



Market for Critical Raw Materials and its Influence on Mineral Prices

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Abstract

The paper has focused on market for critical raw materials and its influence on mineral prices. Usually ores and ore products are deemed critical raw materials if they mostly or totally come from foreign countries, have difficult replacement, and are vital for the Nation's economy, especially for defence issues. Tungsten, niobium, graphite and lithium were chosen for analysis from the critical mineral commodities declared by the European Commission and the Government of the Czech Republic. An analysis of these mineral commodity market conditions has been made, and their impacts on particular mineral availability and price have been assessed. As regards tungsten supplies, there are relatively many producer countries with the existing or developing extraction structures, but China has at its disposal 60% of the deposits. Lithium reserves are sufficient, but supplies are highly concentrated – four producer companies deliver about 90% of lithium in the world. Also niobium supplies are extremely concentrated, in the period, 2009–2012, two Brazilian mines and a single Canadian one produced 99% of niobium in the world. The biggest world producer of natural graphite is China that dominates 70% of the market.

Natural resources of the above mentioned mineral commodities are not critical. The Earth's crust deposits are sufficient for long-term exploitation, and what's more, a technology has been patented for lithium recycling. What rather matters is the issue of the free play of market forces. The theoretical preconditions for the free play of market forces and balanced price convergence – market presence of many various producers and many customers – are disturbed by producer structure, high concentration of mining companies and countries. Free market interference is implied in dominance of individual producer countries or production companies, and their ability to decide about production levels and related prices. Nevertheless, the inevitable rise of mineral commodity prices will mean that exploitation of some sources, which are currently deemed uneconomical, may become interesting.

Keywords: critical raw materials, market, price, tungsten, lithium, niobium, graphite

Introduction

Usually ores and ore products are deemed critical raw materials if they mostly or totally come from foreign countries, have difficult replacement, and are vital for the Nation's economy, especially for defence issues. Availability of these critical commodities is of substantial importance for economic growth, national security, technological progress, and industrial/agricultural supply chains (Focus Graphite, 2015).

Assuring deliveries of critical raw materials means providing for their actual extraction and creating conditions under which particular commodities are traded. In terms of current global markets, the extraction per se is not the issue for Nation's economies but particular trade and delivery conditions are and play vital roles. Prices of mineral commodities are among the most important conditions.

Market prices converge where demand and supply meet. It is about a price for which a producer is willing to operate and a consumer to buy the product. Market price convergence mechanism represents a kind of a feedback

control loop, whose operation is based on information about the current state of demand and supply forces in action. Nonetheless, in practical terms of mineral commodity markets, such theoretical mechanism is influenced by several major factors. Among these are especially:

- Raw materials deposits as such (how much the Earth can provide, inclusive recycling),
- Functioning of market economies as regards structures of raw materials supply,
- Functioning of market economies as regards free play of market forces.

The European Commission deemed critical these mineral commodities: antimony, beryllium, borates, chromium, cobalt, coking coal, fluorite, gallium, germanium, indium, magnesite, magnesium, natural graphite, niobium, phosphates, platinum group metals, noble earth elements, silicon, tungsten (European Commission, May 2014). The Government of the Czech Republic added lithium and kaolin as two commodities of the European importance.

In view of the paper editorial constraint, our attention has focused on the following mineral commodities: tungsten, lithium, niobium, and graphite. An analysis of these mineral commodity market conditions has been made, and their impacts on particular mineral availability and price have been assessed.

Tungsten

Wolframite and scheelite are tungsten ores that are extracted. Processing of these ores provides for tungsten concentrate. The concentrate serves the purpose of producing ammonium paratungstate or ferro-tungsten, as semi products for further processing.

As regards supplies, there are relatively many producer countries with the existing or developing extraction structures like China, Austria, Portugal, Russia, Canada, Vietnam, United Kingdom, and Spain. It can be assumed that tungsten world deposits are sufficient but China has at its disposal 60% of these deposits (World Tungsten Metal Production). In 2012, the tungsten production of China represented about 82% of this metal production worldwide (Wood & Timber Times, 2014).

Government interferences with the free market mechanism for tungsten are considerable. In the United States, the regulation policies were oriented by economic issues – for example in 1951, the Domestic Tungsten Purchase Program was introduced that provided for higher prices of tungsten produced in the country. There were cases of direct interference in China – for example in 1995, some tungsten mines were temporarily closed and active extraction capacities reduced.

Lithium

In the Earth, lithium occurs in the form of igneous rocks, lithium brine, lithium clay or compounds dissolved in seawater (the latter has not been industrially utilized as yet).

It is generally agreed that lithium reserves are sufficient (Vikström et. al. (2013). Nevertheless, not all producers are flexible enough to be able to meet fast growing demand (Grosjean et. al. (2013). Recycling can be a supplementary resource. In 1992, a technology was patented that can provide for lithium extraction from waste or dead batteries. Nonetheless, the recycling contribution is generally assessed as being rather too optimistic (Miedema a Moll, 2013).

Lithium supplies are highly concentrated – four producer companies deliver about 90% of lithium in the world. One of these companies extracts lithium rocks in Australia, the other three process lithium brines.

