DISCUSSION PAPER

REVIEW OF QUÉBEC'S ROLE IN THE DEVELOPMENT OF CRITICAL AND STRATEGIC MINERALS
Québec possesses significant mineral resources, and mineral extraction in Québec accounts for one-fifth of total Canadian production. The range of resources mined is the most varied in Canada, with the production and processing of 17 metals and 14 non-metallic minerals. Québec already makes a major contribution to the supply of critical and strategic minerals (CSMs) since it produces nickel, niobium and graphite and has mining projects under development for lithium, vanadium, rare earth elements and tantalum (Figure 1). This is why the Québec government believes there is a need to consult its partners about Québec’s role in the development of critical and strategic minerals.

This discussion paper outlines the role of CSMs worldwide, the potential for mining them in Québec, and related issues. We look forward to hearing your comments on the development steps in the CSM value chain to provide input for the debate.
2. Background

WORLDWIDE DEMAND
The world economy is undergoing a radical transformation, and new technologies are increasing the pace of change while transforming our lifestyle. As part of this economic mutation, the demand for CSMs will only increase.

CRITICAL AND STRATEGIC MINERALS
The Ministère de l'Énergie et des Ressources naturelles (MERN) considers as critical minerals those that have significant economic importance in key sectors of the economy, present a supply risk, and have no commercially-available substitutes. Strategic minerals are those needed to implement Québec's economic policies, such as the 2020-2030 Electrification and Climate Change Plan and the 2030 Energy Policy. For example, the manufacture of lithium-ion batteries requires lithium, graphite, nickel, cobalt, cooper, manganese and aluminum. Figure 2 illustrates the concept of criticality for metals and minerals. It shows the estimated number of years remaining before currently known resources are exhausted and the number of producer countries which, if low, represents a supply risk.
STRATEGIC AND CRITICAL MINERALS IN QUÉBEC

**RICH POTENTIAL**

### Graphite

Several graphite projects are underway in Québec.

1. **Lac-des-Îles**
   - Imerys Graphite and Carbon Canada
   - Active mine

2. **Lac Guéret**
   - Mason Graphite
   - Deposit appraisal

3. **Matawinie**
   - Nouveau Monde Graphite
   - Deposit appraisal

4. **La Loutre**
   - Québec Precious Metals Corporation
   - Deposit

### Cobalt and Platinum Group Elements

Two mines extracting cobalt and platinum group elements as nickel by-products.

5. **Raglan**
   - Glencore Canada Corporation
   - Active mine

6. **Nunavik Nickel**
   - Canadian Royalties Inc.
   - Active mine

7. **Dumont Nickel**
   - Magneto Investments Limited Partnership
   - Deposit appraisal

8. **Bravo**
   - Jien Nunavik Mining Exploration Ltd
   - Deposit

### Titanium and Vanadium

Québec is the world’s second-largest producer of titanium in the form of ilmenite.

9. **BlackRock**
   - BlackRock Metals Inc.
   - Deposit appraisal

10. **Vanadium-Lac Doré**
    - VanadiumCorp Resource Inc.
    - Deposit

11. **Vanadium-Lac Doré**
    - VanadiumCorp Resource Inc.
    - Deposit

### Lithium

Québec has significant high lithium potential.

12. **North American Lithium**
    - North American Lithium
    - Mine under maintenance

13. **Rose**
    - Critical Elements Lithium Corporation
    - Deposit appraisal

14. **Lac Moblan West**
    - Lithium Guo Ao Ltée and SOQUEM Inc.
    - Deposit appraisal

15. **Lac Tio**
    - Rio Tinto Fer et Titane
    - Active mine

### Rare Earth Elements

Québec has several rare earth deposits and is recognized as having global potential.

16. **Kwyjibo**
    - SOQUEM Inc.
    - Deposit appraisal

17. **Eldor (Ashram)**
    - Commerce Resources Corporation
    - Deposit

18. **Strange Lake - Zone B**
    - Torngat Metals Ltd
    - Deposit

### Niobium

Québec is the second largest producer of niobium in the world and the only producer in the Northern Hemisphere.

