1 mm of precipitation. The month with the most rain in Paracale is November (when average rainfall is 384 millimeters). The month with the least rain is April (average rainfall of 72 millimeters).

Paracale is extremely humid throughout the year (Figure 4).

Local Resources

Paracale is classified as a third-class municipality in Camarines Norte. The 2020 PSA Census lists the municipality's population as 60,198; that is equal to a density of 300 inhabitants per km^2, residing in 13,096 households. The municipality's poverty incidence rate is roughly 36%. Barangay Casalugan is one of the 27 communities in Paracale hosting a population of roughly 14,158.

Agriculture and ASGM (often informal gold mining and ore processing) are the two central economic activities in Paracale. ASGM in Paracale dates to the Spanish colonial period in the late-16th century. Aproximately 50 % of the population of Paracale are engaged in activities related to ASGM; i.e., financiers, miners, processors, or independent gold panners (ILO, 2017). Small-scale activities continue to develop in all 27 communities within the municipality, and more than 17,000 residents directly benefit financially from the ASGM sector.

Infrastructure

Water supply

Barangay Casalugan's water is mostly supplied through well systems of various depths. SMBC's water supply comes from streams, spring water, artisanal wells, and the main shaft. Given the high level of participation in the region, ample water is available throughout the year for industrial development.

Power supply

SMBC is serviced by local electricity supplier CANORECO. Power in the region is fairly reliable and back-up generators are available if required.

Communication

Paracale has standard cellular phone service, and access to the telecommunication system run by the Department of Transportation and Communication. Satellite offices of the national wireless carriers: Smart Communications, and Globe Telecom, serve the municipality; In addition to a bank ATM, and a postal office.

Mining - Large Scale

There are no large-scale mining companies currently active in the area. Several of the companies lost their social license with the local population, and their mining permits were revoked by the government. Below is a partial list of past active mining companies in the district:

- United Paragon Mining Corporation.
- Unidragon Mining and Development Corporation (subject to a cease-and-desist order by MGB).
- Baotong Mining Corporation (subject due to a cease-and-desist order by MGB).
- Konka Fulim Mining and Development Corp. (KFMDC).

Historically, industrial gold mining in the district has been both underground and open pit.

Mining - Small Scale

The MBP area in Barangay Casalugan is currently being actively mined by four associations with approved SSMC permits. These associations have an estimated total of 456 members while approximately 710 informal miners are also operating without legal permits.

The majority of artisanal gold mining in Paracale consists of underground tunnel mining. Mining occurs under extremely dangerous conditions--within un-engineered openings; without proper support; personal protective equipment, or ventilation. In many cases, underground openings do not have a secondary mode of egress.

Gold processing facilities are scattered across the municipalities of Labo and Paracale and are commonly located in residential areas. The larger facilities are cyanide-based. These facilities utilize the Carbon-In-Pulp ("CIP") leaching system, with grinding provided by ball mills. The more common smaller facilities use rod mills, for grinding, with mercury amalgamation, and hand panning for gold recovery. Many of these facilities are attached to their owners' houses, and freely burn mercury without retort systems. This creates serious harm to the health of family members, and their communities (ILO, 2020).

The majority of the artisanal processing plants in Paracale are situated outside the MBP (estimated to be more than 30 plants) and are operating informally without proper permits and/or licenses. The field visit found five rod mill/mercury amalgamation plants situated within the MBP, most are used intermittently.

Physiography

The province of Camarines Norte covers an area of approximately 2,320 km2 which amounts to 12.4% of the total Bicol area. It is bounded on the north by the Pacific Ocean, San Miguel Bay in the east, Lamon Bay to the west, as well as the Quezon and Camarines Sur province to the south. Camarines Norte is politically subdivided into 12 municipalities: Basud, Capalonga, Daet, Jose Panganiban, Labo, Mercedes, Paracale, San Lorenzo Ruiz, San Vicente, Sta. Elena, Talisay, and Vinzons. Mercedes is the largest town followed by Capalonga.

The municipality of Paracale covers a total land area of 198 km2. Paracale is both a town and a municipality. The town sits on the northeastern Pacific coast next to the Philippine Sea; and the municipality is characterized by a diversity of topographic landforms. The area is moderately mountainous with gentle, rolling foothills and a low coastal plain. The highest point consists of Mount Bagacay in the Southern portion of Paracale which reaches 787 m above sea level (m.a.s.l.) and is an inactive volcano. The lowest elevations are the coastal areas-- approximately 25 km in length. Within the MBP, the highest point is 276 m.a.s.l. located on the Cabcabin hillside, but the typical elevation is between 90 and 190 m.a.s.l. (Figure 5). The dominant aspect has an orientation NE-SW, and has an average elevation greater than 190 m.a.s.l, and a slope between 16° and 38° (Figure 6).

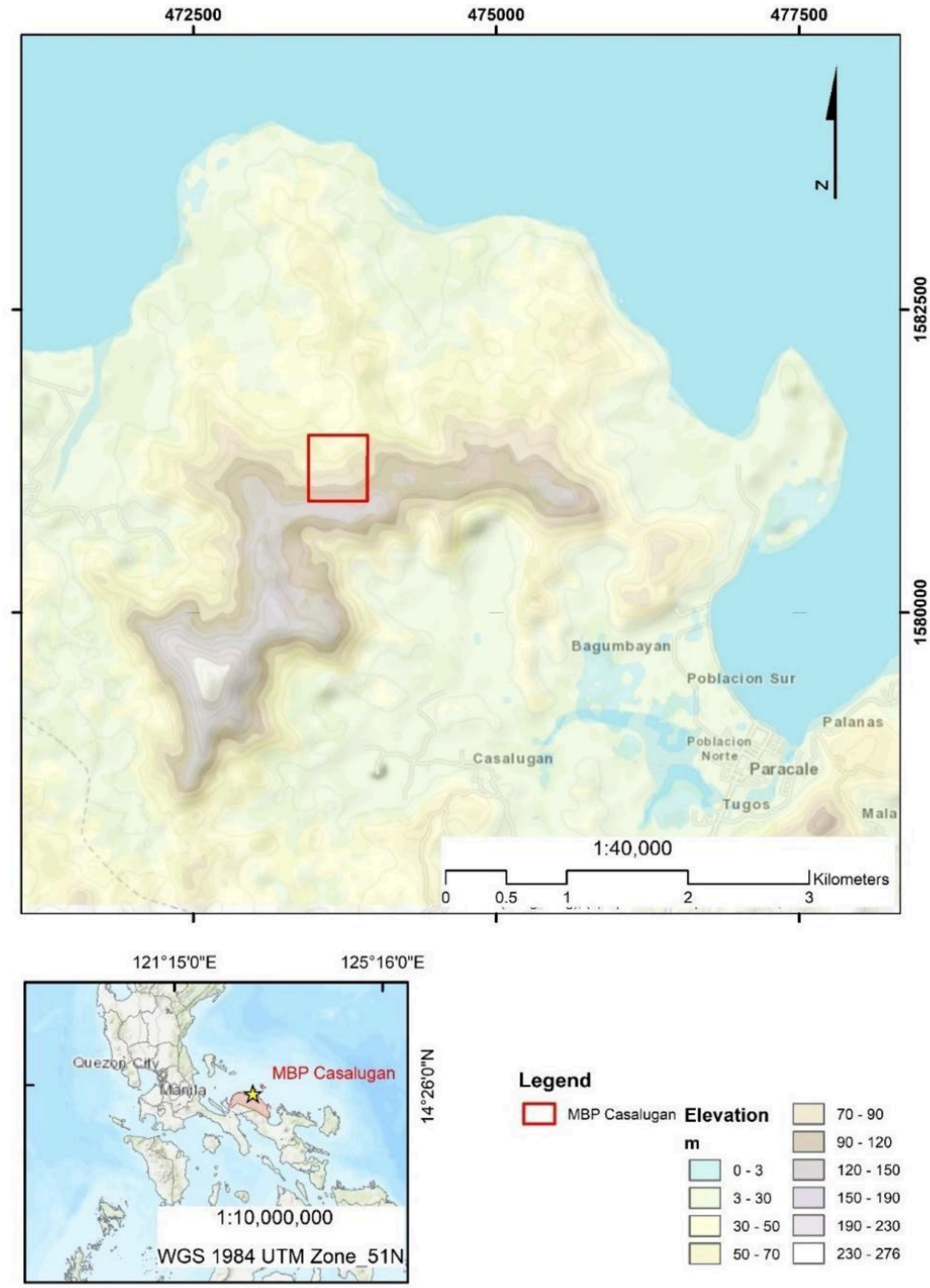

Figure 5: Elevation map of Northwest of Paracale, Camarines Norte

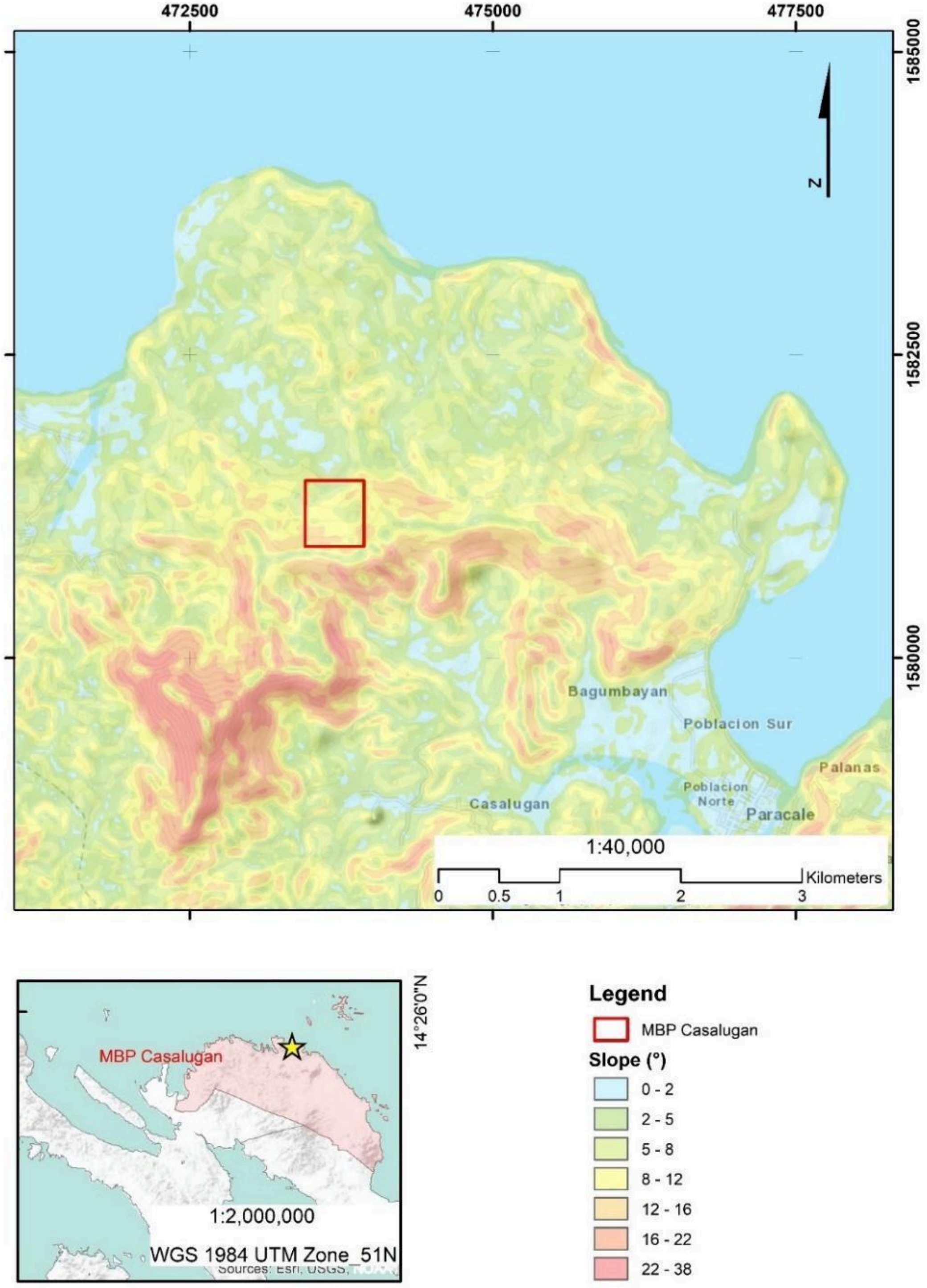

Figure 6: Slope map of the Northwest part of Paracale, Camarines Norte

History

The municipality of Paracale traces its roots back to 1581 when it was founded by Franciscan friars as a mission post. The post eventually developed into a small community and Paracale was recognized as a town in 1863. Today, the Municipality of Paracale has 27 barangays. The name “Paracale” roughly translates to “canal digger” and is a result of the areas rich gold mining history. ASGM in Camarines Norte traces its roots back to well before colonial times. In fact, the Aeta indigenous tribes settled and mined in Jose Panganiban (then called “Mambulao” – a name derived from the Bicolano word “mabulawan” which means “rich in gold”) – at least a century before the first permanent Spanish Settlement in the Philippines in 1565 . The Aetas dug shallow pits, canals, and narrow tunnels to access gold nuggets which were traded with Chinese merchants who regularly visited the area.

