



Gold supply chain

From Brazil to the world

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About this report

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Summary

Despite the difficulty in researching the trade of gold around the world, this research resulted in some key takeaways which can support advocacy for better, more transparent gold supply chains in the future.

Gold traceability is among the hardest to achieve for all commodities, despite there being requirements for disclosures in key sectors like consumer electronics. A large part of the reason that gold is difficult to trace is by its very nature – a high-value, low-volume, hyper-manipulated, intensely circulated and imperishable commodity makes it an easy target for smuggling and illegality. Add to this the secrecy, corruption and lack of demand for transparency throughout the supply chain, tracing specifically the movements of gold around the world becomes virtually impossible to achieve without corporate cooperation.

Yet, it is still possible to confirm that all examined consumer electronics companies (Apple, Samsung, Microsoft, Intel and Sony) and electric vehicle manufacturers (Volkswagen, Ford, General Motors, Tesla) are sourcing gold from Brazil. Of their traceable origins, they are sourcing gold from AGA Mineracao (owned by South African mining company AngloGold Ashanti) and Marsam Refinadora, a Brazilian integrated refinery.

The luxury goods sector is extremely opaque for all raw materials, but especially gold. Virtually none of the jewellery or watch companies make any effort to disclose where their raw materials are coming from, nor how much is going into the manufacture of their products. The same conclusion has been made in past research efforts on gold in the sector.¹ Yet, given that most of these companies are located in Europe and the prevalence of refineries in Switzerland and Italy, it is clear that links are likely to exist, which in turn may have supply chain links with Brazil.

In our process of due diligence, we contacted refineries in Brazil and in top importing refineries, and found that most did not respond to our request for further information or pointed to business confidentiality. Where companies did respond, they either denied exporting to the countries we researched, or they denied trading with Brazil. While these claims are possible, they are also impossible to verify without further concrete disclosures by companies.

Perhaps it is time to turn around burden of proof: can these companies proof that they are not linked to potentially illegal flows of gold from Brazil?

Abbreviations

RJC	Responsible Jewellery Council
3TG	Conflict Minerals, as defined under SEC regulations in the US

Introduction

Gold is a commodity that is notoriously difficult to trace, due in part to the intensity of circulation of this material. Adding to this complexity is the corruption and illegality entwined in the sector. Estimates state that between 17-28% of Brazilian gold comes from illegal mining.² Despite the host of environmental issues and human rights abuse known to be present in the extraction of gold around the world, there is as of yet little pressure to improve the traceability of this precious metal.

There are however increasingly reports by media and civil society linking Brazilian gold from deforested and indigenous lands in the Amazon to refiners in Europe and North America. These include:

- Reporter Brasil 2021 investigation on gold extracted illegally on Kayapo indigenous lands in the south of Para being refined by Italian manufacturer Chimet.³
- Mongabay 2022 investigation into the prevalence of Brazilian Amazon gold in Switzerland. Swiss gold refineries such as MKS PAMP, Metalor, Valcambi and Argor-Heraeus are among the largest in the world.⁴
- Associated Press 2022 series on the violence and criminal activity brought on by illegal mining operations on different communities and areas in Brazil,⁵ and how it enters supply chains around the world through Brazilian refiner Marsam supplying the likes of Microsoft, Tesla and Amazon.⁶

This report aims to contribute to the research on gold traceability. It outlines where gold from Brazil gets processed and where it may be ending up around the world.

1

Methodology

This section provides an overview of the main sources of information for establishing supply chain relationships for gold produced in Brazil using trade data, available corporate disclosures and communication with the refineries identified throughout the research.

1.1 Overview of methodology

The research for this report uses a combination of trade data, corporate disclosures, existing media reports and investigations as well as direct feedback from companies to piece together a picture of the Brazilian gold supply chain.

First, trade data was downloaded and analysed to understand where most gold from Brazil was exported to in 2020 (see section 1.2 for more details). This provided a basis for selecting from the top importing countries for further investigation of the downstream supply chain: Canada, Switzerland, the UK and Italy.

Second, using company websites and publications, and industry sources, a list of top refiners of gold in each of these countries and in Brazil were outlined, and further research done into the possibility of these refiners sourcing gold from Brazil. All refiners identified were then contacted by Profundo for comment on the origins and destinations of their gold. Whenever feedback was provided, this was incorporated into the report.

Finally, in 2021, the estimated global consumption of refined gold for non-financial uses was 30% for jewellery and 6% for electrical and electronics products.⁷ Given that jewellery and consumer electronics are the most consumer-facing industries, and that electric vehicles represent a growing proportion of gold use,⁸ the research focused on these three sectors and the potential links the top companies involved may have with gold from Brazil.

Wherever possible, the main source of information used for these industries were corporate disclosures on conflict minerals which are mandatory for companies in the US. Companies in the UK and Switzerland are for now exempt from making such disclosures. Other sources of information include company policies, publications and Responsible Jewellery Council (RJC) audit reports, though these are not often transparent on the origins or amounts of gold sourced.

1.2 Trade data and limitations

Trade data was downloaded from the UN Comtrade database in May 2022 for imports of gold from Brazil to all countries. Records were downloaded for the Harmonised System code 7108 ('Gold, incl. gold plated with platinum, unwrought or not further worked than semi-manufactured or in powder form' which includes all forms of monetary and non-monetary gold).

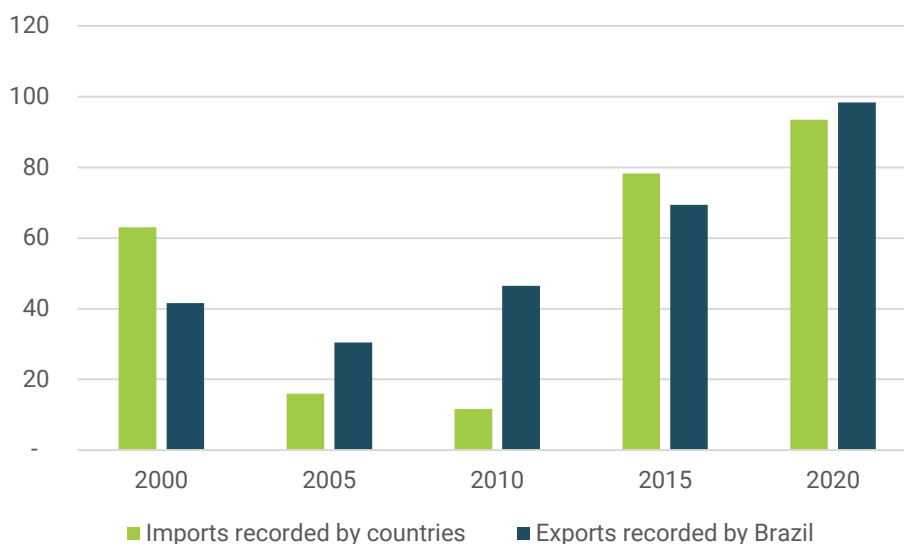
Further sub-codes were also distinguished, and it was found that monetary forms of gold have not been recorded in the trade data under 7108 or 710820. Thus, all trade data here refers to non-monetary gold.

There are limitations to using official trade data on gold, many of which are the result of the industry’s reliance on secrecy and corruption. A recent report by Global Witness outlines some limitations including big fluctuations in the trade data, discrepancies that can’t be explained (e.g. we found that In 2010, the total imports of gold commodity codes reported from Brazil do not match the imports of 7108, with a gap of 2.7 tons), mined gold being reported as scrap gold and countries without any significant gold deposits recording exports of large amounts of gold.⁹

Additionally, the circulation of gold around the world is intense, with gold being produced, exported, re-exported, melted, recycled and so on from different sources and destinations all the time. One part of the problem with trade data is that it cannot dissect which gold is being re-exported from production countries. For example, a higher proportion of gold may be entering Switzerland from Brazil if one considers that gold may be going via refiners in the United Arab Emirates, though the reverse could also be true (that gold from Brazil refined in Switzerland actually ends up in the US). So the picture that trade data on an imperishable and hyper-manipulated product that is traded in small volumes like gold provides is very limited.

