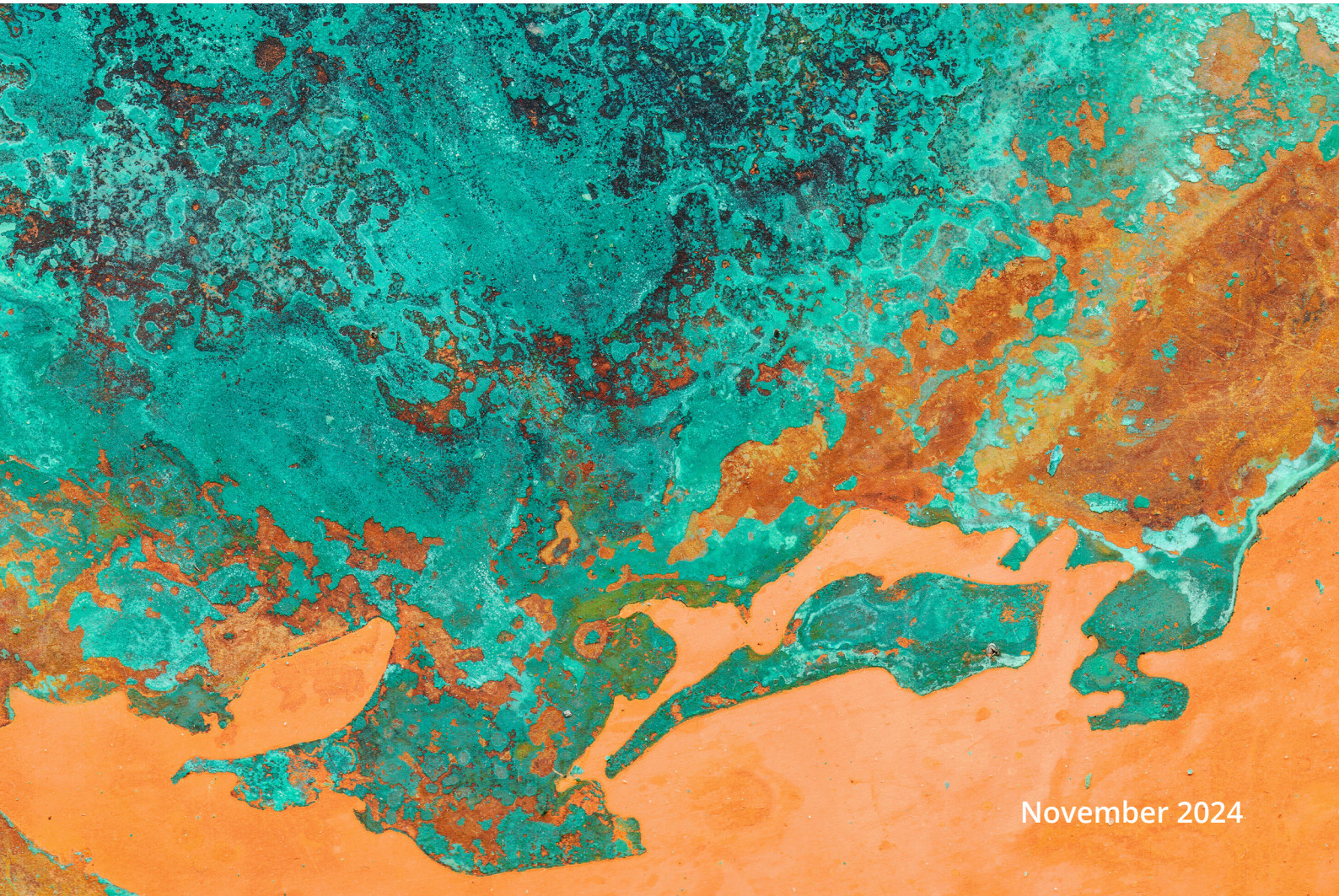


Mining for Trouble

Deep sea mining poses a
high risk to mining economies



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Executive summary

While proponents of deep sea mining argue it is needed to meet future demand for energy transition minerals, questions are beginning to be asked about the economic risk deep sea mining could pose to countries that mine these metals on land. By analysing the 12 biggest countries mining copper, cobalt, nickel and manganese, this report aims to highlight the value at risk to these economies if deep sea mining was to be green lit.

There is growing evidence that deep sea mining could cause significant negative irreparable damage to deep sea ecosystems,¹ and could be more carbon intensive than terrestrial mining.² While these environmental costs are often framed as being outweighed by financial benefits, previous Planet Tracker research has highlighted that deep sea mining would generate very little value in taxes or royalties for the 169 International Seabed Authority (ISA) Member States. In addition, new technologies and circular economy strategies increasingly mean that deep sea mining may not be required to meet future critical mineral demands for the low carbon transition.