Records of small-scale mining activities in Paracale, Camarines Norte date back to 1626 during the Spanish colonial period when the local population extracted gold nuggets from surface soils prior to the height of the gold rush.

The Paracale area was first explored using modern techniques in 1936. Preliminary prospecting was initiated by Marsman & Company on three properties in the district: Mother Lode, Gumaus Goldfields, and Southern Paracale (Casalugan ore deposit). Coco Grove, Inc. resumed exploration in 1939. The area was largely ignored by larger companies until the early seventies when renewed interest in the district attracted Metals Exploration Limited (“MEL”) of Australia to the Paracale area. MEL and Marsman & Company later forged a joint venture agreement under the name of Metals Exploration Asia Inc (“MEA”). The Casalugan deposit area was also explored and developed under this partnership. At its height, MEA controlled an area of 1583 ha consisting of 1888 claims.

In 1974 and 1975, San Mauricio Mining Company and Santa Barbara Mining Company through a joint venture embarked on an extensive diamond drilling campaign in the Paracale mining district. Unfortunately, drill data and geological information gathered by the joint venture has been largely lost.

D.A. Singer (2008) identified three major Cu-Au ore deposits in the Paracale Gold District: Longos gold mine, Matanlang Cu-Au deposit, and Pinagbirayan. Seven key prospects/gold showings were also listed by Singer in the area: Kalaw, Haligoing- Bato, Bantum-Nakulo, Malaguit, Paracale, United Paracale, and Santa Rosa Mine. The locations of the mines and key prospects are labled on the map below (Figure 7).

In March 1999, the Japan International Cooperative Agency (Metal Mining Agency of Japan) conducted an arial geophysics, field survey of 35 sites, and geochemical analysis. In addition to regional satellite image analysis of mineral resources in the Bicol area of the Philippines.

Despite the long history of gold mining in the municipality, gold reserves remain abundant in Paracale. A 2004 resource assessment by the region's MGB, estimates that the gold endowment in four barangays alone (Gumaus, Paracale, Tugos and Sitio Tapukan) amount to as much as 17Moz.

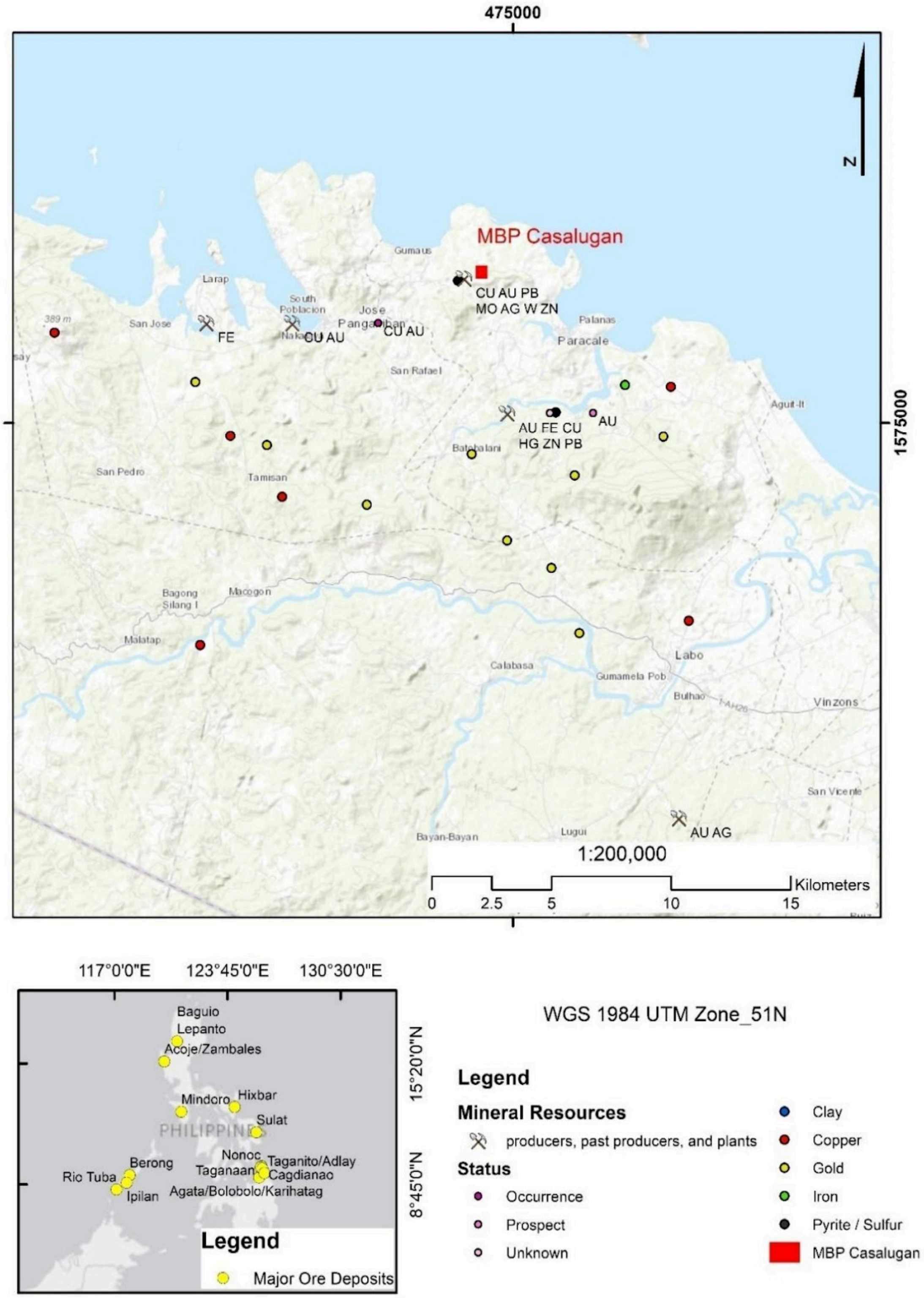

Figure 7: The map shows the mineral occurrences in the Paracale gold district and the location of the primary ore deposits, prospects, mines, and plants in the region

Geological Setting and Mineralization

Regional Geology

Philippine Arc: Tectonic Setting

The Philippine oceanic arc is 1,000 km long and extends from Bicol to eastern Mindanao; it runs parallel to the Philippine Fault (Figure 8). The Philippine Fault is a left-lateral strike-slip fault (Figure 8), that is 1,200 km long, and spans the length of the Philippine Archipelago. This fault has been active since the mid-Miocene and discrete segments of the arc have been active since the Oligocene. Post-Pliocene arc magmatism was related to west-directed subduction of the Philippine Sea Plate at the Philippine Trench. Pre-Pliocene magmatism may have been related to east-dipping subduction from the west (Hammarstrom, et al, 2005).

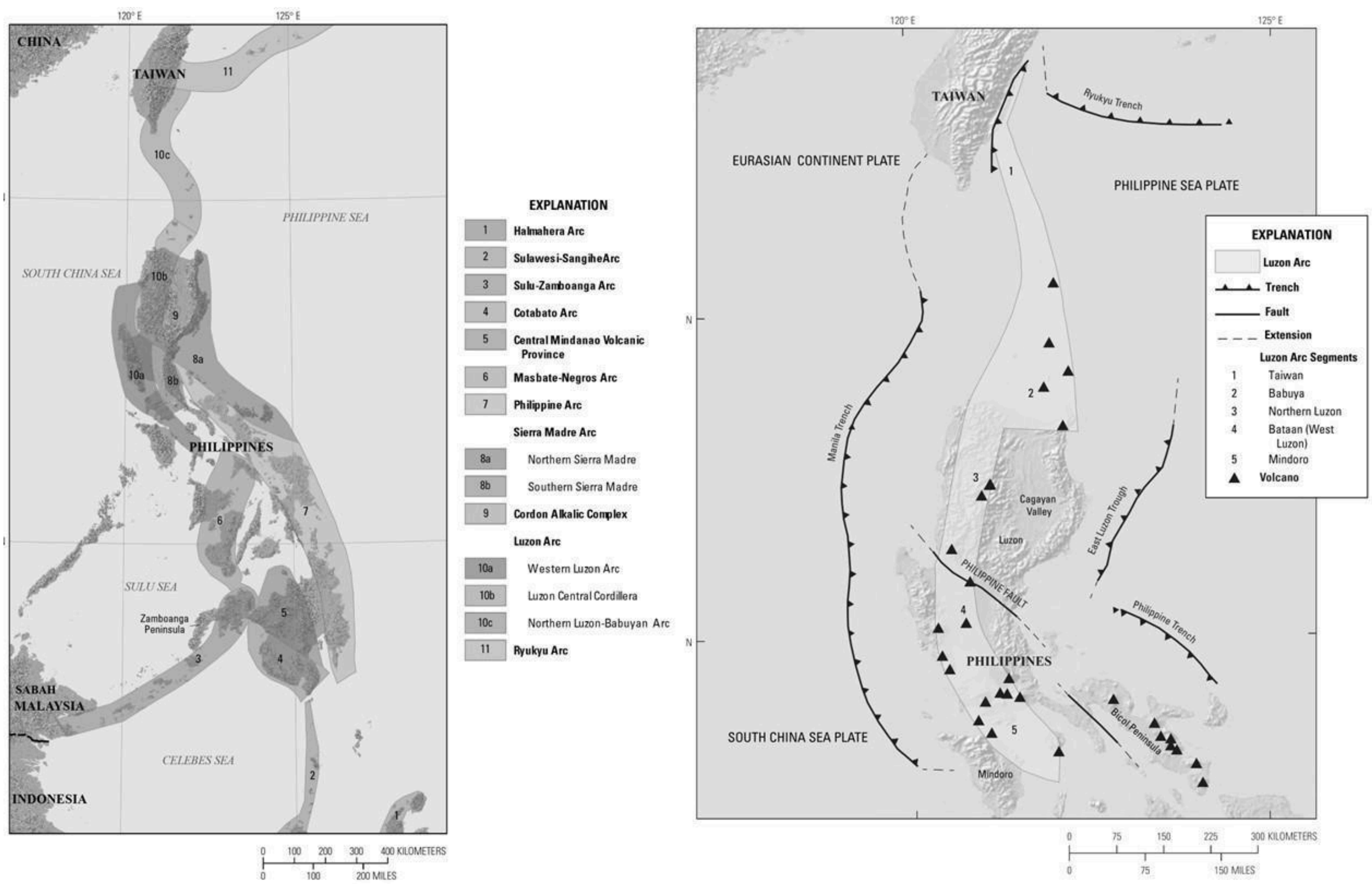

Figure 8: Left, Map showing the Philippine Arc. Right, Map showing the major tectonic faults of Luzon Arc and Philippines Arc

The arc includes segments that have been active at different times between the Oligocene and Quaternary. Oligocene-Miocene basaltic breccias and turbidites are overlain by Neogene andesitic to dacitic volcaniclastic rocks, lavas, and calcareous siliciclastic rock units in northeastern

Mindanao. A foliated to massive trondjhemite dome (Paracale granodiorite (Frost, 1959), Miocene diorite and andesite porphyry, and Pliocene dacite porphyry occur in Camarines. The diorite and andesite porphyry intrusions in the Leyte, Surigao, Co-O, and Masara areas of east Mindanao are Miocene in age. Miocene andesitic volcanic rocks, volcaniclastic rocks, and intrusions also characterize the Leyte sector of the arc. In eastern Mindanao, late Pliocene to Quaternary andesitic volcanoes, associated eruptive products and porphyritic stocks occur near Surigao and Lake Leonard in the Masara region (Garwin, et al, 2005).

The NW-SE trending Bicol Peninsula is in the southeastern part of Luzon Island (Figure 9); along with the other regions of the Philippine archipelago. This island has a long history of subduction, collision, and accretion of continental-derived sediments and ophiolitic fragments, starting in the late Mesozoic, and continuing into the early Cenozoic eras (Queaño et al., 2009, Graciano et al., 2020).