There are also profound asymmetries in trade reported by importing versus exporting countries. In the case of Brazil, for example, there have been differences where the exports recorded are almost four times as high as the imports recorded by a country (Figure 1). There can be many reasons for these discrepancies, for example, mis-invoicing the weight and purity of the gold in order to undervalue an export, thus allowing for capital flight. More sophisticated criminal organizations have been found to turn gold in one continent into cryptocurrency on another in multimillion dollar transactions that leave no trace.¹⁰

Figure 1 Difference in recorded exports and imports for Brazilian gold trade (MT)



Source: UN Comtrade (2022)

Recorded imports are generally considered to be more reliable, therefore all trade figures here-on will refer to import records of gold from Brazil. This does not make a difference to the rankings of the key importing countries of Brazilian gold, which when looking at either sets of figures in 2020 are (from largest to smallest) Canada, Switzerland, the United Kingdom (UK), the United Arab Emirates (UAE), and Italy.

The complete list of recorded imports and exports for the trade of Brazilian gold can be found in Appendix 1.

2

Brazilian gold supply chain

This section first provides a short overview of Brazilian gold production and trade, and then outlines the gold supply chain from key mining companies and refineries in Brazil, to refineries in Canada, Switzerland, the UK and Italy, all the way to potential uses in jewellery and consumer electronics industries.

2.1 Overview of the Brazilian gold industry

2.1.1 Production and international trade of Brazil gold

Gold is mined in around 80 countries, with around 3,000 tons produced every year and the majority of it produced in China, Australia, Russia, and the US (Table 1). Most newly mined gold comes from large, industrial mines, though 15 to 20 percent of the world's gold comes from small-scale or artisanal mines, primarily in Africa, Asia, and Latin America.¹¹

Mine production accounts for the largest part of global gold supply – typically, 75% each year. However, annual demand requires more gold than is newly mined and the shortfall is made up from recycling. The majority of recycled gold – at least 90% - comes from jewellery, with gold extracted from technology providing the remainder.¹²

Like many countries, Brazil has a centuries-long history with gold inextricably linked to colonialism and evident in the continuing exploitation and corruption in the industry today. It is not a top gold miner of the world but has consistently produced 2-3% of global gold in 2020 and 2021 (Table 1).

Table 1 World gold mine production and reserves (MT)

Country	2020	2021	Reserves
China	365	370	2,000
Australia	328	330	11,000
Russia	305	300	6,800
United States	193	180	3,000
Canada	170	170	2,200
Ghana	125	130	1,000
Mexico	102	100	1,400
Uzbekistan	101	100	1,800
South Africa	96	100	5,000
Sudan	90	90	NA
Peru	87	90	2,000
Indonesia	86	90	2,600
Brazil	78	80	2,400
Kazakhstan	63	60	1,000
Argentina	59	60	1,600
Burkina Faso	58	60	NA
Papua New Guinea	54	50	1,100

Colombia	48	50	NA
Tanzania	47	50	NA
Other countries	572	570	9,200
World total (rounded)	3,030	3,000	54,000

Source: Sheaffer, K.N. (2022) *Mineral Commodity Summaries: Gold*, US Geological Survey

According to the trade data, fourteen countries are officially registered as trading with Brazil in products made of gold (Table 2). The top 5 largest importers of gold from Brazil in 2020 are Canada, Switzerland, the United Kingdom (UK), the United Arab Emirates (UAE), and Italy. Canada occupies by far the largest share, with 35% of the value of all Brazilian gold imports around the world.

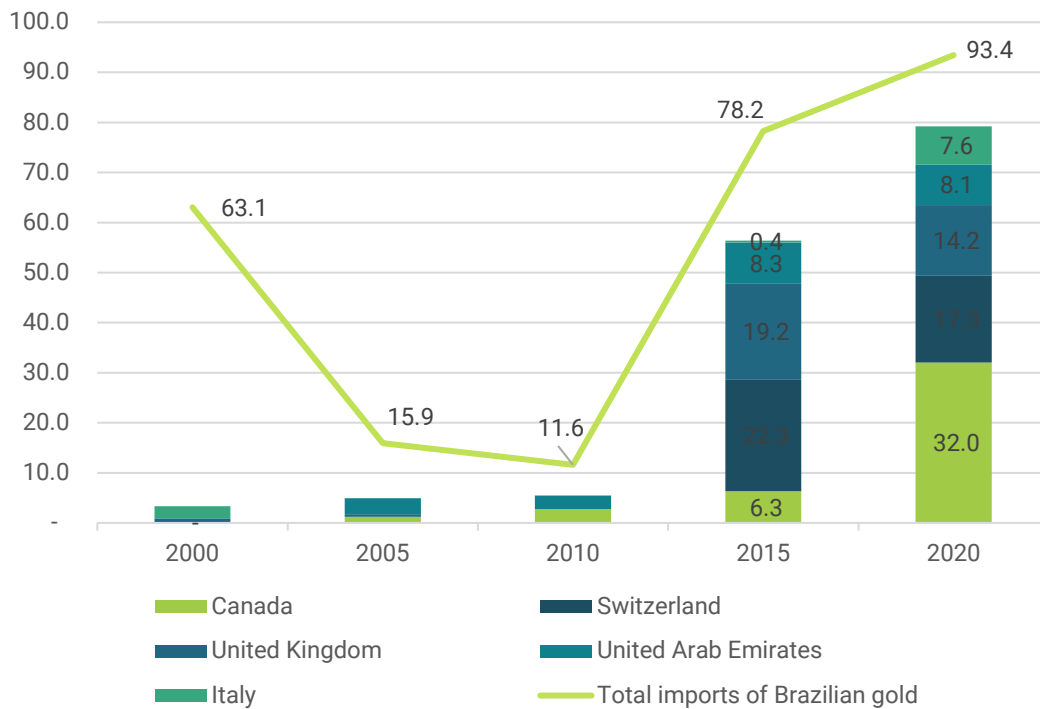
Table 2 Importers of Brazilian gold in 2020

Importers	MT	USD (bil)	Share of value
Canada	32.0	1.751	35%
Switzerland	17.3	0.852	17%
United Kingdom	14.2	0.808	16%
United Arab Emirates	8.1	0.406	8%
Italy	7.6	0.417	8%
India	4.7	0.240	5%
USA	3.5	0.199	4%
Belgium	2.9	0.159	3%
Turkey	1.6	0.091	2%
Germany	0.9	0.051	1%
China, Hong Kong SAR	0.5	0.026	1%
France	0.03	0.001	0%
Portugal	0.02	0.000	0%
Spain	0.001	0.000	0%
Grand Total	93.4	5.0	1.0

Source: UN Comtrade (2022)

The top importing countries have not always imported large amounts from Brazil, only occupying a significant share since 2015. Canada's volumes of imports from Brazil in particular have grown dramatically in the last twenty years, from nothing in 2000 to 32 tons in 2020 (Figure 2).

Figure 2 Top 5 importers of Brazilian gold in 2020, since 2000 (MT)



Source: UN Comtrade (2022)

This report identifies and examines key refiners of gold in Canada, Switzerland, the UK and Italy.

2.1.2 Illegality in the Brazilian gold supply chain

Gold laundering in Brazil is commonplace. This happens both to hide gold illegally mined in Brazil, but also illegally obtained from neighbouring countries like Colombia, French Guyana and Venezuela, from where gold is often sold and refined in Brazilian cities in Amazonas, Amapa and Roraima.¹³

The OECD reports that the regulatory framework in Brazil is highly conducive to gold laundering, citing a Brazilian prosecutor describing efforts to deter illegal mining as “like trying to stop ice from melting”.¹⁴ Paperwork of any kind, including certificates of origin, can be quickly and easily generated, and is often done so directly by the sellers. Gold then effectively becomes legal at the first point of sale, often with companies who are not known to scrutinize origins (see Section 2.3.1 on DTVMs). Moreover, regulators like the National Mining Association (ANM) and other agencies have long been weak on enforcement.¹⁵

Official data provides some insight into the scale of gold laundering. In 2020, preliminary data from the ANM showed Brazil produced 62 tons of gold, yet the foreign trade ministry registered 98 tons of gold being exported that year.¹⁶

2.2 Mining, smelting and refining in Brazil

The Brazilian mining sector is highly concentrated despite the operations of thousands of firms in the country. In 2020, there were 6,466 companies registered in the mining sector and the market share of the five largest was nearly 70%.¹⁷ The largest mining companies in Brazil in 2020 are Vale, Anglo American, CSN Mineração, Kinross Brasil and Mineracao Usiminas (Table 3). These are all public, listed companies and in most cases (Vale, Anglo American, Kinross) are multinational companies with mining operations around the world.