19. **Niobec**
    - Niobec
    - Active mine

20. **Crevier**
    - Les Mineraux Crevier Inc.
    - Deposit

21. **Kipawa (Zeus) (Lac Sheffield)**
    - Mining title suspended. Québec Precious Metals Corporation and Ressources Québec Inc.
    - Deposit

22. **Niobec - REE Zone**
    - Niobec inc.
    - Deposit

23. **Carbonatite from Montviel**
    - Geomega Ressources Inc.
    - Deposit
Several graphite projects are underway in Québec.

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   - Imerys Graphite  
   - Carbon Canada  
   - Active mine

2. Lac Guéret  
   - Mason Graphite  
   - Deposit appraisal

3. Matawinie  
   - Nouveau Monde Graphite  
   - Deposit appraisal

4. Lac Knife  
   - Focus Graphite Inc.  
   - Deposit

5. La Loutre  
   - Québec Precious Metals Corporation  
   - Deposit

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   - Glencore Canada Corporation  
   - Active mine

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   - Canadian Royalties Inc.  
   - Active mine

8. Dumont Nickel  
   - Magneto Investments Limited Partnership  
   - Deposit appraisal

9. Bravo  
   - Jien Nunavik Mining Exploration Ltd  
   - Deposit

10. Hopes Advance  
    - Nickel North Exploration Corp.  
    - Deposit

11. Lac Menarik  
    - Harfang Exploration Inc.  
    - Deposit

12. Lac Rocher  
    - Victory Nickel Inc.  
    - Deposit

13. Nisk-1  
    - Critical Elements Lithium Corporation  
    - Deposit

Niobium

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    - Niobec  
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    - BlackRock Metals Inc.  
    - Deposit appraisal

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    - VanadiumCorp Resource Inc.  
    - Deposit

19. Magpie  
    - The Magpie Mines Inc.  
    - Deposit

Lithium

Québec has significant high lithium potential.

20. North American Lithium  
    - North American Lithium  
    - Mine under maintenance

21. Whabouchi  
    - Nemaska Lithium  
    - Construction and commissioning

22. Authier  
    - Sayona Québec  
    - Deposit appraisal

23. Rose  
    - Critical Elements Lithium Corporation  
    - Deposit appraisal

24. Lac Moblan West  
    - Lithium Guo Ao Ltée  
    - Deposit appraisal

25. James Bay  
    - Galaxy Resources Limited  
    - Deposit

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Aeronautics, telecommunications, renewable energy (solar, wind, etc.), energy storage, the medical sector and transportation electrification are all high-growth sectors in which the supply of CSMs is vital. In addition to these sectors, CSMs play a role in our daily lives. They are found in many everyday objects: graphite, lithium, cobalt and nickel are used to make batteries for laptop computers, cellphones, electric vehicles and energy storage; platinum group elements are used in computer hard drives; and rare earth elements are found in the permanent magnets used in electric motors.

According to a report by the World Bank published in 2017, “The growing role of minerals and metals for a low carbon future”, the energy transition towards a low-carbon economy will involve a significant increase in the demand for minerals including zinc, copper, lithium, cobalt, graphite and the rare earth elements. Figure 3 shows anticipated growth in the demand for certain elements from 2017 to 2050 as the result of more widespread use of technologies with low greenhouse gas emissions, in particular to fight climate change and transition towards renewable energy sources. Mining and recycling can also help meet the increase in demand.
Access to the necessary resources has a growing impact on political, commercial and economic relations between the major world powers. Countries including the United States, Germany, France and Japan consider certain substances to be strategic necessities for their economic, technological and military development, and are currently assessing ways to diversify and secure access to supplies.

To meet this anticipated increase in demand, supplies from producer countries such as Canada will have to increase by 2050. Considering that the time needed to develop a new mine is between ten and twenty years, a major effort will be required over the short, medium and long terms to support exploration, deposit appraisal and mineral extraction. Some jurisdictions, such as Australia, have already adopted strategies for elements considered critical by the United States, the European Union and Japan in order to meet demand from those countries.

However, it will be difficult to respond to the increase in demand by simply increasing production. For some metals such as silver, copper, tin and cadmium, all known reserves will be exhausted by 2050\(^1\) (Figure 2).