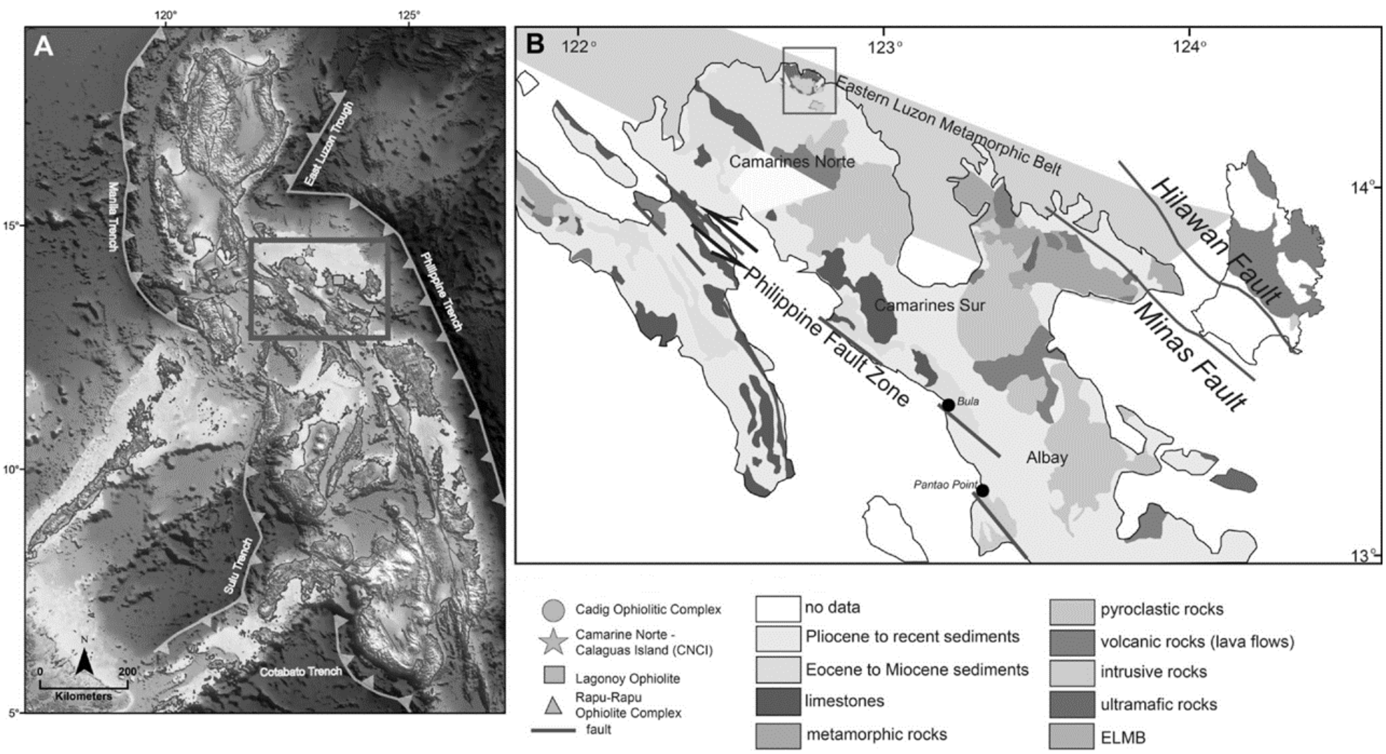

Figure 9: Left, Tectonic map showing the location of the study area. The location of the Cadig, Camarines Norte-Calaguas Island, Lagonoy and Rapu-rapu ophiolite complexes are also indicated.; Right, Location of the Paracale Mineral District in Camarines Norte

Arc formation and accretion events during the Cenozoic are mainly attributed to the interaction of the Philippine archipelago with the bounding plates; namely, the Philippine Sea Plate to the east' and the Sunda Plate to the west (Yumul et al., 2008). Oblique subduction of these bounding plates is responsible for the formation of the left-lateral Philippine Fault Zone (Graciano et al., 2020).

The Paracale Mineral District is bounded by the NW-SE trending Philippine Fault Zone to the west,

and the west-dipping Philippine Trench to the east. In between these two active tectonic features are a series of NW-SE trending sinistral faults: the Hilawan Fault, and the Minas Fault (David et al., 1997).

This district, which lies to the west of the Minas Fault, is floored by the Cadig Ophiolitic Complex (COC) which is correlated with the Jurassic to Cretaceous ophiolitic suites exposed in nearby areas (Figure 9). Paleogene to Neogene intrusive rocks cut through the basement ophiolite suite (Encarnacion, 2004 , Graciano et al., 2020). Metamorphic rocks are associated with regional metamorphism, and contact metamorphic aureoles are related to intruded plutonic bodies. Amphibolite soles; associated with the emplacement of ultramafic bodies, and chlorite-epidote schists intercalated with quartzofeldspathic schist hosting volcanogenic massive sulfides (VMS), are found throughout the Bicol Peninsula and adjoining islands (Sherlock et al., 2003). This metamorphic belt corresponds to the NW-SE East-Luzon-Samar-Mindanao (ELBB) disrupted terrane that lies east of the Philippine Fault Zone. Unconformably overlying the metamorphic rocks are turbiditic clastic rocks, volcanic rocks, and minor shallow marine limestones. A NW-SE Pliocene to Recent volcanic arc characterizes the Peninsula. The Arc is thought to be related to the subduction of the Philippine Sea Plate along the Philippine Trench since the late Miocene–Pliocene time (Ozawa et al., 2004, Figure 8).

Project Geology

The geology of the MBP is characterized by the presence of a roughly 36 km2 silicic pluton, the Paracale Granodiorite ("PG"), intruded into the ophiolitic suite of southeastern Luzon Island. Graciano (Graciano, 2020) suggests that the PG could represent a Late Cretaceous to Paleogene magmatic arc generated during the subduction of the proto-Philippine Sea Plate.

Stratigraphy

The stratigraphy of the study area (oldest to youngest) is categorized as:

- Jurassic to Cretaceous Cadig Ophiolitic Complex ("COC");
- Upper Eocene to Lower Oligocene Tumbaga Formation;
- Oligocene Larap Volcanics; and

- Lower Miocene Bosigon Formation. The pre-Tertiary COC is made up of harzburgites, dunites, layered ultramafic cumulates, isotropic gabbro, dike swarms, pillow lavas and

- breccias that are exposed mostly in the northern and coastal areas of Paracale. The ophiolitic suite is best exposed in the north of the MBP. This ophiolitic complex is the basement in the area. The COC is correlative with the Jurassic to Cretaceous Camarines Norte-Calaguas Island Ophiolitic Complex and Lagonoy Ophiolite.

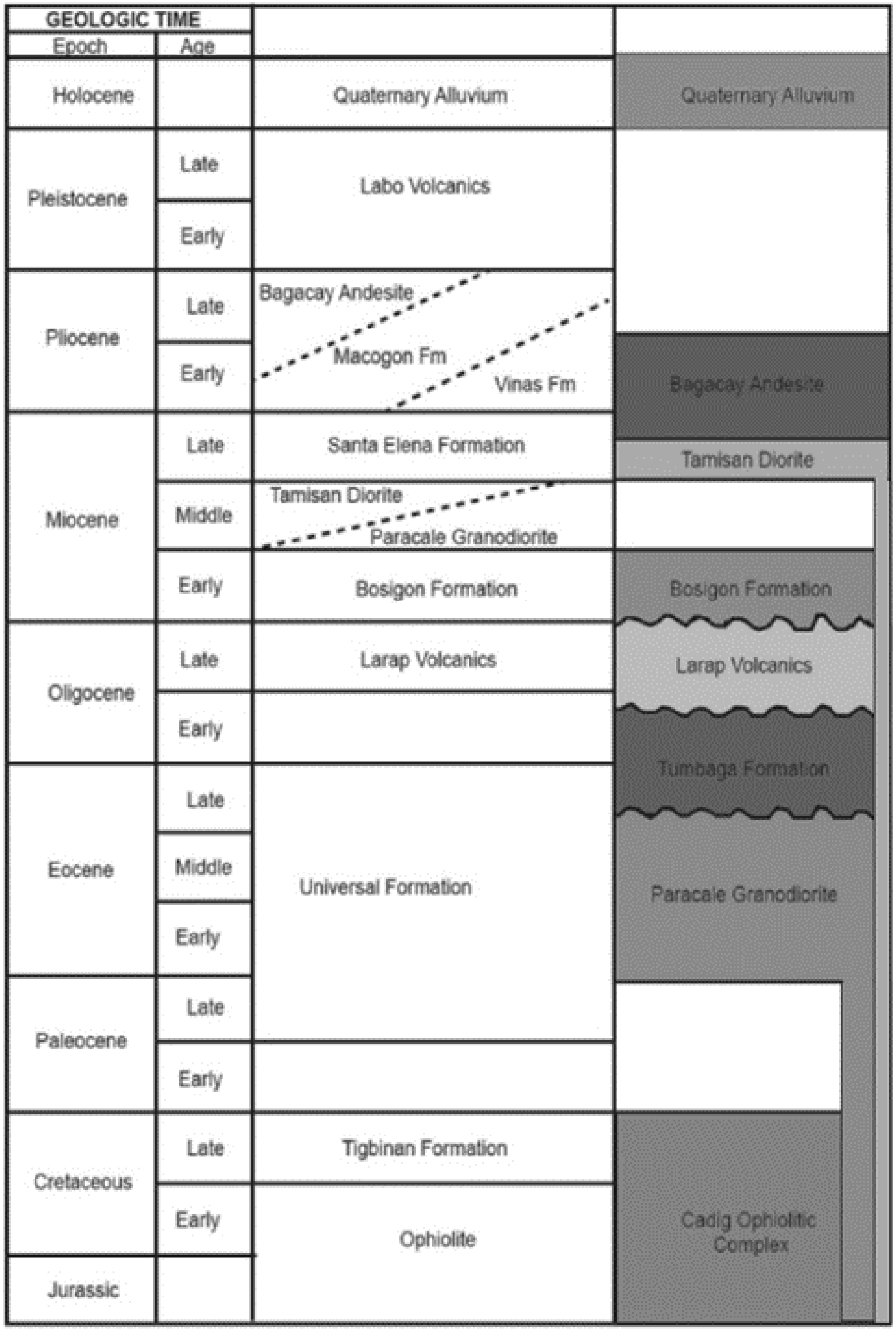

Figure 10: Stratigraphic column of the Paracale studying area. Modified from Graciano et al. (2020)

The Upper Eocene to Lower Oligocene Tumbaga Formation, formerly called the Universal Formation, is composed of a lower member of interbedded grayish to greenish sandstone, siltstone and rare conglomerates, and an upper member of bedded marble. Coarser varieties (lithic sandstone and conglomerate) in western Jose Panganiban, show mafic and quartz detrital. In addition to granule to pebble sized lithic fragments of peridotite and granodiorite. Silicification, chloritization and pyritization are noted in the vicinity of quartz veins intruded into the Tumbaga

Formation. The compositional make-up of the Tumbaga Formation shows that the PG and the COC are the primary sources of this formation (Mines and Geosiences Bureau, 2010).

The Oligocene Larap Volcanics, on the other hand, are made up of massive porphyritic andesite to layered andesite, oriented N55W/65SW. The Lower Miocene Bosigon Formation consists of light gray, fine- to medium-grained arkosic sandstone, that is slightly magnetic. Associated conglomerates with clasts of mostly andesite porphyry and minor limestone are set in a grayish, calcareous matrix are. The clastic rocks are underlain by calcareous, bedded, fine- to medium-grained sandstone, and grayish limestone (Graciano et al., 2020)

The PG comprises roughly the central portion of the Paracale area, oriented approximately in a WNW-ESE direction and surrounded mostly by peridotites. This unit consists of quartz and plagioclase, with subordinate amounts of biotite, relict pyroxenes, and opaque minerals. The PG are coarse-grained, leucocratic rock with a distinct foliation. Fine grained or dark varieties are enclaves. The average mineralogical composition of the PG is plagioclase (38-65 vol.%), quartz (32-42 vol.%), biotite (2-19 vol.%), and K-feldspar (1-2 vol.%). Dark varieties, enrichment of biotite, apatite, sphene, epidote, and opaques occur as xenoliths and schlierens. The mineralogical composition of the general leucocratic varieties classifies the PG as a trondhjemite (Giese, et al., 1986).

The geochemistry of the coarse grained trondhjemite shows a composition of about 71% SiO2, and 17.5-18.3% Al2O3. The high Al content combined with the relatively low Ca, Na and K concentration results in a normative corundum content of 3-3.5 wr. %. The rock is peraluminous--with affinity to the calc-alkaline magma series. The trondhjemite, which comprises the PG, may have been intruded as semi-solid plagioclase cumulate; which resulted in a pronounced flow lamination of the rocks (Giese, 1986.

The granodiorite is metamorphosed in many places; being in transition to quartz-feldspar schists. This is most prominent near the contact with the peridotites (Figure 11). Schist texture and a foliation trend of NW-SE are noted. The PG is intrusive into the COC. Gabbro, peridotite, and chlorite schist xenoliths are found within the granodiorite. The age of the granodiorite ranges from Paleocene to Pleistocene (Giese et al., 1986). A K-Ar dating of samples of biotite, provide a range of ages from 14.4 Ma (Giese et al., 1986) to 18.6 Ma (Geary et al., 1988). This indicates a late, early Miocene to early, middle Miocene age. The isotopic dates of Giese and Geary reveal that the Miocene age could represent the last metamorphic event in the Paracale district.