Over \$560 billion in export earnings at risk from deep sea mining

If deep sea metals were to enter the market, global prices of copper, cobalt, nickel and manganese could decline. This report found that these four commodities contributed on average over USD \$560 billion in export earnings per year (2018 – 2022) in total for the 12 countries most economically dependent on mining these metals. Export earnings from these four metals equate to 5% or more of total national export earnings and GDP for these countries.

Across all 12 countries, export earnings from copper, cobalt, manganese and nickel made up on average 39% of total average annual export earnings from 2018 – 2022. Even a small reduction in the price of these commodities could trigger significant reductions in government revenues as well as other negative economic and social impacts, such as increases in unemployment and economic slowdown.

Many of the countries most at risk are lower income and more vulnerable

Five of the 12 countries identified in this analysis were categorised by the World Bank as lower middle income in 2023 (Congo, Georgia, Mongolia, Papua New Guinea and Zambia) and one (DRC) was categorised as low income. These countries are likely to be less well equipped to deal with the negative economic impacts that deep sea mining-related price shocks may bring.

A significant proportion of national GDP is at risk

On average, export earnings from all four metals were equivalent to 16% of GDP per year across all 12 countries from 2018 – 2022. For Zambia and DRC, export earnings from these metals were equivalent to 38% and 34% of GDP respectively over this period. This highlights the significant potential for deep sea mining to negatively impact countries' overall economic development.

All of this represents only a fraction of the total direct economic benefits that mining these metals brings to governments, such as tax income and employment. However, it is important to highlight that terrestrial mining also brings significant negative social, economic and environmental impacts and challenges, from poor labour conditions and human rights abuses to habitat destruction and pollution and more needs to be invested in tackling these issues.

Call to action

Deep sea mining could have significant negative economic impacts on countries that export cobalt, copper, nickel and manganese, on top of causing large-scale environmental damage.

Financial institutions should therefore support [*a moratorium on deep sea mining.*](#)

Instead, financial institutions should support the improvement of the social, economic, and environmental governance of terrestrial mining, which will continue regardless of whether deep sea mining takes place.



Introduction

While proponents of deep sea mining argue it is needed to meet future demand for critical minerals, there are questions over whether it could pose a significant economic risk to countries that mine these metals on land. This research analysed the 12 biggest countries exporting copper, cobalt, nickel and manganese and aims to highlight the value at risk to these economies if deep sea mining were to take place.

There is increasing evidence that deep sea mining could have significant negative impacts on deep sea ecosystems³ which are technically and financially impossible to restore,⁴ and could be more carbon intensive than mining on land.^{5 6} While these environmental costs are often framed as being outweighed by financial benefits, previous Planet Tracker research has highlighted that deep sea mining would generate very little value in taxes or royalties for the 169 International Seabed Authority (ISA) Member States.

There is also increasing evidence that deep sea mining is not necessary to meet the critical mineral demands of the low-carbon energy transition and that new technologies and circular economy strategies will reduce the need for raw materials.⁷ For example, lithium iron phosphate (LFP) batteries which contain neither cobalt nor nickel now make up 40% of electric vehicle sales and remain significantly cheaper than traditional NMC batteries.⁸ Leading battery manufacturers such as BYD,⁹ CATL¹⁰ and Northvolt¹¹ have also announced expansion plans for sodium-ion batteries which could cost up to 20%¹² less than current mainstream technologies and do not contain cobalt, nickel or copper.

The potentially negligible economic benefits and significant environmental risks that of deep sea mining along with the questionable need for deep sea mining in the first place has contributed to the growing opposition to these activities, with companies, investors, national governments, scientists and civil society organizations calling for a moratorium on deep sea mining.

Purpose, methodology and scope of this report

This report aims to analyse the economic benefits and risks countries may be exposed to from deep sea mining. The analysis focuses on the impact of mining polymetallic nodules in the Clarion-Clipperton Zone (equatorial eastern Pacific), as this has received the most commercial attention to date and is currently the most likely area to be mined in international waters.

This paper provides a practical working resource for financial institutions to understand and assess their exposure to the key financial risks associated with deep sea mining from a sovereign perspective. The analysis and recommendations are intended for financial institutions with exposure to deep sea mining activities and countries that may be negatively impacted by deep sea mining, as well as those seeking to support the transition towards a more sustainable economy.

Which terrestrial mining countries are most at risk from deep sea mining?