Table 3 Five largest mining companies in Brazil based on tax 2020

Company	Country	Ownership
Vale	Brazil	Listed
Anglo American	UK	Listed
CSN Mineração	Brazil	Listed
Kinross Brasil	Canada	Listed
Mineracao Usiminas	Brazil	Listed

Source: Bnamericas (2020, July 28) "Spotlight: The largest mining companies in Brazil," Bnamericas, online: <https://www.bnamericas.com/en/features/spotlight-the-largest-mining-companies-in-brazil>, viewed May 2022; company annual reports.

Gold that is refined in Brazil comes in part from these large mining operations (either directly as gold or as by-products hidden within other minerals like copper). Gold also comes from smaller-scale operations, including what is called artisanal, small-scale mining, both legal and illegal. It is also often smuggled into Brazil from neighbouring countries like Colombia, French Guyana and Venezuela.

The companies owning gold refining operations in Brazil do not overlap at all with the top mining companies, though some of these companies do own and operate mines in Brazil. The gold refining companies in Brazil are Umicore Brasil, AGA Mineração, Marsam Refinadora and Casa da Moeda do Brazil (the Brazilian Mint) (Table 4).

Table 4 Gold refining companies in Brazil

Company	Ownership	Refinery/ies, location	Annual capacity (MT)	LBMA Good delivery list?
Umicore Brasil	Umicore (Belgium), public company	Guarulhos, São Paulo	40	Former
		Coimpa, Manaus	Unknown	No
AGA Mineração	AngloGold Ashanti (South Africa), public company	Quieroz (part of Cuiaba complex), Nova Lima, Minas Gerais	1.75 ¹⁸	Yes
		Corrego do Sitio (CdS), Minas Gerais	1.6 ¹⁹	No
Marsam Refinadora	Private company	Sao Paulo, Sao Paulo	Unknown	Former ⁱ
Casa da Moeda do Brazil	Government of Brazil	Santa Cruz, Rio de Janeiro	Unknown	Former

Source: company websites and annual reports, LBMA Good Delivery list (current and former).

• Umicore

One source from 2009 claims that Umicore's Guarulhos refinery is the largest gold refining and manufacturing complex in Latin America, with an annual gold refining capacity of 40 tons.²⁰

ⁱ Before merger in 1997 of Ourinvest, Vanity and Goldmine into Marsam, Ourinvest and Goldmine were both on the LBMA Good Delivery list.

A representative from Umicore responded to Profundo's request for information, stating that there are no flows from Umicore Brazil to Canada, Switzerland, the UK or Italy.²¹

- **AGA Mineração**

AGA Mineração is owned by AngloGold Ashanti, a global gold producer with 12 operations on four continents. The group's revenue is mainly derived from gold income, and gold from Brazil alone accounted for almost 20% of total gold income in 2021.²²

Approximately 59% of the group's total gold produced is sold to 3 customers of the group: ANZ Investment Bank Ltd in Australia (20%), Standard Chartered Bank in the United Kingdom (23%), and Bank of Montreal in Canada (16%).²³

AGA Mineracao has not responded to requests for information from Profundo on the production and destinations of their gold.

- **Marsam**

From Marsam, the gold travels far and wide. More than 300 publicly traded companies list Marsam as a refiner in responsible mining disclosures they are required to file with the U.S. Securities and Exchange Commission. The refiner has been virtually the only supplier to Brazil's mint over the past decade, according to data provided to the AP through a freedom of information request.²⁴

Marsam responded to Profundo's request for further information, stating that Marsam Refinadora does not directly export the refined metal, and thus could not provide any further detail as to the destinations of the gold they refine.²⁵

- **Casa da Moeda do Brasil (CMB)**

Casa da Moeda do Brasil (CMB) is Brazil's mint which produces money for Brazil and other countries in South and Central America and Portuguese-speaking Africa.²⁶

Profundo requested access to information on CMB gold operations and sourcing, and received a response from the Ombudsman that: *"I inform you that the Brazilian Mint - CMB does not export gold to the mentioned countries. In addition, CMB is not operating in the gold refining market at the moment."*²⁷

2.3 Trading gold in Brazil

The official production and trade data indicate that most of the gold produced in Brazil gets exported, as much as 81% in 2020 according to some estimates.²⁸ This section provides an overview of available information on the middlemen companies involved in the trade of gold in Brazil.

2.3.1 DTVMs

Distribuidora de Títulos e Valores Mobiliários (DTVMs) are authorized by the Central Bank as the first official trading point for extracted gold. As such, they are the point at which "rough gold" typically enters the legal market, and the primary point where taxes on small-scale gold mining is collected. Once rough gold moves up the supply chain, it is exceedingly difficult to trace its origins and distinguish between legal and illegal gold.²⁹

Of all the metal bought by DTVMs in 2019 and 2020 in Pará, at least 60% have no proven origin. A Reporter Brasil investigation in 2021 found that only three DTVMs – Ourominas, FD'Gold and Carol DTVM - buy more than 70% of this potentially illegal metal.³⁰

2.3.2 Exporters

Gold from industrial mines may be exported directly to refiners, while artisanal gold may pass from one trader to another before being exported for refining. However, understanding more precisely which agents and companies in Brazil are responsible for exporting gold is virtually impossible due to the secrecy of key holders of information. It can be presumed that DVTMs and gold mining companies have some share of exporting capacity, but otherwise this part of the supply chain is extremely opaque.

Illustrating this opacity, Reporter Brasil used Freedom of Information requests to try to obtain a list of the largest gold exporters in the country as well as the main foreign buyers. The Federal Revenue and Central Bank claim confidentiality reasons for making these unavailable. Reporter Brasil plainly state that: "Organizations in the sector do not know, will not speak or will not reveal names."³¹

3

Refiners in top importing countries

Gold refiners play a crucial role in the gold supply chain and are sometimes called the “choke point” of the gold supply chain because there are so few around the world.³² This section will review the full list of refiners in top importing countries – Canada, Switzerland, the UK and Italy – and determine the likelihood of these refiners sourcing gold from Brazil.

3.1 Canada

The top companies refining gold in Canada are, for the most part, multinational companies with headquarters in other countries (Table 5).

Table 5 Refiners of gold in Canada

Company	Capacity	Ownership	Group Revenue 2021 (USD bln)
CCR Refinery	Unknown	Glencore (Switzerland), public company	181.8
Vale Canada	Unknown	Vale (Brazil), public company	54.5
Teck Resources	Unknown	Public company	13.5
Royal Canadian Mint	Unknown	Government of Canada	3.6
Asahi Refining Canada	Unknown	Asahi Holdings (Japan), public company	1.4

Note: Asahi group revenue for 2021 is converted to USD from JPY using rate on 31 December 2021.

Source: Company websites and 2021 financial statements.

- **CCR Refinery (Glencore)**

CCR is a copper refinery that processes copper anodes from Glencore’s copper smelters as well as copper anodes from third party sources.

Glencore sold 1.8 million ounces of gold 2021.³³ Its operations map shows that it has a marketing office in Rio de Janeiro and owns a fuel distribution company in the country, but otherwise does not have any mineral assets in Brazil. Further, it’s production report for 2021 shows that Glencore has no current or future assets in Brazil, implying that none of the minerals it is processing from it’s own operations worldwide are coming from Brazil.³⁴

Finally, CCR Refinery has responded to requests for further information from Profundo, confirming that they do not source gold or copper anodes containing gold from Brazil.³⁵

- **Vale Canada**

Part of the multinational group Vale based in Brazil, Vale Canada has mines, smelters and refineries in Canada from which it ships products all around the world.

Vale Canada has two refineries processing gold and precious metals:

- Sudbury Operations, one of the largest integrated mining complexes in the world with five mines, a mill, a smelter and a refinery. It produces nickel, copper, cobalt, platinum group metals, gold and silver.³⁶
- Port Colborne Nickel Refinery in Ontario,³⁷ which processes raw materials that are shipped from Vale's Sudbury Operations for processing, including precious metals.

Vale has also claimed to be receiving in Canada the silver and gold by-products from copper operations at Sossego and Salobo in Brazil.³⁸ However, a representative at Vale Canada has responded to requests for information from Profundo, stating that their refineries in Canada do not currently process gold from Brazil.³⁹

- **Teck Resources**

Teck produces and markets gold doré bars, and refines these at their Trail Operations in British Columbia,⁴⁰ one of the world's largest fully integrated zinc and lead smelting and refining complexes.⁴¹ Gold is thus a co-product of their lead smelting process.