As noted, granodiorite clasts are present in the Late Eocene to Early Oligocene Tumbaga

Formation. The Late Miocene (hornblende K-Ar age date of 6.96–10.6 Ma) Tamisan Diorite is a classic "salt and pepper" type, with an almost equal felsic (feldspar + quartz) and mafic (mainly hornblende) components (Mines and Geosciences Bureau, 2010). The diorite is slightly to moderately magnetic, although silicified varieties rarely exhibit this property.

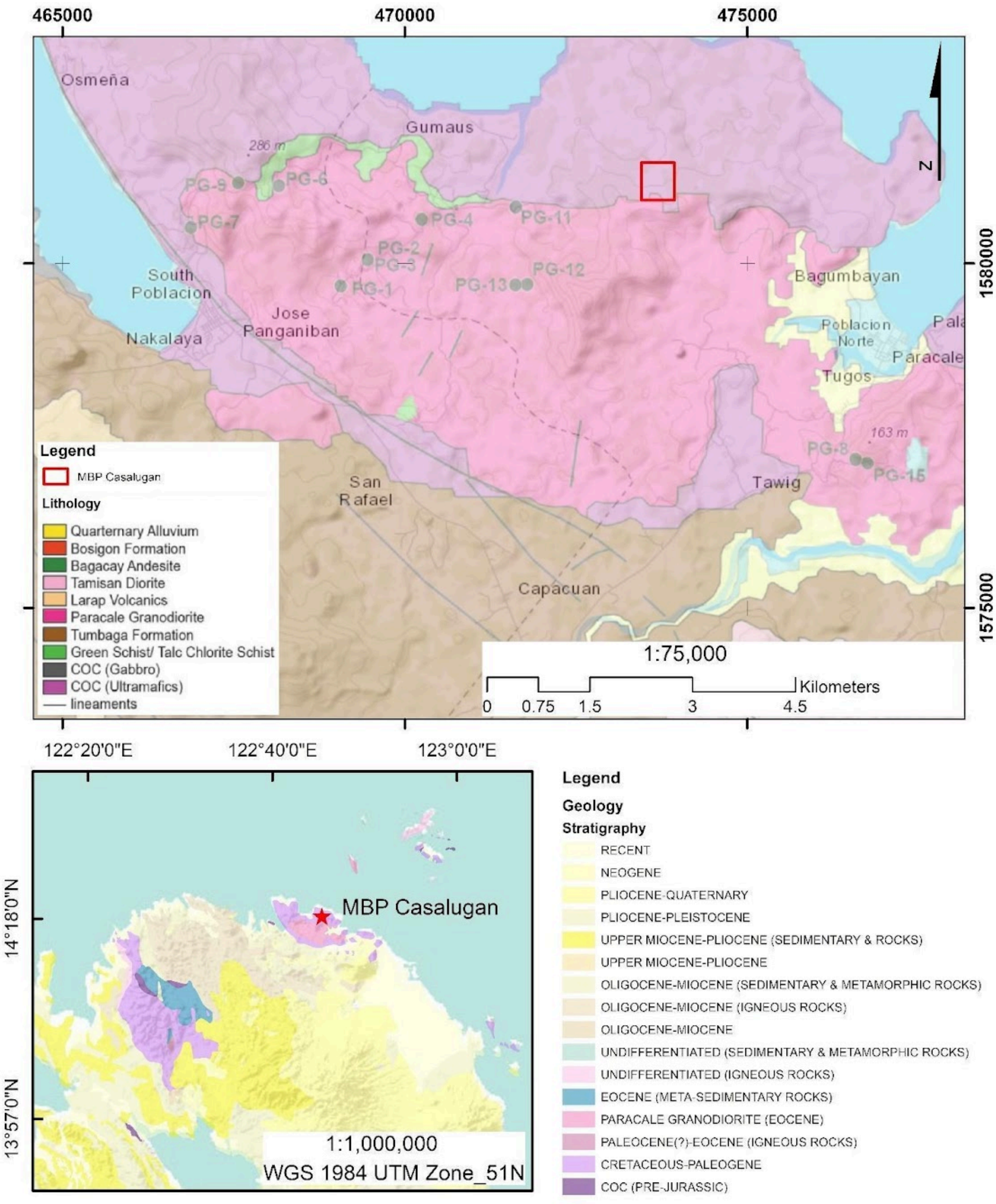

Figure 11: Geologic map of the Paracale Mineral District

Mineralization

The gold districts of Paracale, Sta Elena-Tabas, and Nalesbitan in the Camarines Norte are characteristic of the gold districts of the Philippine arc (Figure 12). Several historic intermediate-sulfidation lodes in the Paracale area occur along the contact (tectonic) between the Paracale trondjhemite and serpentinized ultramafics (greenschist). Gold in the Paracale and Sta Elena-Tabas areas are associated with intermediate-sulfidation lodes, which contain tellurides at Exciban, and the Larap (Mantanlang) porphyry Cu-Mo-Au deposit. Nalesbitan is a small high-sulfidation gold deposit hosted by andesitic volcanic rocks (Garwin et al., 2005, Figure 1, Figure12, Figure 13). The Paracale Mineral District has the presence of adakitic rocks which are used as an exploration indicator; as they are a directly correlation with areas characterized by precious and base metal mineralization (Deng et al., 2019).

The Paracale mining district has five distinct types of gold deposits: Garnet-bornite; Chalcopyrite-gold; Pyrite-arsenopyrite; Pyrite-gold; and Sulfide ores hosted in granodiorite (Bryner, 1969). The sulfide ore in the granodiorite type has been the most productive and the Casalugan ore deposit in Paracale-Gumaus belongs to this type. Bryner (1969) inferred that the PG body extends roughly 16 km in its east-west dimension and about 10 km north-south.

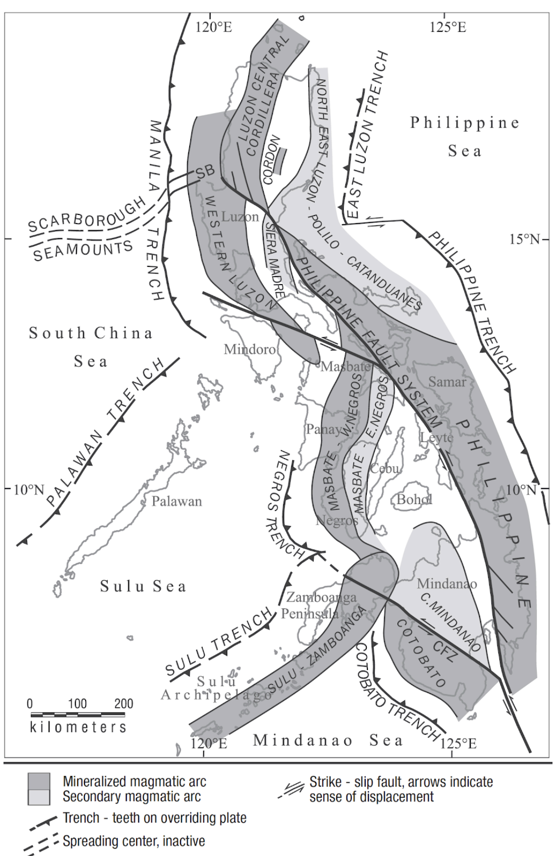

Figure 12: Philippine mineralized magmatic arcs (Garwin et al., 2005)

The Paracale Granodiorite is interpreted to have intruded the COC (Figure 11) and the Casalugan (Paracale) ore deposit is located immediately beneath the ultramafic capping. The PG contains comagmatic related, north-striking, steeply dipping aplitic dikes; ranging from 7 cm in single dikes to an aggregate of 10 m in dike swarms. The dikes have porphyritic texture with traces of garnet, and a few are lamprophyres. The ultramafic wall rock is downfaulted with serpentinization wedge. The primary veins are parallel to the dikes and a second family of vein systems are conjugate. The faults have gouge and breccia zones with a thickness between 50 cm to 1 m. The mylonite zones include elongate fragments of vein quartz. Dip-slip striations on the walls together with vertical gash fractures indicate that normal fault movement occurred along the veins.

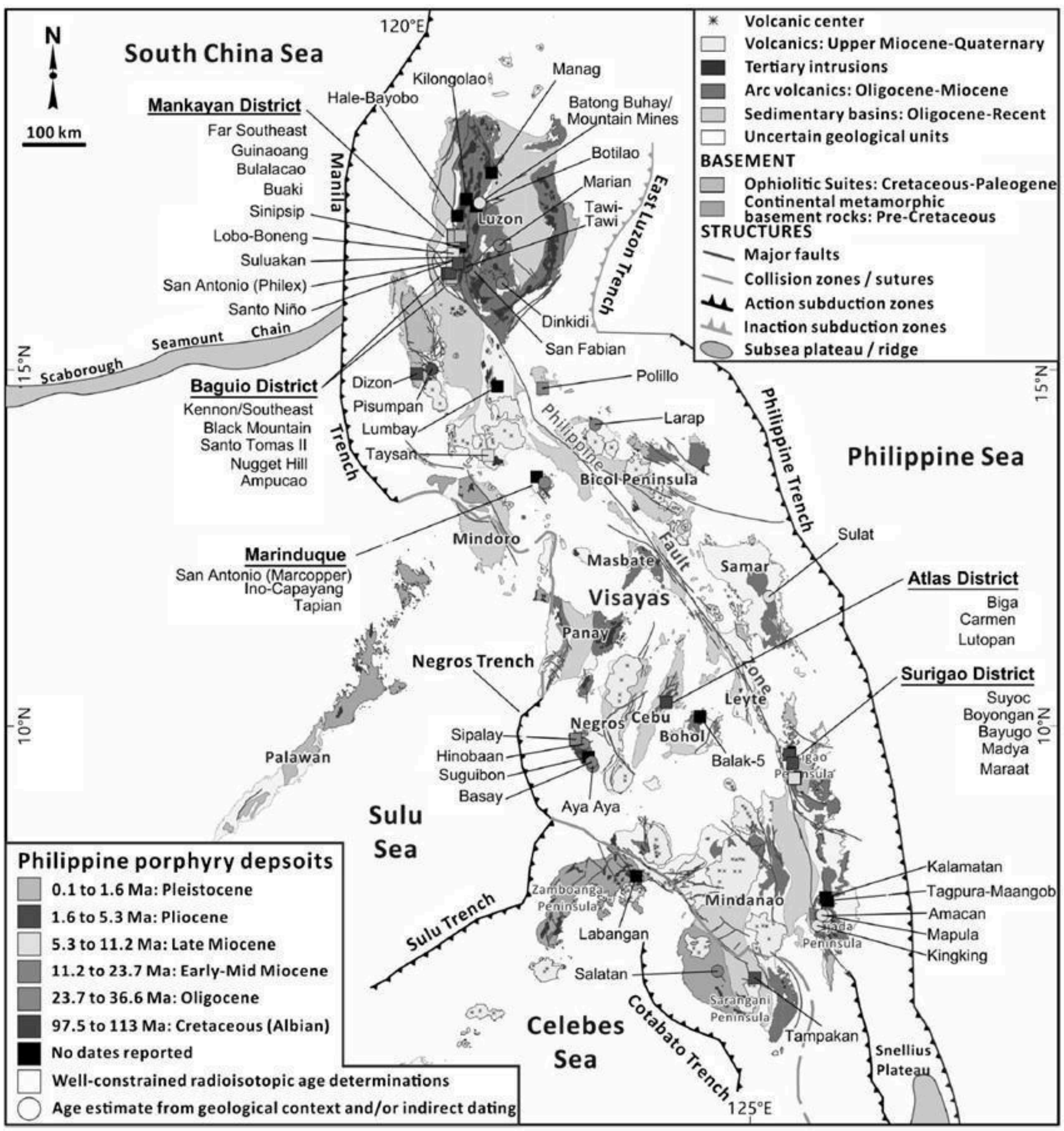

Figure 13: Right, Regional Geology of the Philippines and the distribution of the tertiary intrusions and porphyry deposits (Braxton et al. 2018)

Deposit Types

The Paracale ore consists of gold, pyrite, and chalcopyrite in a quartz gangue. The adjacent PG rock contains disseminations, and veinlets of pyrite and high-grade gold. This is generally associated with sulfide-rich veins and along faults plains. Pale greenish hydrothermal alteration, and bleaching (Chlorite-Epidote-Carbonate) is more apparent and widespread in the vicinity of high-grade veins.

The location of the Casalugan ore deposit in the Paracale-Gumaus mineral district, in Camarines Norte, is shown on Figure 14. The deposit is a typical vein quartz-gold-bearing sulfide associated with an Eocene intermediate intrusive (Paracale Granodiorite) containing gold, silver chalcopyrite and galena ore minerals. The gold-silver in association with galena, sphalerite, pyrite, and chalcopyrite, are contained in the quartz veins with dips ranging between 45-90°, trending generally East-West. The mineralization is believed to be emplaced into post-orogenic fracturing (from Eocene to Miocene) and related to the final stage of the PG intrusion (Figure 13). The observed character of the quartz veins is mesothermal-epithermal emplaced in a single event; some observations indicate pre-existing base metal gold/silver mineralization. Quartz veins vary in thickness from 13 cm up to 6 m. Alteration is intense and varies between the underlying PG (argillic-silicic + pyrite) and in the COC (argillic-propylitic).