Deep sea mining could cause significant negative economic impacts to countries that mine copper, cobalt, nickel and manganese, the main metals that could be produced from mining deep sea polymetallic nodules. If deep sea metals were to flood the market, global prices of these commodities could decrease driven by excess supply in comparison to demand or by reducing supply tensions. This could in turn reduce the volume of exports and export earnings generated by these metals, cutting income for governments of producer countries and a string of other negative effects such as increases in unemployment, and economic slowdown.¹³

Less economically developed States are particularly at risk and, the UN Convention on the Law of the Sea (UNCLOS) requires the International Seabed Authority (ISA) to develop a payment regime that compensates developing economies that for revenue losses caused by deep sea mining, as well as other negative economic impacts caused by land-based mining.¹⁴

Identifying mining countries at risk of negative economic impacts

This study used the following criteria to identify which States are most at risk from negative economic impacts of deep sea mining, taking into account the latest five year period for which data is available from CEPII's BACI Database (based on the Comtrade Database) from 2018 – 2022:

- An average annual combined absolute value of exports of all four metals of over USD \$100 million;
- Very highly dependent: All four metals make up 15% or more of export earnings and GDP annually on average;
- Highly dependent: All four metals make up 5% - 14% of export earnings and GDP annually on average;

For more details on the methodology used in this study, please see Appendix A.

Through this, our analysis has highlighted 12 countries that are highly to very highly economically dependent on the four metals that could be produced from polymetallic nodule mining, as outlined in Table 1 below. The ISA commissioned a study in 2020 which also identified 12 countries most likely to be affected by polymetallic nodule mining.⁹ Of the 12 countries identified in this report, seven also feature on the ISA's list: Zambia, Democratic Republic of Congo (DRC), Chile, Mongolia, Peru, Gabon, Namibia and Papua New Guinea.

Table 1: An overview of countries that are highly - very highly economically dependent on copper, cobalt, nickel and manganese mining and exports. Source: Planet Tracker analysis based on data from CEPII's BACI Database.

Country	Metals exports average annual value 2018 - 2022 (USD)	Value of metals export earnings as a % of total export earnings	Value of metals export earnings as a % of GDP
Chile	\$240Bn	47.8%	14.5%
DRC	\$105Bn	79.0%	34.2%
Peru	\$88Bn	28.7%	6.8%
Zambia	\$51Bn	71.4%	37.5%
Congo	\$16Bn	24.1%	20.0%
Mongolia	\$14Bn	24.4%	16.6%
New Caledonia	\$12Bn	96.6%	21.5%
Gabon	\$9Bn	17.3%	9.0%
Papua New Guinea	\$8Bn	9.6%	5.3%
Georgia	\$7Bn	25.2%	6.8%
Armenia	\$6Bn	25.4%	7.0%
Namibia	\$5Bn	14.0%	7.5%

The next section will highlight key findings from our analysis and will explore some of the key risks that deep sea mining could pose to these 12 economies.

How much is at risk for countries mining metals on land?

Over \$560 billion in export earnings at risk from deep sea mining

In total, this report has found that copper, cobalt, nickel and manganese contributed on average over USD \$560 billion in export earnings in total annually for all 12 countries, equivalent to 16% of GDP per year on average and 39% of total export earnings per year. This represents only a small fraction of the total direct economic benefits that mining these metals brings to governments, such as tax income and employment.

However, terrestrial mining also brings some significant negative social, economic and environmental impacts and challenges, from poor labour conditions and human rights abuses to habitat destruction and pollution. More needs to be invested in tackling these issues as terrestrial mining will continue regardless of whether deep sea mining takes place.

The total export earnings at risk ranges from USD \$5 billion annual average export earnings for Namibia up to USD \$240 billion export earnings for Chile. While estimating the potential impact that deep sea mining will have on these export earnings is beyond the scope of this report, even a small reduction in the global price of these commodities could trigger significant reductions in government revenue as well as other negative economic and social impacts.

Overall copper makes up a total of 88% of value at risk annually over the five year period as highlighted in Figure 1 below. Whilst the ISA's research has shown that polymetallic nodule mining is unlikely to affect the copper market's supply/demand balance, deep sea mining could still cause declines in the price of copper by reducing supply tensions, which is true of all four metals.⁹

