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Geological Availability

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5 Geological Availability

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Concerns over a secure raw materials supply imply questions over the geological availability of resources. Long term observations of production and reserve data indicate that from a geological point of view no supply shortages are to be expected. Reserve and resource numbers are dynamic figures, because their size depends on price and technical availability. Furthermore reserves and resource are not fully describing the geological potential, simply because deposits might be unknown and vast areas of the world are still unexplored.

5.1 Reserves and resources

Prior to discussing a potential physical scarcity of resources it is necessary to define the terms to be used. A widely accepted classification of reserves and resources has been published by the USGS (2010).

The key concepts of reserves and resources are often confused and used inconsistently, with little or no appreciation of the important differences between them. In particular, the category "Undiscovered resources" has often been neglected.

"Undiscovered resources" are similar to known mineral bodies and may be reasonably expected to exist in the same producing district or region under analogous geological conditions. They may also occur either in known types of deposits in favourable geological settings where mineral discoveries have not been made, or in types of deposits as yet unrecognized for their economic potential. The potential to discover new deposits in the earth crust is regarded as high.

"Undiscovered resources" contribute to the category "identified resources", which is divided into demonstrated and inferred reserves and resources. According to the definition given by the USGS a ***resource*** is a concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

Reserves are that part of the reserve base which could be economically extracted or produced at the time of determination. Reserves include only recoverable materials, but the term reserves need not signify that extraction facilities are in place and operative. Reserves can be divided into subgroups (measured, indicated and inferred reserves) according to the degree of knowledge about those deposits.

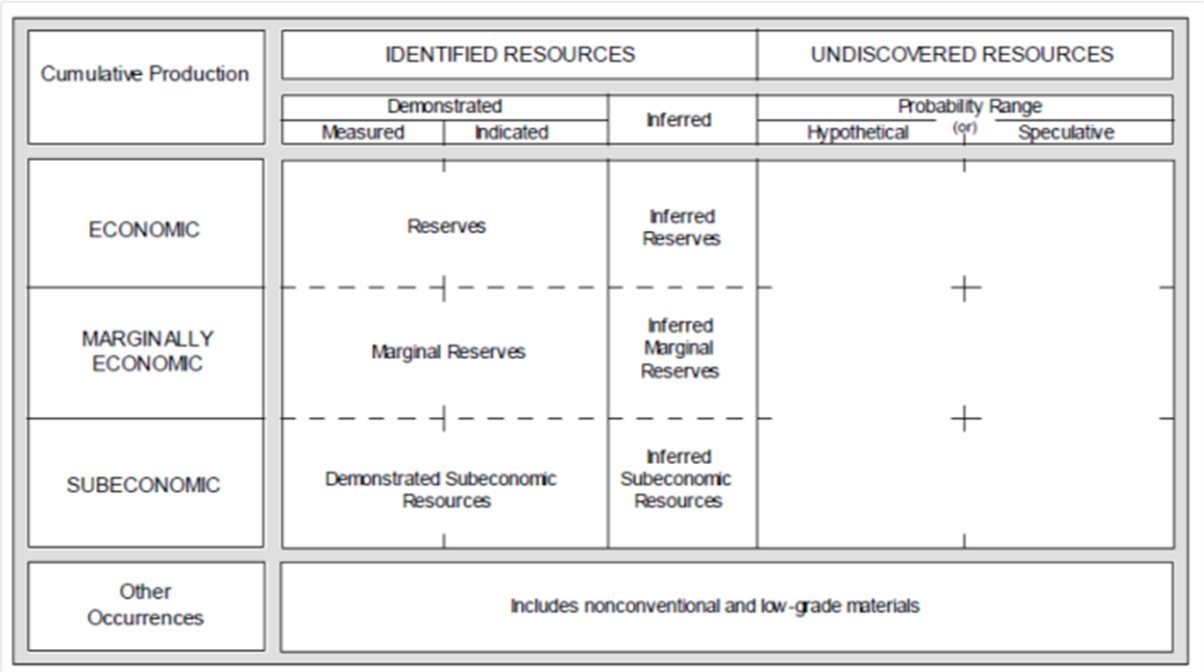

Figure 1: Reserve classification according to the USGS (2010)[1]

To indicate the part of the resources that might be available for future extraction the USGS has used the term "***reserve base***" until 2009. The reserve base included those resources that are currently economic, marginally economic and some of those that are currently subeconomic. The reserve base represents that part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices. The reserve base is the in place demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics.

Reserves and resources do not fully describe the geological potential of a country as there might still be many minable deposits that are simply unknown. Mining companies only explore new deposits to extend production ore to replace reserves that have already been mined. Large areas still remain nearly unexplored. An average of for example 16 US$ per km² was spent on exploration in Africa whereas the corresponding figure for Canada was 55 US$ per km².