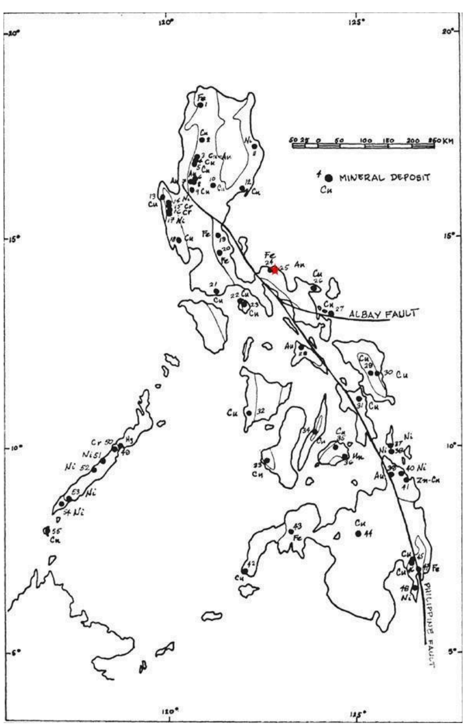

Figure 14: Distribution of important Mineral Deposits of the Philippines. The red star marks the location of Paracale-Gumaus mineral district (Santos, 1974)

Field Investigation

The current MBP field investigation programme included geological mapping (surface and underground), rock chip sampling from the veins, waste rock, and surface outcrops for geochemical data analysis. The UTM WGS84 51 N coordinate system was used for geolocation.

The geological mapping programme covered an area of 27 ha with detailed mapping focused over 19 ha. Underground detailed geological mapping was conducted from the SMBC main shaft over a length of 175.7 m.

The sampling programme was developed in three stages:

- The first stage focused on regional surface geological mapping of outcrops with localized sampling consisting of 16 rock-chip samples.
- The second stage centred on the 12 operational shafts with waste rock and underground sampling. During this stage, 45 samples were collected.
- The third stage consisted of underground sampling down the SMBC main shaft with 20 samples collected.

In total, 81 samples were collected and sent for gold analysis, by fire assay, at MGB Metallurgical Laboratory. All the rock samples were submitted personally, by the author, to the MGB Metallurgical Laboratory at MGB Central Office in Diliman, Quezon City. The MGB Metallurgical Laboratory is a government-owned laboratory, that is open to the public. The MGB facility is certified under the International Organization for Standardization (ISO) 9001:2015 Quality Management System (QMS) for its metallurgical services.

The MGB laboratory also serves as a national research facility; and undergoes regularly scheduled internal QC/QA audits by SGS Philippines. MGB and the AGC Philippines (through the planetGOLD Philippine's project) have a standing agreement through which the samples of this study were analyzed.

Geological Mapping

The geological observations detailed in this section of the report are compiled from surface outcrop mapping withing the MBP claim, and the underground geological survey of the main SMBC shaft.

The Casalugan ore deposit (Paracale) is classified as an epithermal gold, low-intermediate to low sulfidation deposit. The PG intrusive is hosted within the mineralized ore body, and on the halo of metamorphism between the PG intrusion and the COC. The best representative outcrops of the PG unit are in the southern portion of the MBP claim. The PG rock unit has strong quartz, kaolinite, alunite, and iron oxides alteration where exposed surface. The mineral assemblage is interpreted as a pervasive argillic alteration (Figure 16). Further, the unit has selective quartz-sericite (phyllic) alteration. The southern exposure outcrop is 25 m long and 12 m high (Figure 15). The PG outcrop has an approximate surface exposure of 5.7 ha.

Figure 15: PG outcrop in the south part of the MBP study area (Photo © Artisanal Gold Council, 2022)

The PG presented veinlets of clay, quartz-sericite, manganese, carbonates, and iron oxides where examined. The veins are in a conjugate system of 120 and 60, with an average orientation of 55° NE strike with 35° SE dip. The PG unit outcropped at the topographical highs of the MBP claim and overlooked the project area.

Figure 16: The PG outcrops with argillic alteration and system of veinlets located in the south part of the MBP (Photo © Artisanal Gold Council, 2022)

Discrete exposures of the PG unit displayed patchy potassic alteration. This type of alteration is indicative of a hydrothermal system. Most ASGM activities are restricted to the PG within these alteration zones which indicates that the hydrothermal system is mineralized underground. Sillitoe et al. interpret the ore deposit as a vein system consisting of gold base metal mineralization (Sillitoe et al., 1990). These types of deposits are often observed in the vicinity of porphyry Au-Cu systems.

In the study area, the limits of the veins are confined to the Paracale Granodiorite (Figure 17) as are ASGM mining activities. The contact between the PG and the COC generated a metamorphic mineralized aureole.

The underground wall rock and ore consisted of the PG unit. The morphological characteristics of the veins are thicker at the fringe of the granodiorite bodies, and mineralization is also more prominent. The two main mineralized quartz-veins (mineralized bodies) in the SMBC shaft have a 3.8 m average thickness at 90 m depth. The veins are in contact with a metamorphic aureole in the hanging wall and hosted in PG rock in the footwall.

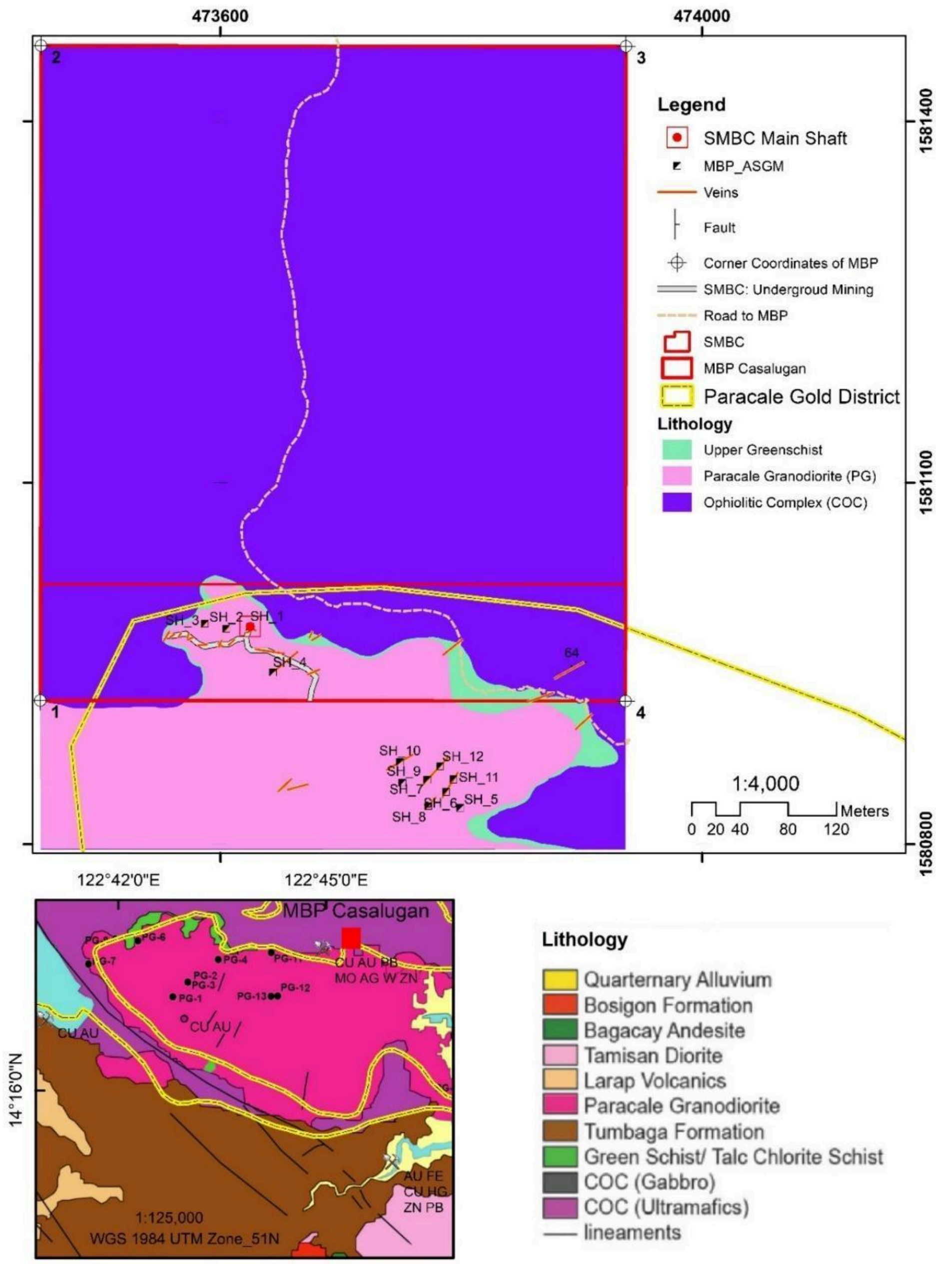

Figure 17: Map of the MBP showing the lithologies in the area, ASGM, veins, and mineralized zones according with the USGS-MRDS (2022)

The contact between the greenschists and the PG (trondhjemite) intrusive body in the underground mine is tectonic (fault zone); which points to possible transport of the mineralization along faults into the intrusion. The underground occurrence of ultramafic rocks are strike-slip downfaulted; forming serpentinized ultramafic wedge, with a halo of propylitic alteration. Greenschist xenoliths are observed in the mine workings, with a granoblastic texture, containing biotite, albite, and quartz (Figure 19, c).

Figure 18: Tectonic contact zone between PG-COC. The PG presents a stronger foliation with concentration of mafic minerals. The COC presents oxidation and hydration of the mafic minerals with chlorite and epidote (Photo © Artisanal Gold Council, 2022)

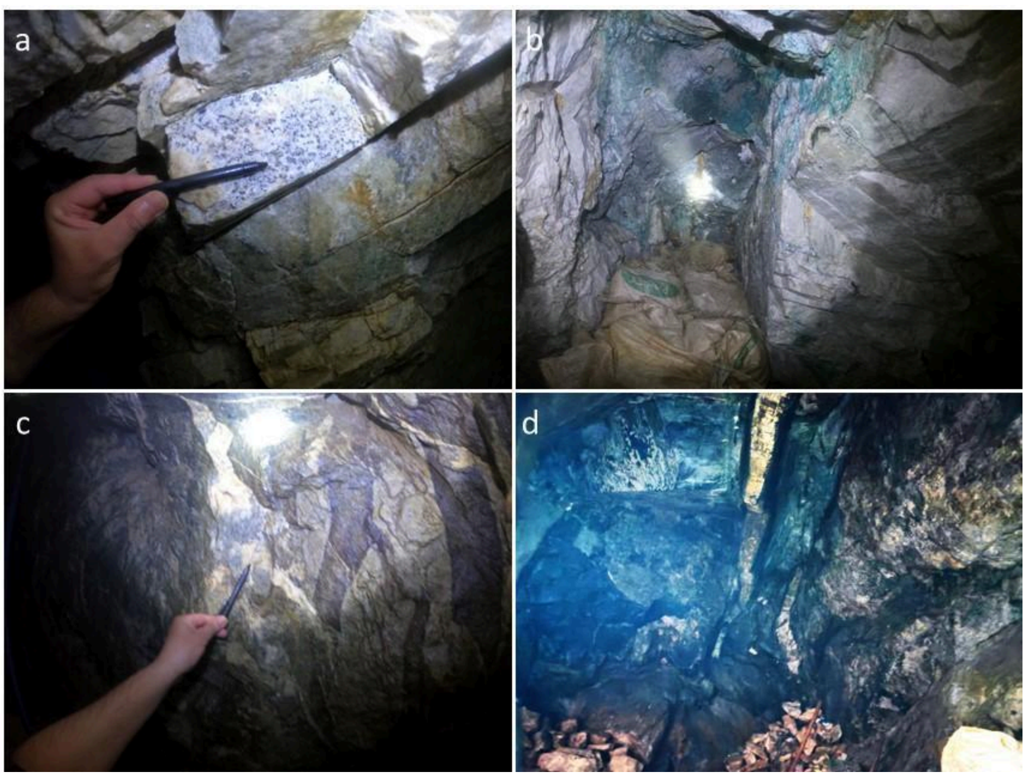

Figure 19: SMBC main shaft veins at 90m depth. A) Porphyritic texture with pyrite, chalcopyrite, and other sulfides in low percentage cutting by white quartz veins. B) PG near the contact between COC altered by chlorite, epidote, and clay minerals (serpentinized zone). C) PG with mafic xenoliths of greenschist. D) System of quartz veins along a fault zone (Photo © Artisanal Gold Council, 2022)

At the SE margin of the MBP PG intrusion; an exposed zone along the mine access road displays a distinct foliation produced by biotite and amphibole alignment. The orientation of the biotite minerals suggest that the PG is a B-tectonite (Figure 18). The foliation is created by the alignment of biotite and recrystallized quartz-ribbons. Underground observations found mylonite rocks, that possibly originated from tectonic stress during the final stages of melt consolidation after emplacement (Giese, 1986). The PG unit joint sets have a preference NE-SW strike orientation. The orientation is well developed in the southern part of the mapped area and underground. The mineralized veins also follow this pattern (Figure 19).