As a result, it is time to draw up strategies for the optimum use of the resources available based, in particular, on re-use. The recycling of products containing CSMs will become a necessary, and responsible, way to meet demand within the framework of sustainable development.

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QUÉBEC’S ADVANTAGES

The business environment in Québec for mining investment is one of the best in the world (ranking fourth according to the Fraser Institute in 2019). In addition, Québec’s geology offers one of the widest range of CSMs in Canada (see Appendix 1). Unlike several other jurisdictions where CSMs are mined, Québec can offer clean energy at a competitive price, has an exemplary social and environmental record, and offers technological expertise and expert knowledge in the university and college sector.

The government policies currently being developed, such as the Electrification and Climate Change Plan of the Ministère de l’Environnement et de la Lutte contre les changements climatiques and Québec’s strategy to develop the minerals used in electric vehicle batteries, drafted by Investissement Québec, are some of the measures that will contribute to the development and processing of CSMs in Québec.

Québec has made an active commitment to green its economy and is taking the necessary steps to double foreign investment within five years, increase its exports, diversify its markets and increase the pace of technological transition for its enterprises. CSM development is consistent with the move towards an energy transition that has already begun in Québec, in particular by the electrification of the transportation system as part of a green economy.

SIGÉOM:
A DATABASE WITH WORLDWIDE RECOGNITION

The geo-mining information system (Système d’information géominière, or SIGÉOM) is recognized as one of the world’s leading databases, in particular for the quality and accessibility of the information it contains. It brings together the geo-scientific data gathered by government, public organizations, industry and the university research sector, and represents 150 years of history and research in the geo-science field in Québec.

The database provides information free of charge and acts as a lever that increases the likelihood of discoveries during the mineral exploration phase while reducing financial risks for the industry. The data it contains can be used to stimulate the development of critical and strategic mineral resources.

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<table>
<thead>
<tr>
<th>Stage</th>
<th>1 Geo-scientific surveys</th>
<th>2 Exploration</th>
<th>3 Deposit appraisal</th>
<th>4 Mine construction and commissioning</th>
<th>5 Extraction</th>
<th>6 Post-operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Identify mineral potential in Québec</td>
<td>Basic exploration: discovery and identification of mineral traces and confirmation of mineral content and continuity</td>
<td>Appraisal of the deposit and definition of the parameters for the mine project</td>
<td>Mine construction Commissioning and testing of mine facilities</td>
<td>Ore extraction and processing Marketing of the product extracted</td>
<td>Closure, securing and restoration of the mine site Post-restoration monitoring</td>
</tr>
<tr>
<td>Methods</td>
<td>Data acquisition: surveys, sampling, research and synthesis of data</td>
<td>Review and synthesis of all available information Prospecting, mapping, surveying, stripping and drilling Sampling at the surface, in trenches and in drill holes Calculation of the available resource</td>
<td>Delimitation of the deposit: drilling Choice of processing method: bulk sampling, pilot testing Engineering design and cost estimates, market studies Analysis of technical, economic, environmental, social, political and financial risks</td>
<td>Project management and quality management Commissioning plan and worker training</td>
<td>Production management to improve quality, yield and employee safety on an ongoing basis Management of site closure and restoration to a satisfactory state</td>
<td></td>
</tr>
<tr>
<td>Target outcome at the end of the stage</td>
<td>Publication of geological information and identification of zones conducive to mineral exploration Preliminary economic assessment of the deposit Decision to develop the deposit</td>
<td>Feasibility study and decision to bring the deposit into production Issue of government authorizations Organization of financing</td>
<td>Achievement of commercial operating conditions</td>
<td>Return on investment Full extraction of the deposit</td>
<td>Restored mine site meeting the requirements for mine site rehabilitation in Québec</td>
<td></td>
</tr>
<tr>
<td>Mineral resource</td>
<td>Inferred</td>
<td>Indicated</td>
<td>Measured</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obligations</td>
<td>Acquire claims and notify the landowner and municipality Obtain the licences and authorizations needed for each impact having an impact on the environment or land base</td>
<td>Complete the provincial or federal environmental assessment process, as applicable Obtain approval for the rehabilitation and restoration plan and deposit the financial guarantee Obtain the mining lease and authorization to construct the mine and extract the mineral</td>
<td>Establish a monitoring committee Conduct environmental monitoring Obtain the licences and authorizations needed to each new activity having an impact on the environment or land base</td>
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<tr>
<td>Good practice</td>
<td>As early as possible in the process, inform and consult the public and the local and Indigenous communities concerned about the progress of the work and project to ensure better integration with the host community and improve the project’s social acceptability.</td>
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</tbody>
</table>