Trail operations alone accounted for USD 1,997 million in revenue in 2021.⁴²

Teck Resources has not responded to requests for information from Profundo on their gold sourcing.

- **Royal Canadian Mint**

A Crown corporation of the Government of Canada, the Royal Canadian Mint (RCM) produces Canada's circulation and collector coins, and operates one of the most respected gold and silver refineries in the world—producing precious metal bars, wafers, grain and custom products.

Producing 39.2 million ounces of gold and silver bullion products, including 1.47 million ounces of gold products, the Mint led global bullion sales in 2021.⁴³

There are no indications of where the gold that RCM sources may be coming from. The RCM has not responded to requests for information from Profundo on their gold sourcing.

- **Asahi Refining Canada**

Owned by Asahi Holdings, a Japanese holdings company, Asahi forms part of a multinational group which specialises in treating, refining and manufacturing precious metals. Gold makes up the majority of revenue, in 2021 totalling over 70 billion Yen in sale, accounting for 43% of total revenue and a 133% increase of 2020 gold sales.⁴⁴

Asahi claims that their North American counterparts are involved in refining gold and silver from mines in the USA and Canada only.⁴⁵

Asahi Refining Canada has not responded to requests for information from Profundo on their gold sourcing.

3.2 Switzerland

Switzerland is a significant market for gold refining for several reasons. The first is that the gold industry was historically linked to the financial sector, and the four major refineries used to belong to the country's top banks which underwrote purchases and sales. Additionally, the country's internationally renowned watchmaking industry and the jewellery industry in neighbouring northern Italy's are both important end markets.⁴⁶

Christoph Wiedmer, co-director of the Swiss NGO Society for Threatened Peoples, which monitors the global gold trade, says that: "Swiss refiners claim that they process only 13% of the gold mined worldwide. However, it is quite certain that this figure is much higher due to indirect sources. Yet, because of the absurd lack of transparency in the gold business, exact figures are unverifiable."⁴⁷ A different source claims that Swiss refiners refine more than half of the world's gold.⁴⁸

Table 6 Refiners of gold in Switzerland

Company	Ownership	Gold refining capacity (tons/year)	Group revenue 2021 (USD bil)
Cendres + Métaux	Public company	Unknown	74.2
Argor-Heraeus	Heraeus Group (Germany), privately owned	1,400	23
Valcambi	Rajesh Exports (India), public company	1,200	2.8
Metalor Technologies	Tanaka Kikinzoku (Japan), privately owned	650	1
MKS PAMP	MKS PAMP (Netherlands), privately owned	450	Unknown
PX Précinox	PX Group (Switzerland), privately owned	60	Unknown

Notes: The gold refining capacity reported by Metalor Technologies is for its operations worldwide, not just in Switzerland; Revenues for Rajesh Exports and C+M are converted to USD from INR and CHF, respectively, using rate on 31 December 2021; It is not clear for which year nor the currency the Heraeus Group data is reported for, viewed on the Argor-Heraeus website in May 2022.

Source: Company websites and 2021 financial statements, Gold Bars Worldwide.

- **Cendres + Metaux**

Cendres + Metaux (C+M) is a Swiss-based group owning operations in both medical technology and dentistry, as well as luxury goods and precious metals. In the last five years, C+M have acquired shares in luxury goods manufacturers worldwide, including PRG Manufacture SA, Queloz and Guillod Gunther (via Queloz).⁴⁹ There is no information about its Bern facility on its website.

C+M has not responded to requests for information from Profundo on their gold sourcing.

- **Argor-Heraeus SA**

Argor-Heraeus is a Swiss company owned by Heraeus Precious Metals (HPM) belonging to the German technological group Heraeus, claiming to make it the world's largest provider of precious metals.⁵⁰ Though it has operations in Switzerland, Italy, Germany and Chile, their main production facility is in Mendrisio, Switzerland – this facility employs 90% of the workforce and almost all the precious metals are worked here.⁵¹

Its annual gold refining production capacity is 1,400 tons, making it the largest refiner of gold in Switzerland (according to available information).⁵²

Argor-Heraeus has not responded to requests for information from Profundo on their gold sourcing, and in the past declined to answer questions on their gold sourcing for an investigation by Mongabay.⁵³

- **Valcambi**

Valcambi was founded by Swiss investors, though today is fully owned by Global Gold Refineries Ltd (GGR) incorporated in Switzerland, which in turn is owned by REL Singapore PTE Ltd in Singapore (95%), in turn fully owned by Rajesh Exports Limited (REL).⁵⁴ REL is headquartered in Bangalore, India, and claims to be the largest processor of gold in the world, processing 35% of gold produced everywhere.⁵⁵ Valcambi's refining operations have an annual capacity of over 1,200 tons for gold.⁵⁶

Valcambi has been accused in two separate reports in 2020 of sourcing gold from illegal and conflict-based sources via its direct supplier the UAE-based company Kaloti.⁵⁷ Valcambi has denied any wrongdoing.⁵⁸

Valcambi responded to Profundo's request for further information, stating that they do not source gold from Brazil, but did not disclose any further origins of its gold.⁵⁹

- **Metalor Technologies**

Established in Switzerland in 1852, Metalor is one of the oldest precious metals companies in the world, and the first Swiss refinery. Metalor was acquired in 2016 by Tanaka Kikinzoku, a family-owned Japanese company leading in precious metals refining and manufacturing.⁶⁰

Metalor is headquartered and owns refineries in Marin, Switzerland, as well as internationally in the US, China, Hong Kong and Singapore. It also owns related businesses in Europe, Asia and Central and South America.⁶¹ In 2014, it had an estimated annual gold refining capacity of approximately 650 tons.⁶²

Metalor Technologies has not responded to requests for information from Profundo on their gold sourcing, and in the past has declined to disclose the origins of its gold imports for an investigation by Mongabay.⁶³

- **MKS PAMP**

In November 2021, PAMP SA merged with MKS (Switzerland) SA, a precious metals trading house, which is today known as MKS PAMP SA.⁶⁴ The MKS PAMP group operates MMTC PAMP, an entity with a refinery in India, though MKS PAMP is the primary company in the group, providing financial and physical trading services, as well as operating the precious metals refinery based in Switzerland.

MKS PAMP operates a precious metals refinery in Switzerland with a capacity exceeding 450 metric tons for gold, 600 tons for silver and 30 tons for PGM per year.⁶⁵ It has stated that: *"MKS PAMP sources gold and silver doré from around the globe. We collaborate with new mining groups operating in new jurisdictions, as well as with large multi-national groups as they expand their geographic footprints. We have brought many of the new mines production to market and helped position a number of new countries on the gold producing map."*⁶⁶

MKS PAMP responded to requests for information from Profundo on their gold sourcing, stating that: *"[...] we do source gold from Brazil, specifically and only from industrial/mechanized mines which are duly registered to operate."*⁶⁷ In a previous 2022 investigation for Mongabay, MKS PAMP denied sourcing gold from the Amazon.⁶⁸

- **PX Precinox**

PX Precinox is privately owned and part of the PX Group, whose companies manufacture customized semi-finished goods for the watch-making, industrial and medical markets in Switzerland and internationally. It is headquartered in La Chaux-de-Fonds in Switzerland, a traditional centre of watch-making in Switzerland for over 300 years.

It also has refineries in other areas of Switzerland, as well as in Penang, Malaysia.⁶⁹

A source from 2013 claims that PX Precinox has an annual gold refining capacity of 60 tons and focuses on the processing of gold-bearing scrap, mainly from the jewellery, dental and electronic industries.⁷⁰

PX Precinox has not responded to requests for information from Profundo on their gold sourcing.

3.3 United Kingdom (UK)

Though the UK is a country with a rich and ancient history with precious metals, it is not today one of the principal refiners of gold. There are three gold refineries in the UK, all of which are privately or government-owned (Table 7).

Table 7 Refiners of gold in the UK

Company	Capacity	Ownership	Revenue 2021 (USD bil)
The Royal Mint	Unknown	Government of UK	1.4
Baird & Co	10 tons	Privately owned	Unknown
Betts Refining	Unknown	Betts Group, privately owned	Unknown

Source: Company websites and 2021 financial statements.