The COC covers more than 80% of the MBP area; and consists of gabbro, pillow lavas, layered ultramafic, mafic breccias, and harzburgite dikes. The rock unit is exposed along streams on the MBP claim, and along some sections of the SMBC access road (Figure 20). These mafic rock occurrences did not show microscopic mineralization in the areas examined. However, mafic rocks in contact with PG, affected by a propylitic alteration halo, were found to average 15 ppm silver. Anomalous silver values are likely related to the hydrothermal zone of influence; due to the PG intrusion. Anomalous surface silver values are possibly indicative of mineralization at depth. The contact between PG and COC was mapped on surface through two trenches cutting dense vegetation cover.

Figure 20: Outcrop pictures of COC. Left, pillow lavas on the stream in the MBP. Right, gabbro cutting by harzburgite dike (Photo © Artisanal Gold Council, 2022)

Where measured, quartz veins generally strike N50E and dip to SW. The veins vary in thickness from a few centimeters to over 3 m. The association of quartz veins, with the PG, is ascribed to the fault system direction. The quartz composition is predominantly milky and white. However, green quartz (surrounded by clay minerals, chlorite, and epidote) was formed at the wall rock contacts.

White quartz is associated with pyrite and chalcopyrite and indicates phases of hydrothermal activity.

Gold mineralization is associated with nearly all quartz types, but native gold is most abundant in green quartz (Figure 21). Pyrite is the most prominent host of gold in the Casalugan deposit and pyrite present in auriferous quartz usually contains gold. Gold in this ore is disseminated, usually partially free and partially locked in pyrite, with visible grains of the metal. The gold has two colours, an intense yellow indicating a low Ag content and a yellow pale associated with higher Ag percentages (Figure 22).

Figure 21: Rock samples from the SMBC main shaft with gold mineralization. A) Granodiorite with propylitic alteration and gold dissemination along of the fracture plane. B) Native gold hosted in green quartz, glassy quartz, clay, and oxides. C) Fracture plane in the granodiorite with porphyritic texture and oxides, quartz, and gold dissemination. D) White quartz vein follows a fault plane hosted in the greenschist facies of the PG (Photo © Artisanal Gold Council, 2022)

The trondhjemite phase of the PG does not show elevated gold grade values due to its late intrusive phase. The granodiorite with strongly altered andesite xenoliths is gold mineralized and it is thought that this PG facies and the quartz veins are genetically related.

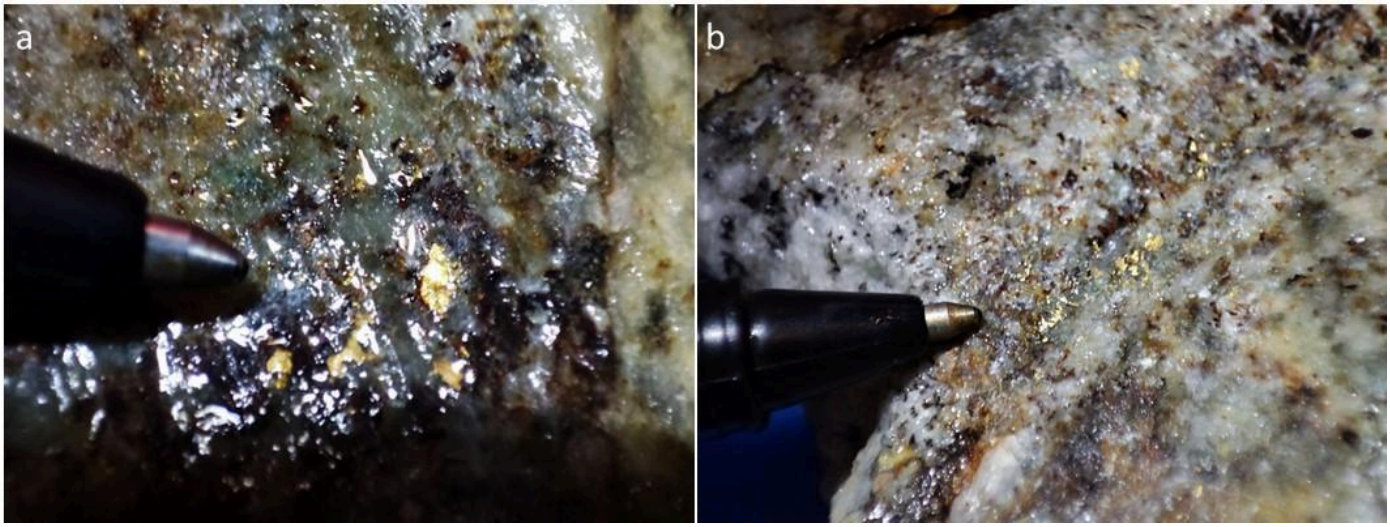

Figure 22: Samples from SMBC main shaft show gold mineralization. A) Coarse grain size gold dissemination in a fracture plane with slickenside. B) Gold dissemination in the porphyritic granodiorite (Photo © Artisanal Gold Council, 2022)

The joints, fractures, and fault planes in the granodiorite show dissemination of gold; and these zones are associated with higher gold grade values (Figure 22 and 23). This mineralization pattern indicates that the hydrothermal fluids moved through zones of weakness and the fracture zone surrounding the contact between PG and COC due to tectonic faulting.

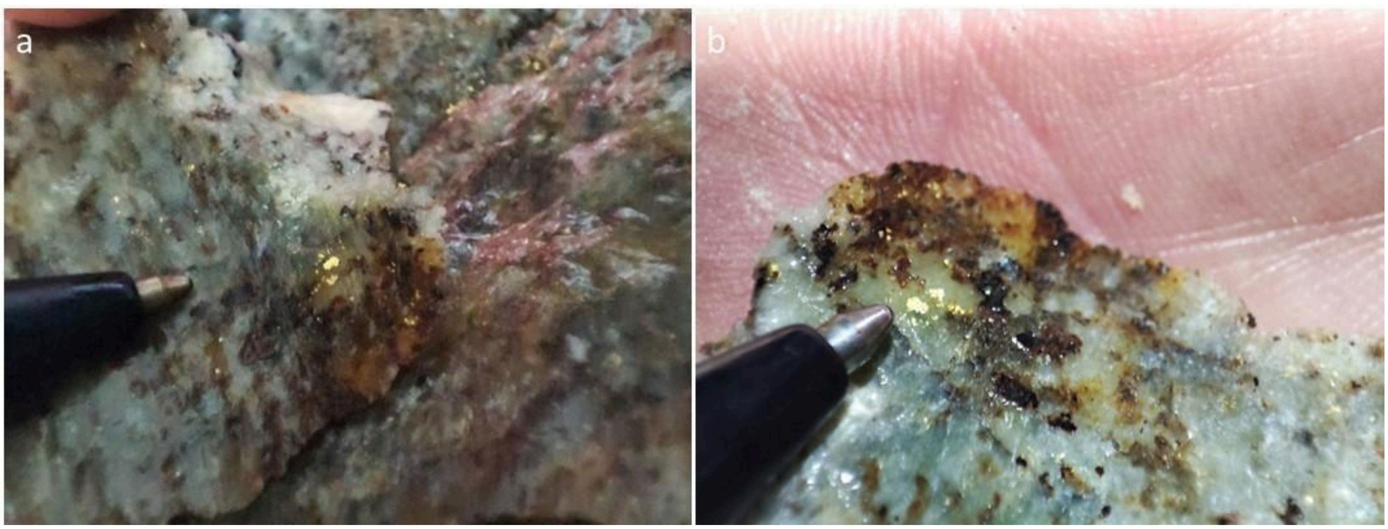

Figure 23: Samples from SMBC main shaft with gold mineralization. A, B) Gold along of a fracture plane with slickensides and selective alteration of oxides, green quartz, and clay minerals (Photo © Artisanal Gold Council, 2022)

Sampling

Sample Preparation, Analyses and Security

The geochemical sampling programme was conducted in three stages:

- Outcrops from the surface;
- Waste rock from artisanal operating shafts; and,
- Mineralized veins from the artisanal shafts (including the SMBC main shaft).

For the present study, 12 batches totaling 81 samples were processed at the MGB laboratory. All samples were analyzed by fire assay for Au and Ag. The QA/QC programme was developed internally by MGB.

It should be noted that AGC's sample processing agreement with MGB is limited to receiving field samples; but restricts the processing of ore standard, pulp blank, and duplicates. Therefore, the geochemical results processed by the MGB and presented in this study are not validated by a proper QA/QC programme and do not adhere to standard industry practices.

Table 5: Laboratory Results from the shafts outside from the MBP

No. Shaft	X	Y	Z	Depth	Dip	Azimuth	Owner Name	Au (ppm)	Ag (ppm)
SH-1	473625	1580981	123	90	-90	0	Main Shaft / SMBC	9.356	4.725
SH-2	473605	1580979	114	27	-90	0	Robert Rogacion	0.607	3.0200
SH-3	473587	1580983	117	50	-90	0	Danilo Ikaro	0.017	0.750
SH-4	473644	1580943	123	20	-90	0	Marvin de Luna	2.371	5.408
SH-5	473799	1580830	135	25	-90	0	Edita Orcini	0	0
SH-6	473787	1580843	135	30	-90	0	Marisa Brozo	15.850	38.342
SH-7	473772	1580854	134	24	-90	0	Eric Galero	13.960	6.006
SH-8	473773	1580832	138	25	-90	0	Lito Galero	0.771	0.275
SH-9	473751	1580851	134	25	-90	0	David Basco	0	0
SH-10	473749	1580868	131	34	-90	0	Jerome Dalit	0.784	3.734
SH-11	473793	1580854	130	16	-90	0	Ricky Brozo	37.220	323.777
SH-12	473782	1580865	127	25	-90	0	Erlinda Bulan	2.844	3.022

The MBP mine average ore grade, of the mineralized structures, was 12.6 gpt gold in the samples collected. This grade is used to estimate the geological potential of ASGM mining operations at small volumes for illustrative purposes. It is not a resource grade, does not meet NI 43-101 standards and is only a guide.

The average sample grade of the mineralized zone corroborates the USGS (Record ID) US Bureau of Mines estimate which reports a gold grade of 12.6 gpt for the area historically.