5.2 Static Lifetime

Concerns over a secure raw materials supply imply questions over the geological availability of resources. Long term observations of production and reserve data indicate that from a geological point of view no supply shortages are to be expected. In the public discussion the

[1] USGS (2010): Mineral Commodity Summaries 2010. Appendix C, p. 289-291. U.S. Department of the Interior, U.S. Geological Survey, Washington 2010. ISBN 978–1–4113–2666–8
http://minerals.usgs.gov/minerals/pubs/mcs/2010/mcs2010.pdf

ratio of reserves to annual production of a commodity, the so called "static lifetime", is often used misleadingly instead of reserve numbers.

The often cited static lifetime of reserves is ineligible for forecasting future supply shortages and exploration success, since the definition of reserves includes an economic aspect. If commodity prices rise, the amount of available reserves also increases. Increasing exploration activities result in the discovery of new deposits formerly included in the "Undiscovered resource" category. Mines are also able to mine lower grade ores, that before has been classified as non economic. Falling static lifetimes under a certain amount of years might indicate an increasing need for exploration, finally leading to new discoveries and thus expanding the amount of reserves. The static lifetime of reserves (and equally of the reserve base) only represents a snapshot in a dynamic system.

Long term analysis of reserve data (reserves and reserve base) in relation to the actual production shows only minor changes in the resulting lifetime. The static lifetime of copper reserves lay between 30 and 40 years during the last three decades. It thus can be concluded that the geological availability of resources will not be a problem in the long run for the majority of materials if exploration, mining and processing continue to be successful an operational. The earth crust still contains many hidden deposits yet to be discovered. Many areas of our globe are still strongly underexplored.

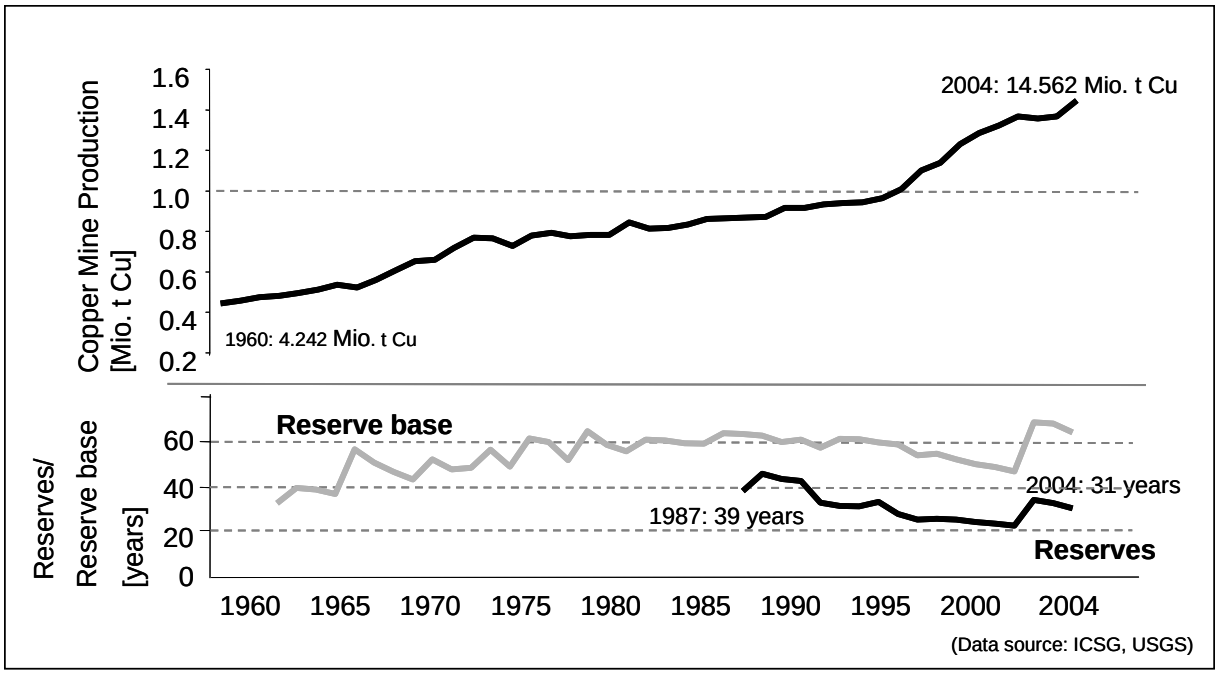

Figure 2: Long term availability of copper reserve in relation to the global copper production (data sources: ICSG, USGS)