- **The Royal Mint**

The Royal Mint processes gold mainly for minting, manufacturing over 3.3 billion coins and blanks a year for over 30 countries at its site in Llantrisant, South Wales.⁷¹

The Royal Mint responded to Profundo’s request for further information on the origins of gold produced. It stated that they do not have refining capabilities at their sole premises in Llantrisant, South Wales, and that the Royal Mint refine all precious metal scrap via a third party supplier, who in turn, recycle and reuse the material to produce other products on our behalf.⁷²

It is possible that this third-party supplier is Baird & Co., as they are the Royal Mint’s official partner and authorized distributor since 2016.⁷³ The Baird & Co. do not report any sourcing of gold from Brazil in its 2021 LBMA audit report, though this does not seem to cover indirect sources in their gold supply chain.⁷⁴

- **Baird & Co.**

Baird & Co. is a family-owned company with its main processing and manufacturing facilities located in East London, and processes over 10 tons of gold a year.⁷⁵ Baird & Co. is the Royal Mint’s official partner and authorized distributor since 2016.⁷⁶

The Baird & Co. LBMA audit report states that the company in 2021 sourced gold with “points of origin” in Germany, Belgium, Isle of Man, Portugal, Ireland, Monaco, Ireland, Finland, Lithuania, France, Switzerland and the United Kingdom.⁷⁷ This does not seem to cover indirect sources in their gold supply chain.

Baird & Co. has not responded to requests for information from Profundo on their gold sourcing.

- **Betts Refining**

Betts Refining is a family business dating back to 1760, when Alexander Betts set up a smelting and refining business in Birmingham to recover precious metals from wastes being produced in the city’s newly established Jewellery Quarter. It has since expanded to include a range of businesses in precious metal markets, including sales, investments and waste management.⁷⁸

Today, the company still owns and operates a refinery in Buxton, the only Fairtrade and Fair Mined certified refinery in the UK and the only UK refinery offering segregated Single Mine Origin gold.⁷⁹

Betts Refining has not responded to requests for information from Profundo on their gold sourcing.

3.4 Italy

Italy is a historic centre of gold refining, servicing the luxury goods sectors in the region (Italy, Switzerland, France, for example) but also specialising in gold refining for industrial applications.

Table 8 Refiners of gold in Italy

Company	Capacity (tons/year)	Ownership	Revenue 2021 (USD bln)
---------	----------------------	-----------	------------------------

TCA	220	Privately owned	1.0
Chimet	70	Privately owned	0.003
8853	Unknown	Privately owned	Unknown
Faggi Enrico	Unknown	Privately owned	Unknown
Italpreziosi	Unknown	Privately owned	Unknown
Safimet	Unknown	Privately owned	Unknown

Notes: TCA revenue is for 2020; Revenues for Chimet and TCA have been converted to USD from EUR using the rate on 31 December 2021 and 2020, respectively.

Source: Company websites and 2021 financial statements.

All of the refineries in Italy are privately owned (Table 8), and have very little information about their operations online or in company publications. Additionally, with the exception of Safimet, none of the companies responded to requests by Profundo for further information on the origins of gold.

- **TCA**

TCA is specialized in the recovery of gold, silver, platinum, palladium and rhodium from ashes and rods. Their main plant is in Capolana, near Arezzo in Tuscany, and has an annual productive capacity of 2,000 tons of ashes, 220 tons of pure gold and over 400 tons of silver.⁸⁰

TCA has not responded to requests for information from Profundo on their gold sourcing.

- **Chimet**

Chimet is an Italian company which has as its core business the activity of refining and recovering precious metals. The company has two production site in the province of Arezzo in Tuscany, and is privately owned by the Squarcialupi family. In 2020, Chimet recorded the highest earnings in its history: more than 3 billion euros (\$3.4 billion) – a 76% increase over the previous year.⁸¹

A 2021 investigation by the Brazilian Federal Police revealed that Chimet sourced gold from a company called CHM, owned by father-son duo Mauro Dogi and Giacomo Dogi, who live in Brazil and are being investigated for illegal gold trading. CHM allegedly bought the gold from Cooperouri, a cooperative of miners operating illegally in the Kayapo Indigenous Territory.⁸²

Chimet's 2022 audit report on responsible gold states that in 2021, Chimet suspended commercial relationships with two suppliers and plan an audit with a third supplier due to high-risk volumes of gold coming from Brazil (without specifying where this information came from, nor who the suppliers are).⁸³ It is not clear whether one of these suppliers is CHM.

Chimet has not responded to requests for information from Profundo on their gold sourcing.

- **8853**

A company with its seat and factory in Milan, 8853 offers a range of products for the industrial, electronic, medical, aeronautical and automotive sectors. 8853 is part of the Banco Villa Group, a family-run precious metals trader in Milan.⁸⁴ There is little information about the privately owned company It is likely at least partly owned by the founder's son Giorgio Villa, who is today the CEO of the company.⁸⁵

8853 has not responded to requests for information from Profundo on their gold sourcing.

- **Faggi Enrico**

Faggi Enrico S.P.A. is headquartered in Florence, and specialises in the production, recovery and refining of fine chemicals and catalysts, and the trading of precious metals. The Company provides metals such as gold, silver, platinum, osmium, and other precious metals.⁸⁶

Faggi Enrico has not responded to requests for information from Profundo on their gold sourcing.

- **Italpreziosi**

Italpreziosi was founded in 1984 and is a main operators in the production, refining and trading of precious metals, production and trade of investment gold based in the province of Arezzo in Tuscany. Italpreziosi also owns shares in companies with mines in South America.⁸⁷

Italpreziosi founded Goldlake IP in 2008, which sells 'ethical gold' exclusively to Cartier sourced directly from the mine.⁸⁸

Italpreziosi has not responded to requests for information from Profundo on their gold sourcing.

- **Safimet**

Safimet is a relatively new company, founded in 2000 and having established its plant in 2014 in Sandrigo, Vicenza. In 2018, it also opened Safimet Brazil, a company "with the aim of locally managing the increase in requests received, to select and evaluate the possibilities of implementation and development."⁸⁹

Safimet responded to requests for information by Profundo on their gold sourcing, stating that they do not source gold from Brazil, though they have operations in the country related to other sectors.⁹⁰

4

Manufacturers using gold

In 2021, the estimated global consumption of refined gold for non-financial uses was 30% for jewellery and 6% for electrical and electronics products.⁹¹ Given that jewellery and consumer electronics are the most consumer-facing industries, this section will focus on these two sectors and the potential links the top companies involved may have with gold from Brazil.

4.1 Consumer electronics

As a highly efficient and reliable conductor of electricity, gold is an integral aspect of the manufacture of electronic products. Small traces of gold can be found in virtually all electronic devices, even microwaves.⁹²

Though there is some pressure from alternative minerals and cheaper fabrication, the demand for this application of gold has been rising due to the general increasing consumption of electronics and important sectors shifting towards electrification. One example is the electric automotive industry, where gold remains the preferred metal for wire bonding, as vehicle electronics have tight safety and reliability requirements, which tend to outweigh material cost considerations.⁹³

Though there are endless applications for gold in electronics, the major consumer-facing products are undoubtedly phones, computers, tablets and sound systems, all of which are produced largely by the top consumer electronics multinationals. These companies are far downstream in the minerals supply chain, and manufacture their products using refined gold or in some cases ready-made component parts purchased from third-party companies.

The top five consumer electronics companies in the world in 2021 are Apple, Microsoft, Samsung, Intel and Sony (Table 9). All of these companies respond to the SEC requirement of disclosing on the origins and direct/indirect suppliers of “conflict minerals” (or “3TG”) defined as gold, tin, tantalum and tungsten. In these reports, all known smelters and refiners in the supply chain of a company, whether supplying conflict minerals directly or indirectly, must be reported.

Table 9 Top five consumer electronics companies and revenues 2021

Company	Headquarter	Revenue (USD bil)
Apple	USA	365.8
Samsung	South Korea	244.4
Microsoft	USA	168.1
Intel	USA	79.0
Sony	Japan	7.8

Note: Revenue for Sony is converted to USD from JPY using rate on 31 December 2021.

Source: Value.Today (2022) *World Top Consumer Electronics Companies List by Market Cap as on Jan 7th, 2022*; company websites and 2021 financial statements.