From 1974 to almost the end of the nineties of the past century, there was a rising trend for lithium prices. In the period 1996–1997, the lithium market was joined by the company, Sociedad Química y Minera (SQM),

producing low-cost lithium from brines. The lithium carbonate price sank by about one-third.

Niobium

In nature, niobium occurs in various minerals together with another element, namely tantalum. From the point of view of mining, the most important role is played by pyrochlore.

It is generally believed that there is enough niobium in the Earth's crust. The US Geological Survey estimates that niobium reserves worldwide can meet the demand for more than 500 years. Brazilian reserves are estimated to last hundreds of years (Vulcan, 2016). As such, recycling of niobium steel and alloys is of marginal importance.

Niobium supplies are extremely concentrated. Brazil is the biggest producer of the commodity with their surface extraction of pyrochlore. Canada follows with their underground mining. In the period, 2009–2012, two Brazilian mines and a single Canadian one produced 99% of niobium in the world (Earth Magazine, 2014). Niobium mineral deposits are located in Nigeria and Congo.

Graphite

The natural graphite occurs in metamorphic rocks as flake, amorphous, and vein graphite. It can be also produced synthetically.

The graphite deposits should suffice for the next few centuries if current consumption is taken into account (Focus Graphite, 2015). Recycling of graphite is technically difficult and unprofitable, and is of little interest.

The biggest world producer of natural graphite is China that dominates 70% of the market (Skidmore, 2012). But it is about production of low-quality amorphous, and flake graphite. This raw material is not suitable for high-tech applications.

China interferes with free-market mechanisms, which action is oriented towards preserving China's natural resources and producing higher VAT goods. China's taxes production of graphite and economic/extraction restrictive measures were also introduced for environmental reasons.

Summary

Natural resources of the above mentioned mineral commodities are not critical. The Earth's crust deposits are sufficient for long-term exploitation, and what's more, a technology has been patented for lithium recycling.

What rather matters is the issue of the free play of market forces. It concerns producing structures – production of niobium and lithium is highly concentrated that refers to both producer countries and mining com-

panies. As regards graphite, China dominates. Governments and companies (SQM, as regards lithium) interfere with the free market mechanism.

The theoretical preconditions for the free play of market forces and balanced price convergence – market presence of many various producers and many customers – do not exist.

Thus, it can be assumed that “criticality” of the above mentioned mineral commodities rather refers to the free play of market forces. Free market interference is implied in dominance of individual producer coun-

tries or production companies, and their ability to decide about production levels and related prices. Nevertheless, the inevitable rise of mineral commodity prices will mean that exploitation of some sources, which are currently deemed uneconomical, may become interesting.

Concerning the latter, the Raw Material Initiative of the European Union with their strong emphasis on utilization of domestic raw material resources is a positive action (European Commission, 2008).

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Rynek surowców krytycznych i jego wpływ na ceny minerałów

W artykule skoncentrowano się na rynku surowców krytycznych i ich wpływie na ceny surowców mineralnych. Zazwyczaj rudy i produkty wzbogacania uznane za surowce krytyczne surowce jeśli w większości lub w całości pochodzą z innych krajów, mają trudno zastępowalne i są niezbędne w gospodarce narodowej, zwłaszcza dla przemysłu obronnego. Jako przedmiot analizy wybrano wolfram, niob, grafit i lit będące surowcami krytycznymi w dokumentach opublikowanych przez Komisję Europejską i rząd Republiki Czeskiej. Przeprowadzono analizę rynku surowców oraz jego wpływ na dostępność i cenę minerałów. Zasoby wolframu zostały zidentyfikowane w kilku krajach natomiast 60% złóż znajduje się w Chinach. Rezerwy litu są wystarczające, ale podaż jest bardzo skoncentrowana cztery firmy producenckie dostarczają około 90% litu. Również podaż niobu jest niezwykle skoncentrowana, w latach 2009-2012 dwie kopalnie brazylijskie i jedna kanadyjska wyprodukowały 99% niobu na świecie. Największym światowym producentem grafitu naturalnego są Chiny, które obejmują 70% rynku światowego. Zasoby naturalne wymienionych surowców mineralnych nie są krytyczne. Złoża skorupy ziemskiej są wystarczające dla długotrwałej eksploatacji, a ponadto opatentowano technologie recyklingu np. litu. Isotny jest problem gry wolnorynkowej. Teoretyczne warunki wstępne dla swobodnej gry sił rynkowych i zrównoważonej konwergencji cen – rynek to obecność wielu różnych producentów i wielu klientów – warunki są zakłócone przez strukturę producentów, dużą koncentrację firm górniczych. Zakłócenia wolnego rynku są implikowane przez dominację poszczególnych krajów producenckich lub przedsiębiorstw produkcyjnych, oraz ich zdolność do decydowania o poziomach produkcji i cenach. Niemniej jednak nieunikniony wzrost cen surowców mineralnych może oznaczać, że wykorzystanie niektórych źródeł, które obecnie uważa się za nieekonomiczne, może stać się interesujące.

Słowa kluczowe: krytyczne surowce, rynek, cena, wolfram, lit, niob, grafit