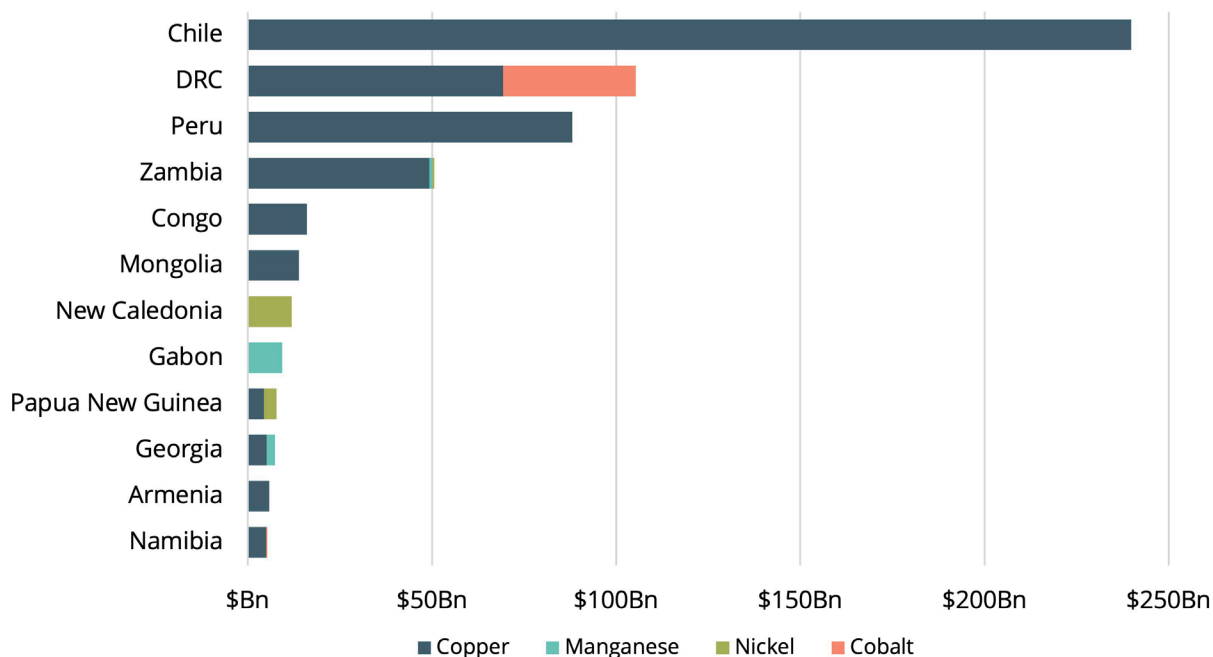
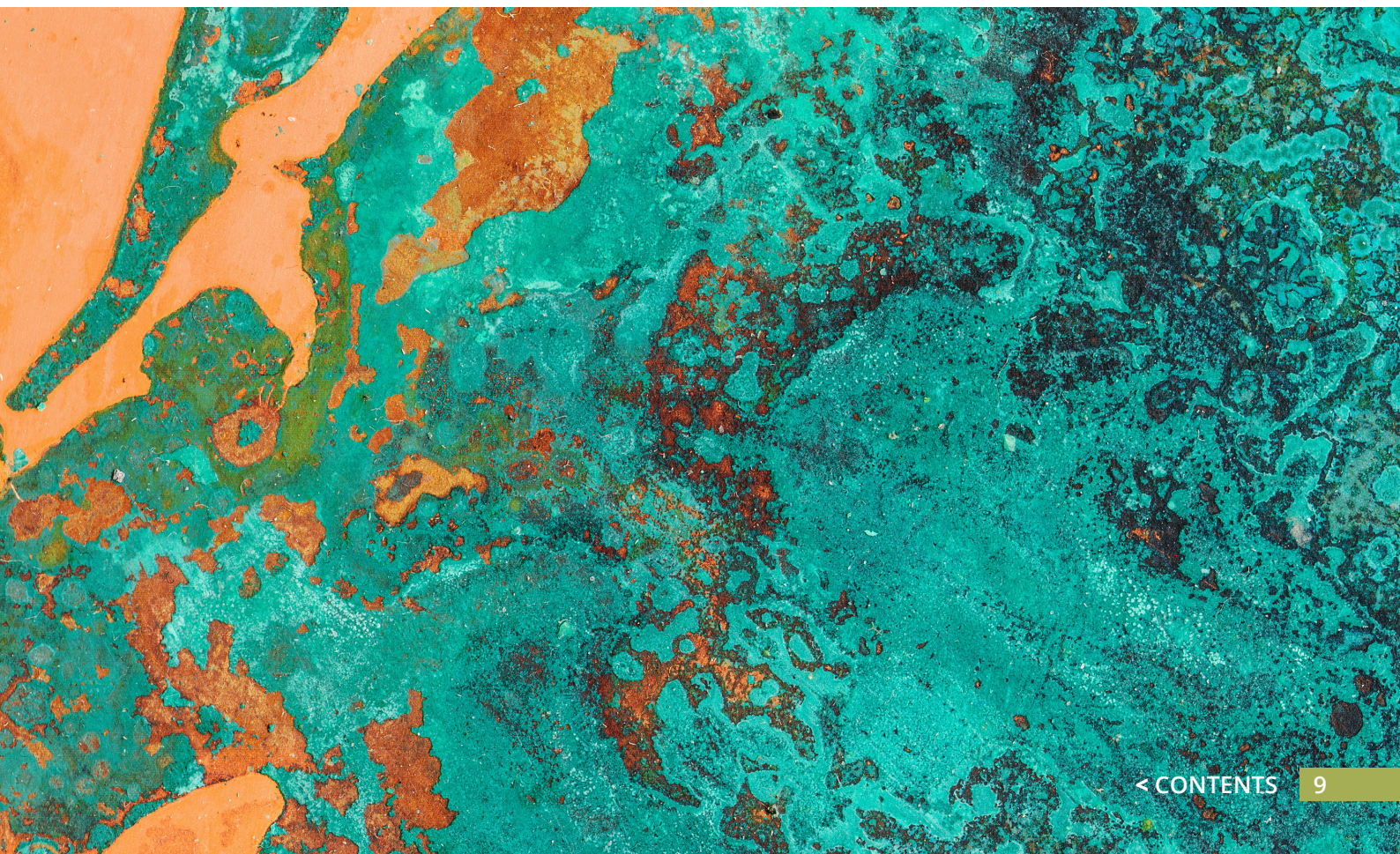