- **Apple**

Apple is by far the largest consumer electronics company in the world by sales. In 2021, the company brought in USD 365 billion in net sales, over half of which is from their iPhones.⁹⁴ It reports that it has stopped buying from 163 smelters and refiners since 2009, 85 of which were supplying gold.⁹⁵ Apple does not disclose which suppliers have been suspended.

- **Samsung**

Samsung, the South Korean electronics conglomerate, ranks second in revenue among consumer electronics companies worldwide. In 2020, Samsung requested a contract suspension with all suppliers sourcing gold from Heraeus Precious Metals (Germany) and Umicore Brasil (Brazil) due to lack of certification.⁹⁶ Despite suspending suppliers for non-compliance, Samsung has been sourcing from an increasing number of gold suppliers since 2016, more so than for any other mineral (Table 10).

Table 10 Number of smelters within the supply chain, 2016-2021

	2016	2017	2018	2019	2020
Tantalum	46	42	40	40	38
Tin	75	71	73	76	53
Tungsten	38	41	41	41	42
Gold	95	101	104	104	107
Cobalt	-	-	-	30	27

Source: Samsung (2021) *Responsible Minerals Report 2021*, p.10.

- **Microsoft**

Another American mammoth of the technology industry, Microsoft also discloses sourcing from many of the same smelters and refiners in Canada, Switzerland, Italy and Brazil as its peers. Unlike its above peers, however, Microsoft does not disclose if suppliers have been suspended from the supply chain.

- **Intel**

Intel, an American multi-national company and the largest semiconductor chip manufacturer in the world, sources gold from a total of 117 suppliers. It reports that in 2021 and 2022, four suppliers became non-conformant and have been or are in the process of being removed from their supply chain: AU Traders and Refiners (South Africa), Kyrgyzaltyn JSC (Kyrgyzstan), Yunnan Yunfan Non-ferrous Metals Co. (China) and Gejiu Kai Meng Industry and Trade (China).⁹⁷

Table 11 Number of smelters and refiners (SORs) in Sony supply chain 2021

	Total Number of SORs	Conformant SORs	Not listed as Conformant SORs
Gold	173	109	64
Tantalum	36	36	0
Tin	81	64	17
Tungsten	49	46	3
Grand Total	339	255	84

Source: Sony (2021) *Conflict Minerals Report 2021*, p.7.

- **Sony**

Sony is a Japanese multi-national media and technology conglomerate and famous producers of the video game console Playstation, and has its primary manufacturing facilities in Asia.⁹⁸ Sony sources from a total of 173 smelters and refiners around the world, 63% of which it reports as being conformant with Sony minerals policy and requirements (Table 11). Gold has the lowest compliance record of all the conflict minerals that Sony sources.

According to the companies' conflict minerals disclosures in 2021, they are all sourcing from gold refineries in Brazil, Canada Switzerland and Italy (Table 12). None of these companies is sourcing from the UK. The fact that the supplier lists look more or less the same is not surprising given that there are relatively few refiners of gold in the world, and that trade happens between all the major players. Additionally, Canada, Switzerland and Italy in particular are important centers for specialized gold refining.

Table 12 Gold refiners in top consumer electronics companies supply chains 2021

Refiners (Group) / Manufacturers	Country	Apple	Microsoft	Samsung	Intel	Sony
AGA Mineração (AngloGold Ashanti)	Brazil	Yes	Yes	Yes	Yes	Yes
Umicore Brasil (Umicore)	Brazil			*		
Marsam Refinadora de Metais	Brazil	Yes	Yes	Yes	Yes	Yes
Casa da Moeda do Brazil - CMB	Brazil					
Asahi Refining Canada	Canada	Yes	Yes	Yes	Yes	Yes
Vale Canada	Canada					
CCR Refinery (Glencore)	Canada	Yes		Yes	Yes	Yes
Royal Canadian Mint	Canada	Yes	Yes	Yes	Yes	Yes
Teck Resources	Canada					
Valcambi	Switzerland		Yes	Yes	Yes	Yes
Cendres + Métaux	Switzerland	Yes	Yes	Yes	Yes	Yes
MKS PAMP	Switzerland	Yes	Yes	Yes	Yes	Yes
PX Précinox	Switzerland	Yes	Yes	Yes	Yes	Yes
Metalor Technologies (Tanaka Kikinzoku)	Switzerland	Yes		Yes	Yes	Yes
Argor-Heraeus (Heraeus Holding)	Switzerland	Yes	Yes	Yes	Yes	Yes
Baird & Co	UK					
The Royal Mint	UK					
Betts Refining	UK					
Chimet	Italy	Yes	Yes	Yes	Yes	Yes
Italpreziosi	Italy	Yes	Yes	Yes	Yes	Yes
Safimet	Italy	Yes	Yes	Yes	Yes	Yes
TCA	Italy	Yes	Yes	Yes	Yes	Yes

Refiners (Group) / Manufacturers	Country	Apple	Microsoft	Samsung	Intel	Sony
8853	Italy	Yes	Yes	Yes	Yes	Yes
Faggi Enrico	Italy					

Note: Samsung previously sourced from Umicore Brasil before suspending them throughout their supply chain.

Source: Company 2021 Conflict Mineral Reports.

4.2 Jewellery and watchmakers

Downstream companies in the luxury goods industry typically rely on complex supply chains to produce each piece of jewellery or watch. Gold, diamonds, and other minerals and gemstones are traded, exported, and processed in countries outside of their country of origin, and are then transformed into jewellery in manufacturing plants and artisan workshops, before reaching retailers. Given the lack of transparency requirements in the industry at large, by the time a piece of jewellery is offered for sale, it is virtually impossible to know the origins of the materials within.

Additionally, the luxury goods market is extremely consolidated, with most of the major brands held under a handful of European umbrella companies including LVMH, Dior, Hermes, Kering and the Swatch Group.⁹⁹ Reporting on responsible sourcing at this level is sparse, and for this reason this section focuses on a handful of the most notorious jewellery and watch brands in Europe and the US which have previously garnered attention for their sourcing of conflict minerals and gemstones.¹⁰⁰

Table 13 Jewellery and watchmakers reviewed in this report, revenue 2021

Retailer	Headquarter	Ownership	Revenue 2021 (USD bln)	Source
Rolex	Switzerland	Private	8.73	101
Tiffany & Co	USA	LVMH, public company	3.66	102
Bulgari	Italy	LVMH, public company	0.48	103
Boodles	UK	Private	0.07	104
Chopard	Switzerland	Private	0.02	105

Notes: None of the revenues above have been reported by the companies themselves; all are estimates from media and market reports which have been referenced directly in the table. Bulgari revenue is estimated for 2018; Revenues for Chopard, Rolex and Boodles have been converted from GBP, CHF and GBP, respectively, to USD using the rate on 31 December 2021; Revenue for Bulgari has been converted from EUR to USD using the rate on 31 December 2018.

Source: references in column 'Source'.

- **Rolex**

Rolex was created in 1905 by a British man, and was moved a decade later to Switzerland to set up a company which would create some of the greatest innovations in watch-making, including the first waterproof wristwatch.¹⁰⁶ Rolex has no reporting at all regarding its raw materials, and has in two previous research efforts been unavailable to provide any context into its gold supply chain.¹⁰⁷

- **Tiffany & Co**

One of the most iconic jewellery companies of the world, Tiffany & Co was established in 1837 in New York, USA. It has since its inception been part of the innovation and history of American jewellery and watchmaking. It was incorporated into the LVMH Group based in France in 2021. Tiffany reports that 60% of its jewellery is made at Tiffany & Co. manufacturing facilities in New York, Kentucky and Rhode Island, while some assembly and polishing is done in the Dominican Republic. In addition, Tiffany's has over 400 suppliers across 36 countries, approximately one third of which are in the U.S., followed by Switzerland, Italy, China and India.¹⁰⁸

Figure 3 Tiffany & Co.'s Precious Metals Traceability

Percentage raw direct metals traceable to mine	The weight in troy ounces, expressed as a percentage, of raw silver, gold and platinum procured directly from a mine during the period February 1, 2020 to January 31, 2021 by Laurelton Sourcing, LLC, (a wholly owned subsidiary of Tiffany & Co.), for the Tiffany & Co. manufacturing facilities. Procurement is as indicated by either (1) the contractual terms with the supplier, which require metals to be purchased from a specific mine(s) or if unavailable (2) the details listed on the invoice received.	Total Raw Direct Precious Metals Traceable to Mine – 46% Silver – 49% Gold – 16% Platinum – 70%
Percentage raw direct metals traceable to recycler	The weight in troy ounces, expressed as a percentage, of raw silver, gold and platinum procured directly from a precious metals refiner whose output is recycled metal during the period February 1, 2020 to January 31, 2021 by Laurelton Sourcing, LLC (a wholly owned subsidiary of Tiffany & Co.), for the Tiffany & Co. manufacturing facilities. Procurement is as indicated by either (1) the details listed on a chain of custody material transfer document received from the supplier, or if unavailable (2) a statement on the recycler's website as of January 31, 2020 and January 31, 2021 stating that the metal is 100% recycled.	Total Raw Direct Precious Metals Traceable to Recycler – 54% Silver – 51% Gold – 84% Platinum – 30%

Source: Tiffany & Co (2020) *Sustainability Performance and Metrics*, p.23.