October 28, 2019
## Appendix 1

Table 1: Minerals and metals of critical and strategic importance for Québec

A- Minerals and metals of critical importance for Québec processing plants (refineries, foundries, aluminum smelters)

<table>
<thead>
<tr>
<th>No.</th>
<th>Mineral/Metal</th>
<th>List of States</th>
<th>Uses</th>
<th>Worldwide production</th>
<th>Worldwide reserves</th>
<th>Mines</th>
<th>Deposit appraisal stage</th>
<th>Orebody (advanced exploration)</th>
<th>Strategic value</th>
<th>Comments</th>
</tr>
</thead>
</table>
| 1   | Aluminium     | USA\(^2\), Japan\(^3\) | Aircraft fuselages and wings, packaging, land transportation, construction, electrical equipment and heat exchangers | Aluminum: 60 Mt  
Bauxite: 300 Mt  
Alumina: 130 Mt | Bauxite and alumina: 30 Gt | 0 | 0 | 0 | Supplies of bauxite and alumina for aluminum smelters come from outside Québec.  
Québec has 9 aluminum smelters, with a total primary aluminum production capacity of 2.8 million tonnes. This represents 90% of Canadian production, ranking fourth in the world after China, Russia and the Middle East (Bahrain and Saudi Arabia).  
Aluminum is recovered in Québec (American Iron and Metals and other metal reclaimers as well as the aluminum cans for which a deposit is charged).  
The recovered aluminum is shipped to the United States for recycling. |
| 2   | Copper        | Japan\(^3\)     | Construction, electronic equipment, batteries, electrical wiring | 21 Mt | 730 Mt | 5\(^5\) | 3\(^5\) | 6 / 7\(^5\) | Supply for the Horne Smelter.  
The demand for copper for batteries is expected to increase by a factor of 11 by 2030,\(^7\) increasing current worldwide demand by around 20%,\(^8\)  
The Horne Smelter operation requires copper concentrate and copper for recycling.  
In Québec, copper is a by-product from nickel, zinc and gold mining. There is some potential for primary deposits.  
Copper is reclaimed and recycled in part at the Horne Smelter. |
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<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>3</td>
<td>Zinc</td>
<td>Japan</td>
<td>Galvanized sheet metal for automobiles, various uses in chemistry, electronics and pigmentation</td>
<td>13 Mt</td>
<td>230 Mt</td>
<td>2</td>
<td>1&lt;sup&gt;5&lt;/sup&gt;</td>
<td>2 / 1&lt;sup&gt;5&lt;/sup&gt;</td>
<td>5 / 3&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Supply for the Zinc Electrolytique du Canada (ZEC) refinery at Salaberry-de-Valleyfield. Current worldwide zinc reserves are insufficient to ensure supply after 2050.</td>
</tr>
</tbody>
</table>

**B- Minéraux et métaux stratégiques liés aux politiques publiques et aux énergies renouvelables (batteries, moteurs électriques, etc.)**