Figure 1: Average annual export earnings from copper, manganese, nickel and cobalt from 2018 – 2022. Source: Planet Tracker analysis based on data from CEPII's BACI Database.

Case study: Chile

Chile is by far the country with the most value at risk, with nearly USD \$240 billion in annual export earnings from copper on average from 2018 – 2022 as highlighted in Figure 2 below. The country is the world's largest producer of copper, making up 27% of global copper mine production on average from 2018 -2022. As such, copper mining makes a significant overall contribution to Chile's Public Treasury, with tax revenues from the top 10 private copper companies (representing 90% of private production) and contributions from state owned mining companies making up 8% of the Public Treasury's budget on average annually from 2018-2022, or USD \$5.46 billion.¹⁵

Beyond tax and export earnings, the mining sector as a whole provided 260,000 jobs per year on average over the same period, which is 3% of jobs nationally,¹¹ with the majority of these roles associated with the copper value chain. All of these are at risk of negative impacts if deep sea mining were to trigger price declines in the copper market.



Deep sea mining could put a significant proportion of countries' export earnings at risk

Across all 12 countries, export earnings from copper, cobalt, manganese and nickel made up on average 39% of total average annual export earnings from 2018 – 2022 and for nine of these countries these metals made up over 20% of total annual export earnings on average over this period – see Figure 2. Deep sea mining-related commodity price drops could therefore pose a significant risk to all 12 countries export earnings, and the ability of their governments to raise revenue and support national development priorities.

New Caledonia (a French overseas territory) is the most exposed to price volatility risks in terms of the contribution these metals make to total export earnings, with nickel making up over 95% of the nation's export earnings on average per year from 2018 – 2022, as shown in Figure 3. DRC, Zambia and Chile are also particularly at risk of deep sea mining-related price drops with export earnings from the four metals equating to 79%, 71% and 48% of total annual average export earnings respectively over the most recent 5 year period. For all three countries copper made up over 45% of average export earnings while DRC also has considerable exposure to cobalt which made up 27% of average export earnings.