Like other jewellery companies, Tiffany & Co. does not divulge much information about its gold supply chain or origins. Its *Sustainability Goals Progress Report* for 2020 states that approximately 68% of all gold, silver and platinum used in jewellery were traceable to mine or recycler.¹⁰⁹ A separate report, the *2020 Sustainability Performance and Metrics*, breaks down the traceability figure, and shows that traceability to mine of gold for manufacturing is in fact only 16% of totally volumes sourced, and 84% for recycled gold material (Figure 3).¹¹⁰

- **Bulgari**

Another historic brand founded in 1884, Bulgari is an Italian jewellery and watch-making company, also owned by the LVMH Group. It claims that as of 2022, it only uses gold that comes from sources that are traceable and certified by the Responsible Jewellery Council (RJC) both in its jewellery and watch collections.¹¹¹ Bulgari claims all its gold can be traced to two mines,¹¹² however, there is no information available about the origins of this traceable gold. Moreover, a 2018 Human Rights Watch assessment of gold in the jewellery industry found that RJC's governance, standards, and system of audits are flawed, allowing companies to be RJC-certified even if they fail to meet basic human rights standards.¹¹³

Sales of jewellery and watches at LVMH surged 167% in 2021 amid Tiffany & Co.'s first year within the group and a strong performance at the conglomerate's other brands. Revenue from the segment soared to EUR 8.96 billion (USD 10.11 billion) as Tiffany's sales reached "record" levels according to an LVMH source.¹¹⁴

- **Boodles**

The oldest of the jewellery and watch companies reviewed here, Boodles was established in Liverpool, England in 1798 by the Kirk family at a time when the city was a booming trade centre. It is still family-owned to this day.¹¹⁵ Boodles claims that all gold it sources is "Single Mine Origin", meaning it is produced and mined from one single mine and plant, and traded segregated. Certified "Single Mine Origin" sources gold from a mine in Mali owned by Hummingbird Resources, and a mine in Cote d'Ivoire owned by Endeavor, and traded via Betts Refining, and two jewellery casters in the UK (VipaO Designs and Brian Fulton).¹¹⁶

- **Chopard**

Chopard was first established in 1860 as a high-precision watch manufacturer in Switzerland specialising in pocket-watches and chronometers, and has since grown into one of the most prestigious brands in the world. Chopard has its own gold foundry which enables it to guarantee the origin of the gold used which it claims to be “100% ethical gold.”¹¹⁷ Chopard defined this as either gold mined from artisanal sources in Peru and Colombia, or gold from RJC Chain of Custody-certified refineries.¹¹⁸ There is no further information on the origins of the latter, and Chopard claimed that in 2021: “[...] no risks have been confirmed through enhanced due diligence that would trigger the implementation of a risk management plan.”¹¹⁹

4.3 Electric vehicles

Gold is used in the circuit boards of electric vehicles (EVs). Because gold offers conductivity advantages over other metals, it remains the preferred metal for wire bonding in EVs, which need to meet strict safety regulations.¹²⁰ Although gold is only used in small quantities, the strong demand for electric vehicles boosts gold demand for electronics.¹²¹

Indeed, the global electric vehicle market has grown rapidly over the past years and is expected to accelerate exponentially. Global EV sales grew by 43% and 108% between 2019-20 and 2020-21, respectively.¹²² It is forecasted that by 2035 all new cars sold in Europe are electric, and by 2040 the rest of the world.¹²³ Currently, there are two types of plug-in electric vehicles: battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV).¹²⁴ BEV is the only zero-emission vehicle and is the largest growing segment. Manufacturers such as Volkswagen and BMW produce both models, next to conventional internal combustion engine (ICE) vehicles, while Tesla only produces BEVs.

Table 14 shows the top 12 electric vehicle companies, based on market capitalization as of July 2022 and ranked by revenue 2021. Only five of these companies are registered with the SEC and must thus adhere to the requirement of disclosing the use of “conflict minerals”, defined as gold, tin, tantalum and tungsten (or “3TG”). In these reports, all known smelters and refiners in the supply chain of a company, whether supplying 3TG directly or indirectly, must be reported.¹²⁵ Volkswagen does not file a conflict minerals report with the SEC, but publishes origins of minerals used in its Responsible Raw Materials Report.¹²⁶

However, two out of five conflict minerals reports filed with the SEC do not disclose the information on origins and are therefore not fully adhering to the SEC requirements for reporting on conflict minerals. These are from Toyota and Stellantis. As a result, the remainder of this section will focus on the EV companies that adequately reported on the origins of gold used in their vehicles produced, which are Volkswagen, Ford, General Motors and Tesla.

Table 14 Top 12 electric vehicle companies, revenues 2021 and mineral reporting

Company	Headquarter	Revenue (USD bil)	Market cap as of July 2022 (USD bil)	Files SEC Conflict Minerals Report?	Reports origins of gold sourced?
Volkswagen Group	Germany	283.33	91.61	No	Yes
Toyota	Japan	223.21	212.93	Yes	No
Mercedes-Benz	Germany	190.21	58.8	No	No
Stellantis	Netherlands	169.20	38.43	Yes	No
Ford	USA	136.34	44.58	Yes	Yes
General Motors	USA	127.00	45.01	Yes	Yes

Company	Headquarter	Revenue (USD bil)	Market cap as of July 2022 (USD bil)	Files SEC Conflict Minerals Report?	Reports origins of gold sourced?
BMW	Germany	125.97	48.08	No	No
Tesla	USA	53.82	728.61	Yes	Yes
Volvo	Sweden	41.13	34.07	No	No
BYD	China	33.15	124.19	No	No
NIO	China	5.67	34.36	No	No
Li Auto	China	4.24	36.02	No	No

Note: Revenue for Toyota was converted from JPY to USD using conversion rate from 31 March 2022; revenue for BYD was converted from CNY to USD using conversion rate from 31 December 2021; revenues for Volkswagen, Mercedes-Benz, BMW and Stellantis were converted from EUR to USD using conversion rate from 31 December 2021; Revenue for Volvo was converted from SEK to USD using conversion rate from 31 December 2021.

Sources: Company annual reports and financial statements 2021; Companies Market Cap (2022, July), "Largest electric vehicle companies by Market Cap", online: <https://companiesmarketcap.com/electric-vehicles/largest-ev-companies-by-market-cap/>; McKinley, P. (2022, April 16), "The 15 Largest EV Companies in the World", online: <https://history-computer.com/largest-ev-companies-in-the-world/>; Carlier, M. (2022, April 28), "Plug-in electric vehicle sales market share by producer 2021", *Statista*, online: <https://www.statista.com/statistics/541390/global-sales-of-plug-in-electric-vehicle-manufacturers/>; SEC.gov (n.d.), "EDGAR search", online: <https://www.sec.gov/edgar/search/#/q=conflict%2520mineral%2520report>, viewed in August 2022.