<table>
<thead>
<tr>
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<tr>
<td>4</td>
<td>Chromium</td>
<td>USA&lt;sup&gt;2&lt;/sup&gt;, Japan&lt;sup&gt;3&lt;/sup&gt;, Aus&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Stainless steel and superalloys</td>
<td>36 Mt</td>
<td>560 Mt</td>
<td>0</td>
<td>0</td>
<td>2 / 1&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Chromium resources are abundant. 95% of the resources are located in Kazakhstan and South Africa.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cobalt</td>
<td>USA&lt;sup&gt;2&lt;/sup&gt;, Japan&lt;sup&gt;3&lt;/sup&gt;, EU&lt;sup&gt;4&lt;/sup&gt;, Aus&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Rechargeable batteries and superalloys</td>
<td>140 kt</td>
<td>6.9 Mt</td>
<td>2&lt;sup&gt;5&lt;/sup&gt;</td>
<td>1&lt;sup&gt;5&lt;/sup&gt;</td>
<td>4&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Demand for cobalt for batteries is expected to triple by 2030, doubling current worldwide demand.&lt;sup&gt;7,8&lt;/sup&gt; Cobalt is a strategic input for the development of the battery manufacturing chain.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Rare earth elements (REEs)</td>
<td>USA&lt;sup&gt;2&lt;/sup&gt;, Japan&lt;sup&gt;3&lt;/sup&gt;, EU&lt;sup&gt;4&lt;/sup&gt;, Aus&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Metallurgical additives and alloys, electronics, magnets, military, aerospace and wind power applications, photovoltaic cells</td>
<td>170 kt</td>
<td>120 Mt</td>
<td>0</td>
<td>1</td>
<td>4 / 1&lt;sup&gt;5&lt;/sup&gt;</td>
<td>In 2018, China dominated worldwide REE production (70.5%), followed by Australia (11.8%).&lt;sup&gt;8&lt;/sup&gt; Important issues for the development of rare earth mines in Québec (economic context, ore processing, infrastructure, social acceptability). The REE sector is in its infancy in Québec and the same is true for the recycling of REEs worldwide.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Graphite (natural)</td>
<td>USA&lt;sup&gt;2&lt;/sup&gt;, Japan&lt;sup&gt;3&lt;/sup&gt;, EU&lt;sup&gt;4&lt;/sup&gt;, Aus&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Lubricants, batteries, fuel cells</td>
<td>930 kt</td>
<td>300 Mt</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>The demand for graphite for batteries is expected to increase by a factor of 9 by 2030, which could triple current global demand.&lt;sup&gt;7,8&lt;/sup&gt; Canada is the world’s third largest producer of graphite (4.3%) after China (68%) and Brazil (10%).&lt;sup&gt;8&lt;/sup&gt;</td>
<td></td>
</tr>
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</tr>
<tr>
<td>8</td>
<td>Lithium</td>
<td>USA, Japan, Aus</td>
<td>Batteries, medical equipment, alloys, ceramics, glass</td>
<td>85 kt</td>
<td>14 Mt</td>
<td>1</td>
<td>3/1</td>
<td>1</td>
<td>lithium</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Platinum group elements (PGMs)</td>
<td>USA, Japan, EU, Aus</td>
<td>Catalytic agents, dental and medical equipment, electronic devices, jewellery, laboratory equipment</td>
<td>Palladium: 210 t, Platinum: 160 t</td>
<td>69 kt</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>Recycling of materials manufactured from PGMs represents more than 28% of worldwide supply.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Nickel</td>
<td></td>
<td>Stainless steel and alloys, batteries</td>
<td>2.3 Mt</td>
<td>89 Mt</td>
<td>2</td>
<td>1</td>
<td>2/2</td>
<td>Demand for nickel for batteries is expected to increase 16-fold by 2030, which could double current worldwide demand.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Cadmium</td>
<td></td>
<td>Ni-Cd batteries, aircraft, pigments, stabilisers in flexible PVC products, thin-film solar cell market</td>
<td>26 kt</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Expected future growth in demand related to the development of solar energy. In 2017, China produced 32% of the world’s cadmium, followed by South Korea with 22%.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Fluorine</td>
<td>USA, Japan, EU</td>
<td>Hydroflouric acid, lithium batteries, aerospace, steel and aluminum manufacturing, solar panels</td>
<td>5.8 Mt</td>
<td>310 Mt</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>In 2017, China produced 61.6% of the world’s fluorine, followed by Mexico with 18%.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Indium</td>
<td>USA, Japan, EU, Aus</td>
<td>LCD glass, solar panels, alloys, liquid and touch screens, telecommunications</td>
<td>750 t</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>In 2017, China produced 40.2% of the world’s indium, followed by South Korea with 31.5%. Canada is almost on par with Japan with just under 10% each.</td>
<td></td>
</tr>
</tbody>
</table>