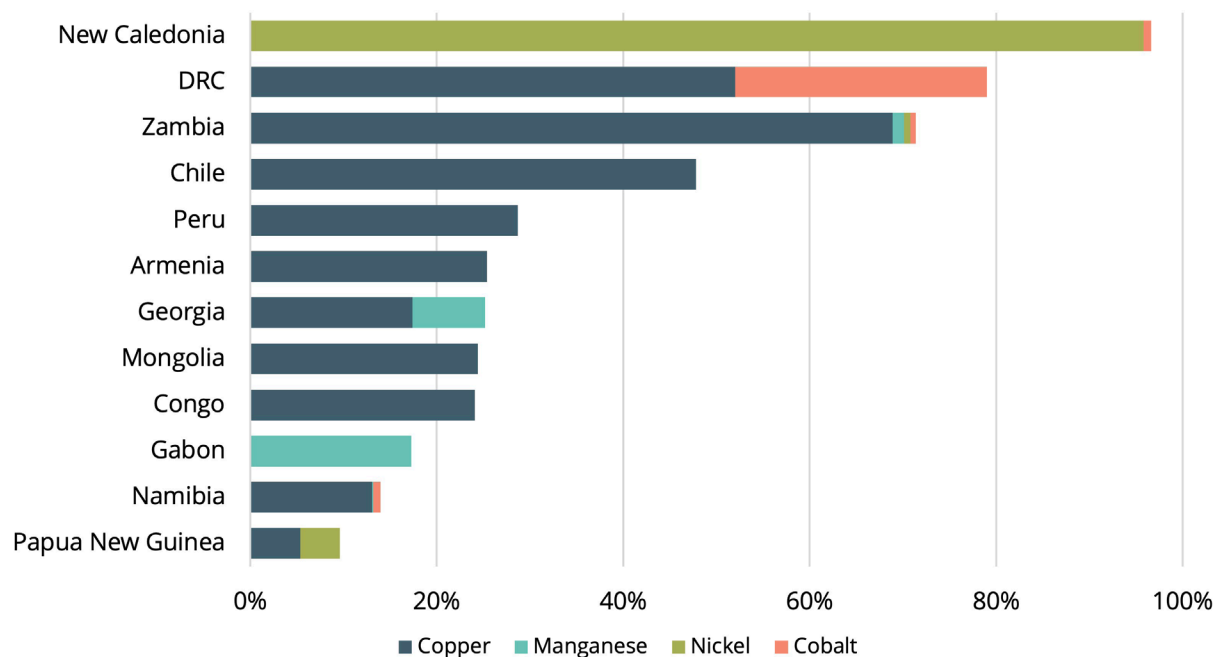


Figure 2: Average annual export earnings as a percentage of total export earnings from copper, manganese, nickel and cobalt from 2018 – 2022. Source: Planet Tracker analysis based on data from CEPII's BACI Database.

Deep sea mining could negatively impact countries' GDP

Finally, this analysis has considered the contribution that export earnings make to national GDP. On average, export earnings from all four metals were equivalent to 16% of GDP per year across all 12 countries from 2018 – 2022 as highlighted in Figure 3.

Zambia, DRC and New Caledonia are again highly exposed to risks from the negative economic impacts from deep sea mining with export earnings from the four metals equivalent to 38%, 34% and 22% of GDP respectively from 2018 - 2022. This highlights the significant potential for deep sea mining to negatively impact countries' overall economic development.

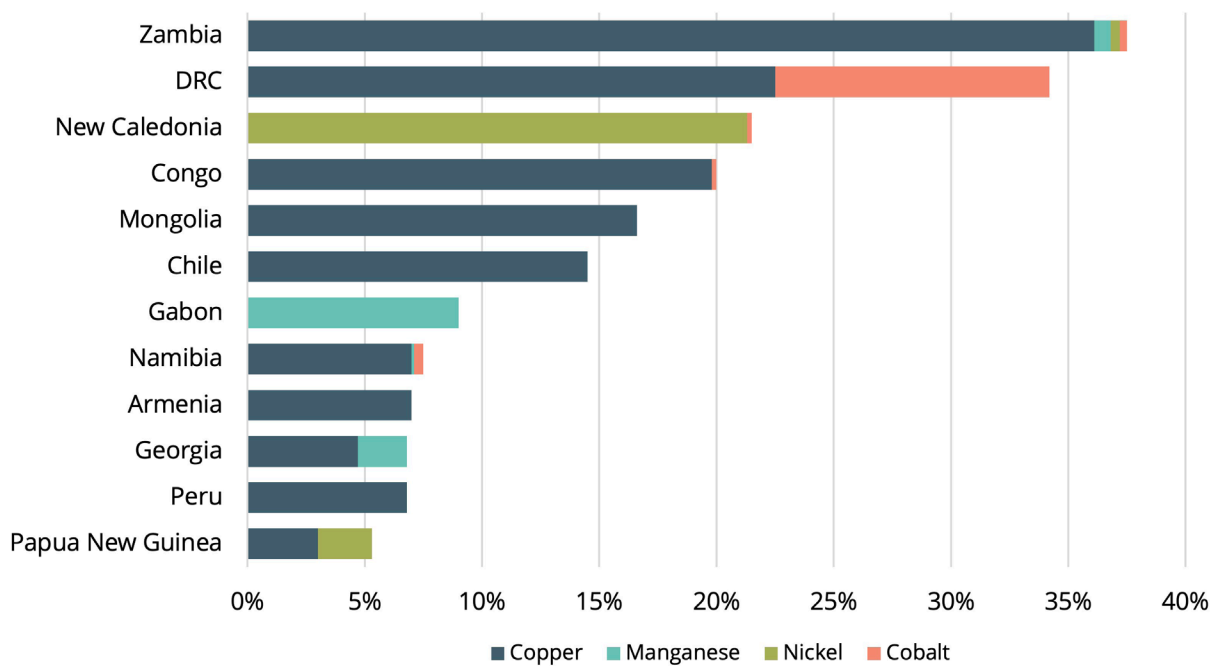


Figure 3: Average annual export earnings as a percentage of GDP from copper, manganese, nickel and cobalt from 2018 – 2022. Source: Planet Tracker analysis based on data from CEPII's BACI Database.