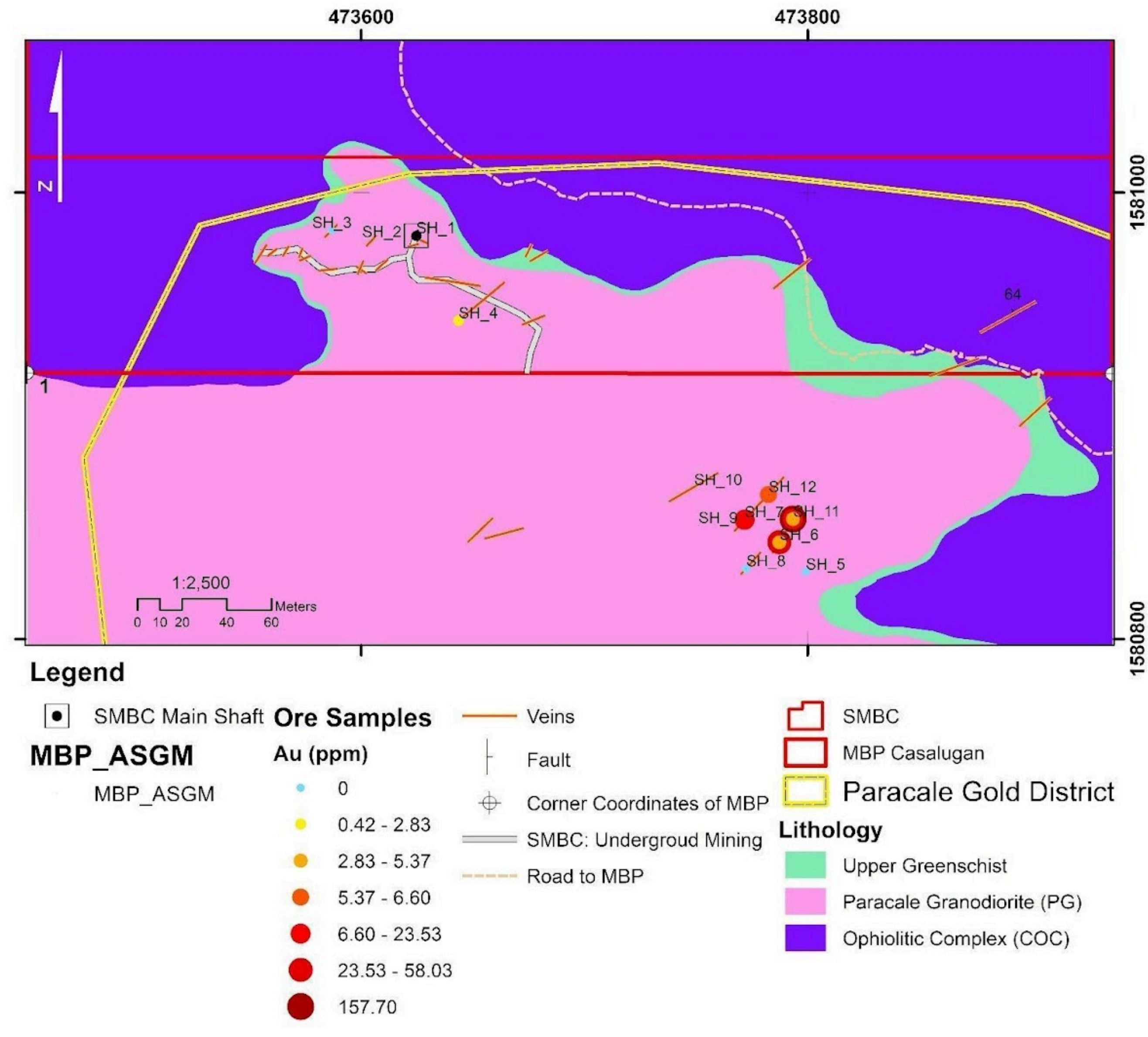

Figure 24: Underground Au sample locations

Samples from Mineshaft Eleven (SH-11) returned the highest gold grade of the study with an average of 37 ppm Au at a depth of 16 meters (Table 5, Figure 24). Shaft Six SH-6 is on the same mineralized system and the sampled mineralized material averaged 16 ppm Au at a depth of 30 m. Considering the topography and measurements underground, the mineralized body has a low angle dip. SH-12 and SH-7 follow the same structure with an average value of 3 and 14 ppm Au. The two veins are semi-parallel, and have a generally NE strike where measured. Further, the grade appears to increase at depth based on the sampling programme.

Shafts SH-5 through SH-12 are in the SE portion of the study area, but are outside the MBP's limits (Figure 24). Samples from these shafts returned an average gold grade of 23.7 gpt. However, samples from the shafts surrounding the SMBC main shaft (SH-2 through SH-4), within the MBP and SMBC, returned significantly lower gold grade; in contrast with the mine sites outside the MBP. Samples from these shafts had an average grade of 1.8 gpt. The significant change in gold grade between the two mining areas likely indicates the presence of two mineralized structures at different depths.

Table 6: Statistics values from the geochemical samples from the SMBC main shaft

SH-1 Main Shaft	*Au (ppm)*	*Ag (ppm)*
Mean	9.356	4.725
Standard Error	2.770	1.615
Median	2.300	0.000
Mode	0.000	0.000
Standard Deviation	12.388	7.401
Sample Variance	153.458	54.779
Kurtosis	0.788	6.391
Skewness	1.294	2.312
Range	40.400	30.150
Minimum	0.000	0.000
Maximum	40.400	30.150
Sum	187.117	99.226
Count	20	21

In total, 20 samples were collected from two headings from the main shaft at a depth of 90 meters. The NWW orientated tunnel penetrates the PG unit and intersects a greater abundance of mineralized veins with visible gold (Figures 22, 23 and 25). The SES orientated tunnel intersects a number of quartz veins with disseminated pyrite and other sulfides (Figure 19 a) but is barron for gold based on the sampling programme as well as conversations with miners (Figure 25).

The average gold grade from the NWW heading was 13.4 gpt, where sampled, and the average spacing between veins was found to generally vary from 0.5 m to 6.0 m. The heading appears to cut the veins perpendicular to its strike (NE).

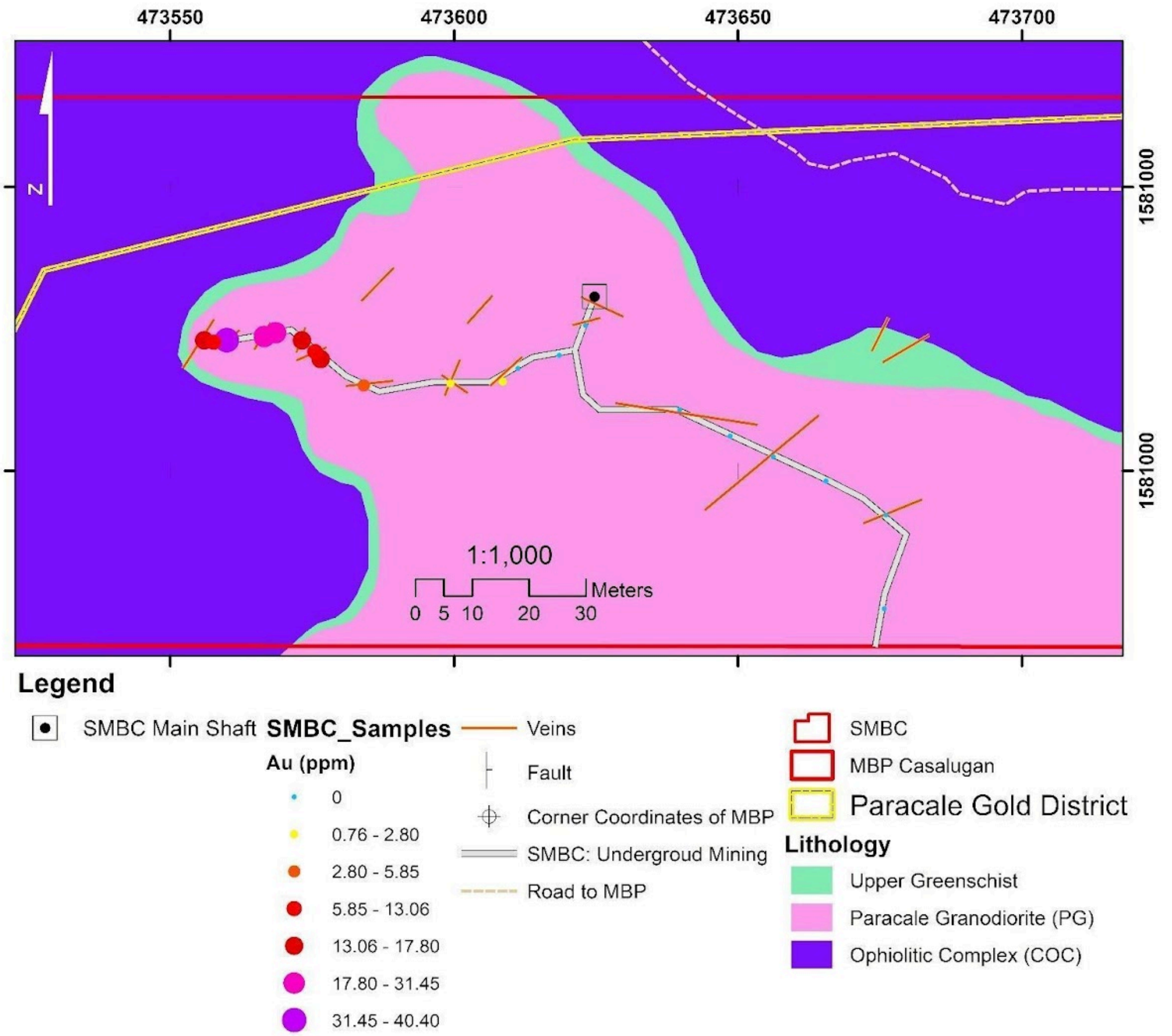

Figure 25: Map showing the two tunnels of the SMBC underground operation and the Au (ppm) values from the geochemical analysis of the samples

Twenty-five samples were taken from waste rock surrounding the operational shafts. The average gold grade from these samples was 1.2 gpt, and the highest grade was found in a sample from SH-7 at 15.8 gpt.

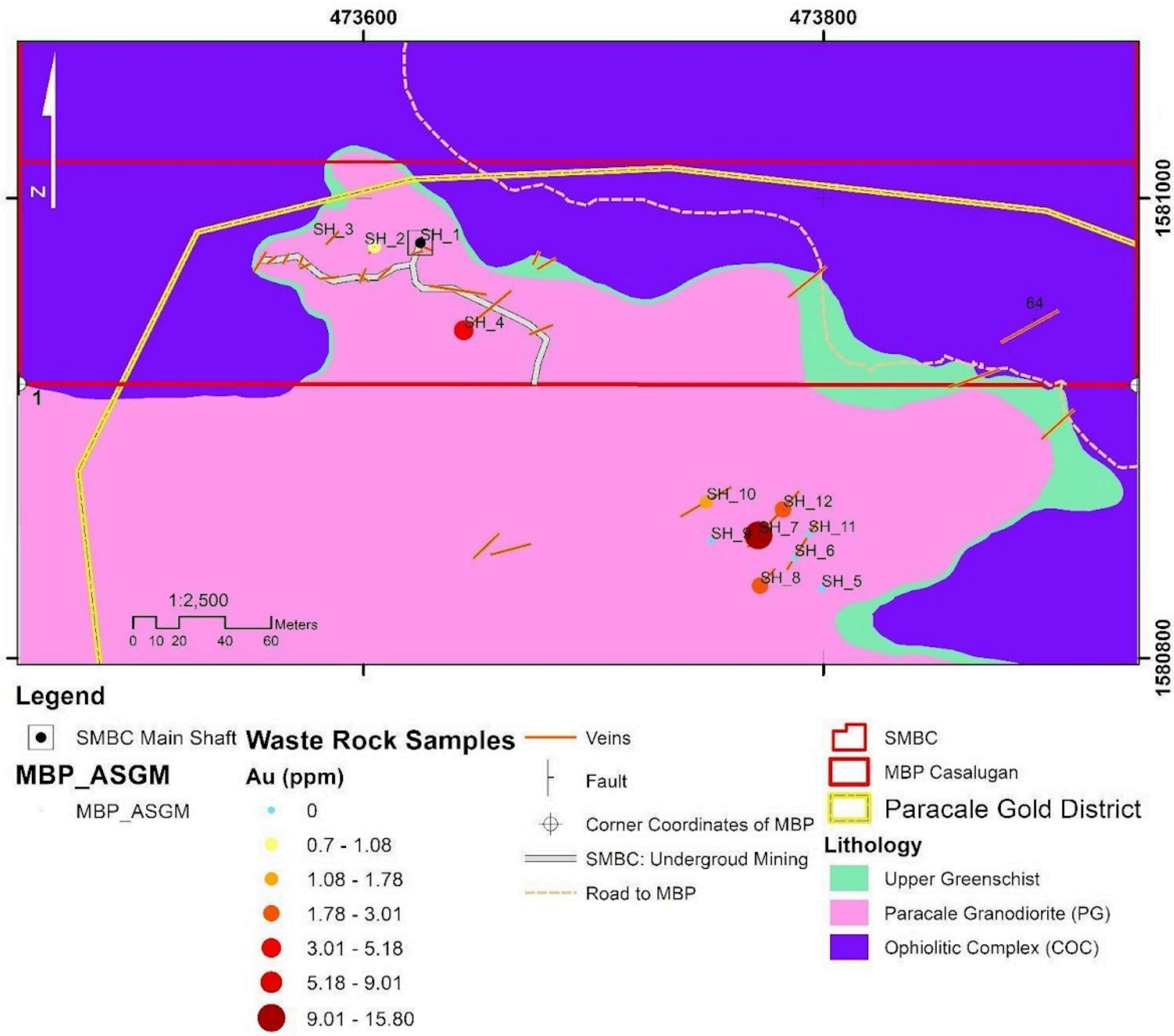

Figure 26: Map shows the geochemical gold results from the waste rock sampling programme

Samples taken from outcrops during the field study did not return gold values. However, some samples contained significant values of silver. The highest silver values were found in samples at the contact between the PG and COC rock units. There is a reasonable probability that these silver values could be surface manifestations of possible mineralization at depth (Figure 27).