References:
1. [Lithium demand for batteries is expected to increase eightfold by 2030, which could triple current global demand.](#) 8
2. Several advanced exploration projects. High discovery potential.
3. In Québec, PGMs are extracted as nickel by-products.
4. Canada is the world’s 3rd largest platinum producer and the 4th largest producer of palladium.
5. In 2017, 70% of Canadian PGM exports went to the United States.
6. Québec is the world’s 10th largest nickel producer (2%). Nickel mined in Québec is processed outside the province.
7. Expected future growth in demand related to the development of solar energy. In 2017, China produced 32% of the world’s cadmium, followed by South Korea with 22%.
9. By-product recovered from residues generated during the processing of zinc ore.
10. Possibility of shortage with the increased use of touch screens.
## No. Mineral/Metal

### List of States

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>14</td>
<td>Tellurium</td>
<td>USA</td>
<td>Solar panels, catalysts, semiconductors, thermocouples with lead, alloys, detonators</td>
<td>440 t</td>
<td>31 kt</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>In 2018, China produced 68% of the world’s tellurium, followed by Japan (8.18%), Russia (7.95%) and Canada (6.81%).&lt;sup&gt;8&lt;/sup&gt;</td>
<td>By-product of the processing of copper ore, copper anode sludge, and smelting residues of lead, nickel, and precious metals. In Québec, tellurium is a by-product of the Home smelter.</td>
</tr>
</tbody>
</table>

### C- Other minerals and metals of strategic importance

<table>
<thead>
<tr>
<th>No.</th>
<th>Mineral/Metal</th>
<th>List of States</th>
<th>Uses</th>
<th>Wordwide production</th>
<th>Worldwide reserves</th>
<th>Mines</th>
<th>Deposit appraisal stage</th>
<th>Orebody (advanced exploration)</th>
<th>Strategic value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Niobium</td>
<td>USA, Japan, EU, Aus</td>
<td>Steel alloys, aerospace industry</td>
<td>68 kt</td>
<td>&gt;9.1 Mt</td>
<td>1</td>
<td>0</td>
<td>1&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Québec is the second largest producer of niobium (10%) in the world. Brazil dominates production worldwide (88%).&lt;sup&gt;8&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Scandium</td>
<td>USA, EU, Aus</td>
<td>Aluminum alloys</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>1&lt;sup&gt;5&lt;/sup&gt;</td>
<td>0</td>
<td>Project to develop by-products from titanium slag processing.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Tantalum</td>
<td>USA, Japan, EU, Aus</td>
<td>Electronic components (miniaturized capacitors), superalloys, corrosion-resistant equipment</td>
<td>1.8 kt</td>
<td>&gt;110 kt</td>
<td>0</td>
<td>1&lt;sup&gt;5&lt;/sup&gt;</td>
<td>1&lt;sup&gt;5&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Titanium</td>
<td>USA, Aus</td>
<td>White pigments and metallic alloys</td>
<td>Ti and TiO&lt;sub&gt;2&lt;/sub&gt;: 180 kt Ilmenite: 5.4 Mt Rutile: 750 kt Ilménite and rutile: 6.1 Mt</td>
<td>Ilmenite: 880 Mt Rutile: 62 Mt Ilmenite and rutile: 940 Mt</td>
<td>1</td>
<td>1</td>
<td>2&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Québec is the leading producer of titanium in the form of ilmenite.</td>
<td></td>
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<tr>
<td>19</td>
<td>Tungsten</td>
<td>USA, Japan, EU, Aus</td>
<td>Manufacture of wear-resistant metals</td>
<td>82 kt</td>
<td>3.3 Mt</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
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<tr>
<td>20</td>
<td>Vanadium</td>
<td>USA, Japan, EU, Aus</td>
<td>Alloys in steels, high capacity batteries</td>
<td>73 kt</td>
<td>20 Mt</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Vanadium is a by-product of iron, titanium and phosphate.</td>
<td></td>
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<tr>
<td>21</td>
<td>Apatite/ phosphate</td>
<td>Japan, EU</td>
<td>Production of fertilizers, phosphoric acid</td>
<td>270 Mt</td>
<td>70 Gt</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>In 2017, China produced 53.5% of the world’s phosphate, followed by Morocco (11%) and the United States (10.4%).&lt;sup&gt;8&lt;/sup&gt;</td>
<td></td>
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<tr>
<td>22</td>
<td>Bismuth</td>
<td>USA, EU, Aus</td>
<td>Pharmaceuticals, cosmetics, industrial chemistry, metallurgy, atomic and medical research</td>
<td>16 kt</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>In 2017, China dominated world bismuth production (80%), followed by Laos (11.8%).&lt;sup&gt;8&lt;/sup&gt;</td>
<td>Bismuth is a by-product of the refining of lead and tungsten. It is recovered to a lesser extent from the refining of copper, tin, silver and gold.</td>
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<tr>
<td>23</td>
<td>Gallium</td>
<td>USA, Japan, EU, Aus</td>
<td>Analog integrated circuits, optoelectrical devices, LED lighting</td>
<td>0.41 t</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>In 2017, China dominated world gallium production (93.8%).&lt;sup&gt;8&lt;/sup&gt;</td>
<td>By-product of the transformation of bauxite into alumina and residues generated during the processing of zinc ore.</td>
</tr>
</tbody>
</table>