There is no just transition to deep sea mining

Half of the countries most at risk are classed as low or lower middle income

Five of the 12 countries identified in this analysis were categorised by the World Bank as lower middle income in 2023 (Zambia, Congo, Mongolia, Papua New Guinea and Georgia) and one (DRC) was categorised as low income. These countries are likely to be less well equipped to deal with the negative economic impacts that deep sea mining-related price shocks may bring.

Fair compensation to terrestrial mining economies is very unlikely

UNCLOS requires the ISA to compensate developing countries for revenue losses caused by deep sea mining as well as any other negative economic impacts caused to land-based mining by deep sea mining. The ISA's economic assistance fund therefore aims to support developing countries which "suffer serious adverse effects on their export earnings or economies" from lower metal prices from the increased supply of metals from the deep sea.¹⁶

The ISA has not yet quantified the funding required to fairly compensate terrestrial mining state most likely to be negatively impacted by deep sea mining and there are a variety of complex questions that must be dealt with in the process, including:

- What counts as an economy 'seriously' affected by deep sea mining?
- What kind of evidence is required to attribute negative economic impacts to deep sea mining?
- How would negative impacts be measured: decreased government revenues, export earnings or overall economic losses?
- Does the ISA aim to fully or partially compensate countries?
- Is compensation long-term or only short-term and transitional?¹⁷

It is extremely unlikely that terrestrial mining countries will receive fair compensation from the negative impacts of deep sea mining. This is based on the level of reliance the 12 countries identified in this report have on copper, cobalt, manganese and nickel (USD \$5 billion - \$240 billion in total average annual export earnings per country), compared to the relatively small value of an ISA royalty fund (a maximum of \$1.1 million per country annually). Therefore, deep sea mining could have significant negative economic impacts, particularly on less economically developed States, and provide very little to no economic benefit from deep sea mining taxes.

Countries that process metals would benefit from deep sea mining

While countries that mine and export copper, cobalt, manganese and nickel could face significant negative economic impacts if deep sea mining were to take place, countries that import these metals would stand to gain from reduced metals prices. China is by far the largest importer of all four metals (see Figure 4 below), and this may in part explain why the country has remained a significant proponent of deep sea mining.¹⁸