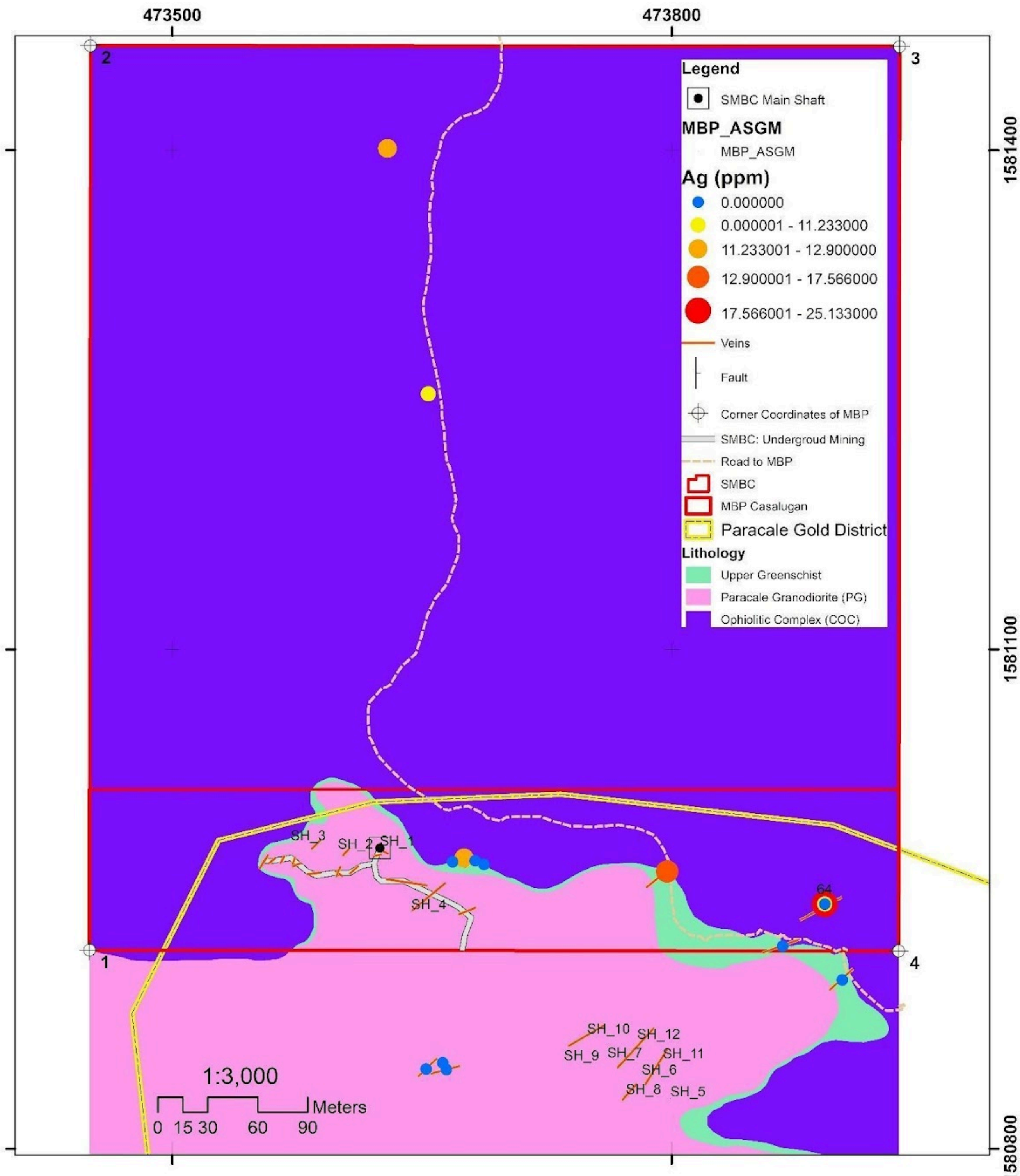

Figure 27: Map showing the distribution of the outcrops samples and the geochemical Ag results from the geochemical results

Figure 28: Trench showing the fault brecciated contact within the COC unit. The samples from this outcrop returned 15 gpt silver (473892 E 1580947 N); Photo © Artisanal Gold Council, 2022

Figure 29: Trench next to the SMBC main shaft showing the contact between overburden and PG with strong foliation and mafic xenoliths. The rock contains veinlets of fuchsite, hematite, and limonite; Photo © Artisanal Gold Council, 2022

Table 7: Surface samples with the results from Ag geochemical analysis

Sample	X	Y	Z	Lithology	Ag (ppm)
PA-O-01	473668	1580972	109	PG/Ov	0.000
PA-O-02	473675	1580975	109	PG/Ov	12.367
PA-O-03	473682	1580973	107	PG/Ov	0.000
PA-O-04	473797	1580967	109	Schist/PG	17.566
PA-O-05	473867	1580922	118	Schist/PG	0.000
PA-O-06	473687	1580971	108	PG	0.000
PA-O-07	473653	1580848	142	PG	0.000
PA-O-08	473663	1580852	136	PG	0.000
PA-O-09	473665	1580848	137	PG	0.000
PA-O-10	473654	1581254	65	COC	10.884
PA-O-11	473629	1581401	44	COC	12.900
PA-O-12	473902	1580901	128	PG	0.000
PA-O-13	473902	1580901	128	PG	0.000
PA-O-14	473892	1580947	114	Ov/COC	11.233
PA-O-15	473892	1580947	114	Ov/COC	25.133
PA-O-16	473892	1580947	114	Ov/COC	0.000

Bulk density (using the true specific gravity methodology) tests for 14 vein samples from the SMBC main shaft were conducted at the MGB laboratory which returned an average specific gravity of 2.74.

Core samples from a historical exploration drilling programme were found on the proposed MFPS construction site. Despite not locating the drill hole, and not having historical information, six core samples were collected from different lithologies for XRF analysis. SGS performed the XRF analysis of the six samples plus two QA/QC for control.

The results demonstrated that the XRF values from the 12 oxides match the lithology types (Table 8) and correspond with the geochemical values published by Graciano (2020) for the Paracale Granodiorite (Adakite). The presumed PG unit samples exhibit calc-alkaline characteristics and have trondhjemitic–adakitic affinity. Quartz and plagioclase with minor biotite, apatite, titanate, and oxide minerals make up the fractionating phases; whereas, the whole rock and biotite mineral chemistry are consistent with a subduction-related setting. A hydrous environment with a temperature of around 600 °C characterizes the melt that formed the PG rock unit and it manifests adakitic geochemical characteristics (Graciano et al., 2020).

Table 8: XRF analysis (XRF76V) results from the core samples. The results are in %

	Lithology	Al_2O_3	CaO	Cr_2O_3	K_2O	MgO	MnO
PA-PT-01	PG	14.87	1.66	<0.01	3.19	0.58	0.1
PA-PT-02	PG, Qtz-vein	14.83	1.18	<0.01	3.98	0.45	0.03
PA-PT-03	COC	9.83	10.38	0.27	0.73	19.22	0.15
PA-PT-04	COC	1.33	0.9	0.38	<0.01	38.08	0.12
PA-PT-05	PG	15.09	1.83	<0.01	2.73	0.4	0.07
PA-PT-06	Greenschist	0.5	0.58	0.31	0.02	39.57	0.1

	Lithology	Na_2O	P_2O_5	TFe_2O_3	SiO_2	TiO_2	V_2O_5
PA-PT-01	PG	4.03	0.13	1.94	70.8	0.23	<0.01
PA-PT-02	PG, Qtz-vein	3.99	0.05	0.92	71.4	0.11	<0.01
PA-PT-03	COC	1.75	0.02	9.61	42.1	0.61	<0.01
PA-PT-04	COC	0.23	<0.01	8.01	39.9	<0.01	<0.01
PA-PT-05	PG	4.05	0.05	1.23	71.3	0.1	<0.01
PA-PT-06	Greenschist	0.26	<0.01	6.94	44.6	0.01	<0.01

Artisanal Exploitable Resource Estimates

The total daily ore production, from the artisanal mines, that feeds the processing MBP plant is estimated at 32 tpd. This estimate is based on the number of sacks delivered to the mill, on a daily basis, from the 12 production shafts. Each sack contains ~450 kg of ore based on miner testimony, and observations on site.

The present study; of the geological potential of gold resources exploitable by artisanal miners in MBP is based on two areas. The first area is 3.49 ha and is restricted to the limits of the MBP. The second area extends to ASGM operations outside the MBP and is estimated to be 9.05 ha.

Given budget and resource limitations, only the geological potential for resources exploitable by artisanal mining techniques was estimated. Geological potential in this context refers to material that can be accessed and processed by artisanal miners; for which an ore quantity and grade can be reasonably estimated based on geological interpretation, with limited sampling. This estimate is not a defined resource or reserve as per National Instrument 41-101 guidelines. The estimate is the opinion of a qualified exploration geologist, based on geological interpretation, and with limited sampling. That was gathered through appropriate techniques; from locations such as outcrops, trenches, and mineshafts.

The geological potential of the entire Casalugan mineralized zone was considered due to the limited sampling, small number of exposed occurrences, the spatial distance between occurrences and the high variability of epithermal deposits. Given these realities, only the geological potential for artisanal gold resources for the MBP were estimated (Table 9).

Table 9: MBP Artisanal Exploitable Gold Resources

Classification	Metric tons	Au (gpt)	Ounces
MBP Geological Potential	118,000	12.6	48,000

It should be noted that the estimate assumes consistent average grades and mineralized thicknesses through the study area. It also assumes that there are no geotechnical or groundwater issues and that the material can be mined without excess dilution.

Furthermore, spatial autocorrelation analysis methodology was used to estimate the exploitable artisanal resources. Spatial grade variability can differ significantly across deposit types and within zones of the same deposit.

The exploitable tonnage was calculated using a rock density of 2.74 for the mineralized body with a variant range of 0.75 to 3.8 m thickness; frequency of veins of 0.75 to 6.75 m, and an ore grade of 12.6 gpt with variogram values of 2.3 gpt to 9.4 gpt.

For context, the USGS U.S. Bureau of Mines (Record ID 5650150011), estimates for Paracale Gold district mineral a total gold endowment of 2,993,000 mt grading 12.6 gpt gold. The USGS estimates are only provided for context on the Paracale District and should not be relied upon for investment purposes.

Interpretation and Conclusions

The Casalugan mineralized zone in the Paracale Gold District is classified as an intermediate sulfidation epithermal gold system hosted in the Paracale Granodiorite. The contact zone between the PG and the Ophiolitic Complex is used as a channel by the hydrothermal fluids to emplace mineralized veins. The sub-epithermal environment shows mineralogical indicators of proximity to a porphyry system. The alteration minerals observed are propylitic, argillic, and phyllic. High-grade gold tends to be concentrated along tensional faults in the PG margin and at contact with older COC. The Casalugan mineralized zone displays geological evidence of valuable mineral potential.

The geological potential of the exploitable artisanal gold resource of the MBP is estimated to be 118,000 t at an average grade of 12.6 gpt for 48,000 ounces.

Recommendations

A series of modern geophysical surveys (Magnetic and Induced Polarization) to estimate the extent of the mineralized material; would help guide miners to exploit the gold resource in a more organized, and efficient manner. Further, a second geochemical sampling programme is recommended, with the implementation of a QA/QC protocol, to validate the laboratory results, and to develop a more accurate grade profile for the MBP ASGM.

Sampling for this report was severely limited due to underground safety concerns. The instability of the shaft walls, poor blasting practices, inadequate shaft infrastructure, and the lack of secondary egress; rendered a comprehensive geochemical sampling programme unsafe. These issues should be addressed to facilitate safe mining operations, as well as further geological exploration.

To improve operations, a Health, Safety, Environment, and Communities (HSEC) Management System Improvement Programme is recommended for the miners from the MBP. Artisanal miners work without proper personal protective equipment (PPE), or safety harnesses to go down mineshafts, and are not properly trained to use explosives for rock excavation. These issues are critical to the safety of the workforce, and if they are left unattended may result in the loss of life, as well as the total loss of the underground operation.

Statement of General Conditions

Standard of Care

This report has been prepared in accordance with generally accepted geological practices in estimating geological potential for artisanal gold exploitable resouces. No other warranty, expressed or implied, is made.

Complete Report

All records, documents, files and data (electronic or otherwise), generated as part of this

assignment are a part of this report. To properly understand the recommendations and opinions of this report, reference must be made to the entire report as described above.

Basis of This Report

This report has been prepared for the specific site and purpose that were described herein. The applicability of any of the findings, recommendations, or opinions expressed in the report are only valid to the extent that there has been no material alteration to any of the said descriptions provided to AGC and the exploration geologist.

Use of This Report

Any use which a third party makes of this report, or any portion of this report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from the use of this report.

Independent Judgements of the Client

The information, interpretations and conclusions in this report are based on our interpretation of the site conditions based on a limited field investigation and limited sampling programme. We cannot accept responsibility for independent conclusions, interpretations and/or decisions made by or others who may come into possession of this report (or any part thereof) which may be based on information contained in this report.

Interpretation of Evidence

This report was based on information and evidence obtained during a the field investigation as well as our experience in the artisanal gold mining industry. Our opinions were formed on the evidence provided and observed. It must be noted that a lack of evidence cannot be interpreted as evidence of absence.

Geological Potential

The geological mining potential reported in this study is only valid for the purposes for which it was prepared. It is essential to understand that the geological potential estimate of an exploitable artisanal resource is based upon a given set of geochemical and geological parameters which have demonstrated their technical and economic viability at a stated point in time. Technical and economic parameters critical to the recommendations/conclusions in this report may change with time. Therefore, conclusions should be used with caution and accommodate current conditions.

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XIII. References

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