1. The list of critical and strategic minerals for Québec has been established from the lists of the European Union, the United States, Japan and Australia.
3. For Japan, the list of critical and strategic minerals was published in a report by the Japanese Minister of Economy, Trade and Industry in 2018.
4. For the European Union (EU), the list of critical and strategic minerals was determined by the European Commission in 2017: [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52017DC0490](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52017DC0490)
6. To be considered at the deposit appraisal stage, a project must be the subject of at least one preliminary economic study.
7. Source: BloombergNEF Note
9. Includes mining projects at the development stage.

S. Element present as a by-product.
N/A: Information not available.
The development of critical and strategic minerals (CSMs) can make a contribution to the energy transition that has begun in Québec, as stated in documents such as the 2030 Energy Policy, the 2020-2030 Electrification and Climate Change Plan and the strategy to improve the processing chain for battery materials, all of which target a green, low-carbon economy. The growing presence of these metals in people’s everyday lives, in particular in electronic devices and batteries, has put pressure on the supplies of some substances.

The goal of this consultation is to present the facts about CSMs and the supply of each substance, along with their importance for the economy.

The development of the CSM sector raises a number of economic, technological, environmental and social issues which, as in any form of development, must be taken into account in a concerted, structured governmental approach.

1. Should Québec and companies in Québec seek to reduce their dependency by sourcing supplies from Québec? If so, how?
2. Should Québec take action in order to become a leading player in CSM supplies for other countries and foreign companies? If so, what would the first steps be?
3. Should the government support the development of the CSM sector? If so, how?
4. Should the government and state-owned corporations support investment attraction in the CSM sector in Québec. If so, how?
**Value chain development**

A typical mineral value chain is complex and has several links (Figure 4). Research and development on new exploration and geo-scientific data acquisition techniques, and new extraction, processing, transformation and recycling processes, could help achieve the full potential of CSMs.

**Figure 4: Mineral value chain**

5. In your view, what are the main issues connected with data and expertise specific to the CSM field (geo-scientific data acquisition, exploration, processing, transformation and recycling)? How can knowledge and expertise be improved? What actions should be prioritized?
Resource prioritization and extraction

The extraction of mineral deposits discovered in Québec depends, to a large extent, on the legislation in force, the market rules, and the ability of companies holding mineral rights to obtain financing, wherever they are headquartered and whatever the final use of the resource. Currently, when a CSM deposit is discovered, appraised and defined, no government measures protect it or prioritize its development.

6. To ensure CSM development, should land continue to be made available? If so, should the focus be on geographical protection, the development of infrastructures (for access, energy and communication), or other aspects, while respecting government commitments and the rights of local communities?