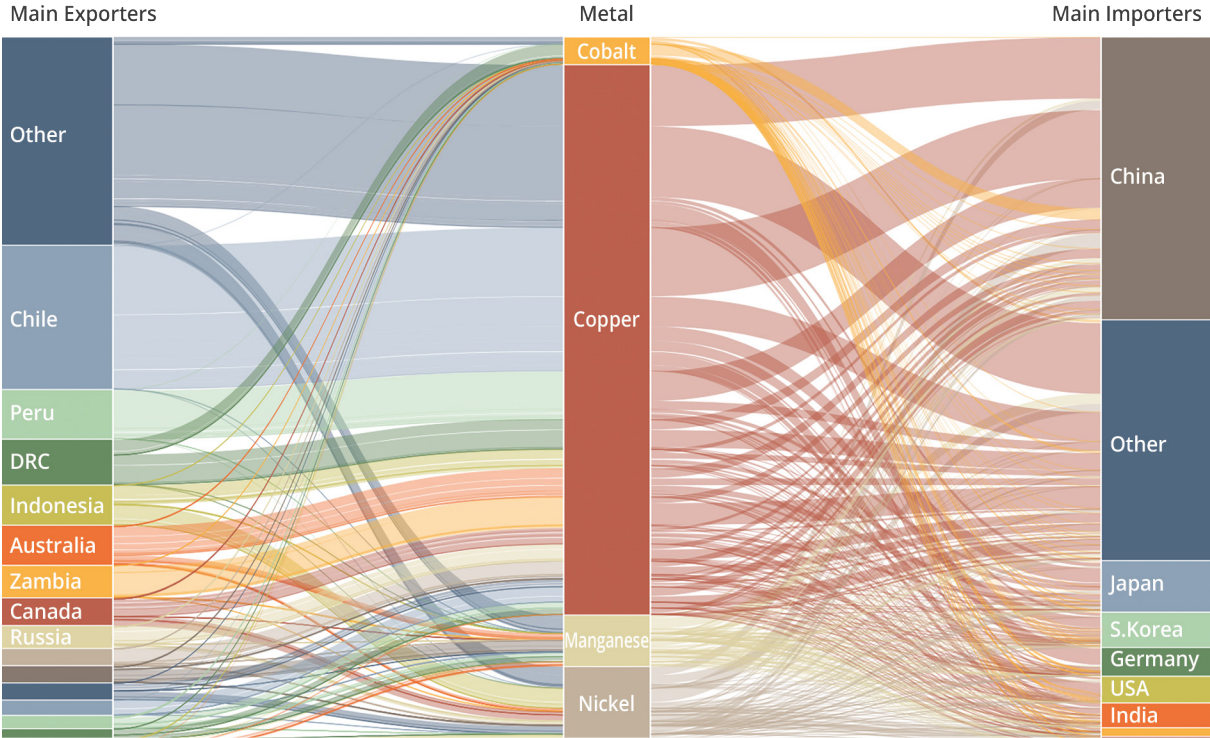


Figure 4: Average annual export earnings as a percentage of GDP from copper, manganese, nickel and cobalt from 2018 – 2022. Source: Planet Tracker analysis based on data from CEPII's BACI Database.

While proponents of deep sea mining have argued that it could improve the security of metals supply for regions such as Europe, there is still significant investment required to develop the technology, infrastructure and skills to shift the geographies of metal processing. Deep sea mining alone is unlikely to transform these trade imbalances.

Conclusions

This report has found that countries that mine copper, cobalt, nickel and manganese could be exposed to significant risk in terms of export revenues and GDP if deep sea mining were to take place. This negative net financial outcome for countries comes in addition to the negative impact deep sea mining would have on the ocean,² climate,³ natural capital, corporate profits and investor returns.¹⁹

Call to action

On top of exposing financial institutions to significant policy, regulatory, reputational and financial risks, deep sea mining could also negatively impact the countries financial institutions invest in or lend to.

They should therefore support *a moratorium on deep sea mining*, by engaging with governments who have not yet explicitly supported a moratorium and developing investment policies that exclude deep sea mining companies.

Instead, financial institutions should support improving the social, economic, and environmental governance of terrestrial mining.

Appendix A

Metals are traded in a variety of forms, from ores and concentrates, to mattes and intermediates and a range of refined products. Trade statistics do not cover all of the different metal products and calculating a total global refined metal production is complicated. However, several forms of metals are usually grouped under a single trade code and this report used the following code from the Harmonize System (HS) of trade codes to explore trade in primary, semi-finished and end products of copper, cobalt, nickel and manganese:

Metal	Sub-group	HS Code	Description
Copper	Copper ores and concentrates	2603	Primary products of copper production
Copper	Copper mattes, cement copper (precipitated copper)	7401	Semi-finished products of copper production
Copper	Copper, unrefined, copper anodes for electrolytic refining	7402	Semi-finished products of copper production
Copper	Copper refined, unwrought, cathodes and sections of cathodes	740311	End products of copper production
Nickel	Nickel ores and concentrates	2604	Primary products of nickel production
Nickel	Nickel mattes, nickel oxide sinters and other intermediate products of nickel metallurgy	7501	Semi-finished products of nickel production
Nickel	Ferro-alloys, ferro-nickel	720260	End products of nickel production
Nickel	Nickel, unwrought, not alloyed	750210	End products of nickel production
Cobalt	Cobalt ores and concentrates	2605	Primary products of cobalt production
Cobalt	Cobalt mattes and other intermediate products of cobalt metallurgy; unwrought cobalt; cobalt powders	810520	End products of cobalt production
Cobalt	Cobalt oxides and hydroxides, commercial cobalt oxides	2822	End products of cobalt production
Manganese	Manganese ores and concentrates, including ferruginous manganese ores and concentrates with a manganese content of 20% or more, calculated on dry weight	2602	Primary products of cobalt production
Manganese	Manganese oxides	2820	End products of manganese production
Manganese	Ferro-alloys, ferro-manganese, containing by weight >2% of carbon	720211	End products of manganese production
Manganese	Ferro-alloys; ferro-manganese, containing by weight ≤2% of carbon	720219	End products of manganese production
Manganese	Ferro-silico-manganese	720230	End products of manganese production
Manganese	Manganese articles thereof, including waste and scrap	811100	End products of manganese production

It is important to note that HS codes only provides an approximate overview of metal product flows.

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ABOUT PLANET TRACKER

Planet Tracker is an award-winning non-profit financial think tank aligning capital markets with planetary boundaries. Created with the vision of a financial system that is fully aligned with a net-zero, resilient, nature positive and just economy well before 2050, Planet Tracker generates break-through analytics that reveal both the role of capital markets in the degradation of our ecosystem and show the opportunities of transitioning to a zero-carbon, nature positive economy.

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