- **Volkswagen**

Volkswagen Group ranks among the largest automotive companies globally and delivered almost 453,000 all-electric and 309,000 hybrid vehicles to customers in 2021.¹²⁷ The Group's global market share in EVs is around 11%, based on 2021 sales (units), ranking second.¹²⁸ Volkswagen Group reports that it has identified Country of Origin data for over 80% of its 3TG smelters, of which almost 69% were conforming with the Responsible Minerals Assurance Process (RMAP).¹²⁹ Volkswagen does not disclose that suppliers have been suspended, but states that it chose direct supplier engagement and capacity building as the most suitable mitigation measures.¹³⁰

- **Ford**

Ford is another automotive company that positions among the largest globally. The company sold 27,000 units of its first fully electric vehicle in 2021 and introduced 2 new models in the beginning of 2022 which are driving EV sales up.¹³¹ Ford reports that in 2021, 77% of its 3TG suppliers provided information on smelters and refiners, resulting in a potential 65% of gold smelters and refiners in its supply chain conformant with a 3rd party responsible mineral sourcing validation program.¹³² Ford's sourcing policy mandates suppliers to use smelters and refiners that are conformant to a 3rd party responsible mineral sourcing program. The company does not indicate that suppliers have been suspended. The company focuses on activities such as capacity building, engagement with suppliers, and direct inquiry to smelters and refiners.¹³³ Ford discloses sourcing from the same selected gold smelters and refiners as Volkswagen.

- **General Motors**

General Motors is among the largest automotive companies worldwide and has been a leader in the development of electric vehicles.¹³⁴ In 2021, General Motors sold more than 516,000 plug-in electric vehicles, reaching an EV global market share of over 7%.¹³⁵ The company reports that it first attempts to work directly with a supplier in case of issues, but if necessary, suppliers can be suspended if the issue remains unsolved.¹³⁶ However, General Motors does not disclose if suppliers have been suspended. For 2021, the company received information on conflict minerals from 94% of its 3TG suppliers.¹³⁷ General Motors discloses sourcing from the same selected gold smelters and refiners as Volkswagen and Ford.

- **Tesla**

Tesla is ranked as the best-selling electric vehicle company globally, selling more than 936,000 EVs in 2021, and capturing an EV global market share of almost 14%.¹³⁸ Moreover, the company is by far outperforming the largest automotive companies based on market capitalization (see Table 14). Tesla reports it requires suppliers to only source from smelters and refiners validated by the Responsible Minerals Assurance Process (RMAP) or an equivalent program. When suppliers with non-conformant smelters or refiners are detected, they are required to transition to a fully conformant supply chain immediately.¹³⁹ However, Tesla does not disclose if suppliers have been suspended. For 2021, the company reached a response rate of around 85% from its 3TG suppliers.¹⁴⁰ Tesla discloses sourcing from the same selected gold smelters and refiners as Volkswagen, Ford and General Motors.

Table 15 Gold refiners in top electric vehicle companies' supply chains 2021

Refiners (Group) / Manufacturers	Country	Volkswagen	Ford	General Motors	Tesla
AGA Mineração (AngloGold Ashanti)	Brazil	Yes	Yes	Yes	Yes
Umicore Brasil (Umicore)	Brazil				
Marsam Refinadora de Metais	Brazil	Yes	Yes	Yes	Yes
Casa da Moeda do Brazil - CMB	Brazil				
Asahi Refining Canada	Canada	Yes	Yes	Yes	Yes
Vale Canada	Canada				
CCR Refinery (Glencore)	Canada	Yes	Yes	Yes	Yes
Royal Canadian Mint	Canada	Yes	Yes	Yes	Yes
Teck Resources	Canada				
Valcambi	Switzerland	Yes	Yes	Yes	Yes
Cendres + Métaux	Switzerland	Yes	Yes	Yes	Yes
MKS PAMP	Switzerland	Yes	Yes	Yes	Yes
PX Précinox	Switzerland	Yes	Yes	Yes	Yes
Metalor Technologies (Tanaka Kikinzoku)	Switzerland	Yes	Yes	Yes	Yes
Argor-Heraeus (Heraeus Holding)	Switzerland	Yes	Yes	Yes	Yes
Baird & Co	UK				

Refiners (Group) / Manufacturers	Country	Volkswagen	Ford	General Motors	Tesla
The Royal Mint	UK				
Betts Refining	UK				
Chimet	Italy	Yes	Yes	Yes	Yes
Italpreziosi	Italy	Yes	Yes	Yes	Yes
Safimet	Italy	Yes	Yes	Yes	Yes
TCA	Italy	Yes	Yes	Yes	Yes
8853	Italy	Yes	Yes	Yes	Yes
Faggi Enrico	Italy				

Sources: Company 2021 Conflict Mineral Reports; Volkswagen Group (2022), *Responsible Raw Materials Report 2021*, p.36, 37.

5

Conclusions

Despite the difficulty in researching the trade of gold around the world, this research resulted in some key takeaways which can support advocacy for better, more transparent gold supply chains in the future.

Gold traceability is among the hardest to achieve for all commodities, despite there being requirements for disclosures in key sectors like consumer electronics. A large part of the reason that gold is difficult to trace is by its very nature – a high-value, low-volume, hyper-manipulated, intensely circulated and imperishable commodity makes it an easy target for smuggling and illegality. Add to this the secrecy, corruption and lack of demand for transparency throughout the supply chain, tracing specifically the movements of gold around the world becomes virtually impossible to achieve without corporate cooperation.

Yet, it is still possible to confirm that all examined consumer electronics companies (Apple, Samsung, Microsoft, Intel and Sony) and electric vehicle manufacturers (Volkswagen, Ford, General Motors, Tesla) are sourcing gold from Brazil. Of their traceable origins, they are sourcing gold from AGA Mineracao (owned by South African mining company AngloGold Ashanti) and Marsam Refinadora, a Brazilian integrated refinery.

The luxury goods sector is extremely opaque for all raw materials, but especially gold. Virtually none of the jewellery or watch companies make any effort to disclose where their raw materials are coming from, nor how much is going into the manufacture of their products. The same conclusion has been made in past research efforts on gold in the sector.¹⁴¹ Yet, given that most of these companies are located in Europe and the prevalence of refineries in Switzerland and Italy, it is clear that links are likely to exist, which in turn may have supply chain links with Brazil.

In our process of due diligence, we contacted refineries in Brazil and in top importing refineries, and found that most did not respond to our request for further information or pointed to business confidentiality. Where companies did respond, they either denied exporting to the countries we researched, or they denied trading with Brazil. While these claims are possible, they are also impossible to verify without further concrete disclosures by companies.

Perhaps it is time to turn around burden of proof: can these companies prove that they are not linked to potentially illegal flows of gold from Brazil?

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Appendix 1 Trade of Brazilian gold: Exports recorded by Brazil 2000-2020

Source: UN Comtrade (2022).

Export destinations	2000	2005	2010	2015	2020
Canada	-	1	1	7	41
Switzerland	1	0	14	20	20
United Kingdom	1	2	22	19	11
United Arab Emirates	-	0	4	6	7
Italy	-	-	-	0	5
India	-	-	-	10	5
Belgium	-	-	-	1	4
USA	37	27	5	6	2
Turkey	-	-	-	-	1
Germany	2	-	-	0	1
China, Hong Kong SAR	-	-	-	1	1
South Africa	-	-	-	-	0
Israel	-	-	-	-	0
Argentina	-	-	0	-	-
Andorra	-	-	-	0	-
Uruguay	-	0	-	-	-
Peru	-	-	-	0	-
Portugal	-	-	-	-	-
Other Asia, nes	-	-	-	-	-
Grand Total	42	30	46	69	98

Appendix 2 Trade of Brazilian gold: Imports recorded by all countries, 2000-2020

Source: UN Comtrade (2022)

Importing countries	2000	2005	2010	2015	2020
Canada	-	1	3	6	32
Switzerland	-	-	-	22	17
United Kingdom	1	1	-	19	14
United Arab Emirates	-	3	3	8	8
Italy	2	-	0	0	8
India	-	-	-	9	5
USA	40	11	4	4	4
Belgium	-	-	-	5	3
Turkey	-	-	1	1	2
Germany	3	-	-	0	1
China, Hong Kong SAR	-	-	-	1	1
France	-	-	-	-	0
Portugal	-	-	-	-	0
Spain	-	-	-	-	0
Kuwait	-	-	0	-	-
Rep. of Korea	1	-	-	-	-
Peru	-	0	-	-	-
Saudi Arabia	14	-	-	-	-
Thailand	0	0	1	-	-
Singapore	-	-	-	1	-
Malaysia	-	-	-	0	-
South Africa	0	-	-	-	-
China	-	-	-	0	-
Qatar	-	-	0	-	-
Japan	2	0	-	-	-
Grand Total	63	16	12	78	93

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