Critical and Strategic Metals and Minerals in the Nordic countries Raw Materials for the $21^{\rm st}$ Century

Anders Hallberg, Geological Survey of Sweden, 18 April 2012 Update by Helge Reginiussen, Geological Survey of Sweden, 22 February 2023

Commodity	Tellurium (Te)	Data source
Significance for the EU (2023)	Not Critical nor Strategic	
Uses of the commodity	Main uses: Thin-film (Cd-Te) solar cells, thermoelectric devices, and photoreceptors. Alloying additive to steel, copper, and lead alloys. Minor uses: Colouring agent in glass and ceramics. Used in chemical industry as vulcanizing agent and catalyst. Future uses: Semiconductor industry.	USGS (2023)
Resources and potential in Nordic countries	Sweden: Nya Kankberg mine: 1,003 t Te in reserves and resources. Several gold and base metal deposits in the Fennoscandian Shield contain tellurium that can be recovered from anode slime. Tellurium is present in several massive sulphide deposits in the Caledonides but knowledge on concentrations and distribution is not satisfactory.	Boliden (2023)
Anthropogenic resources and potential in Nordic countries	Anode slime from electrolytic copper refining. Dust and gases from smelting of sulphide ores.	
Main deposit types in Nordic countries	Te-bearing massive sulphide deposits, some Au- Cu deposits with Te.	
Main global deposit types	Massive sulphide, gold, porphyry copper deposits.	Goldfarb et al. (2017), John & Taylor (2017), Kelley & Spry (2017), Monecke et al. (2017)
Global production (2022)	640 t (refinery production). Public data are assumed as partial only, trade opaque, and refinery production larger than what is published.	SCRREEN2 (2023), USGS (2023)
Nordic production (2022)	Sweden 62 t (mine production), 32 t (refinery production)	Boliden (2023)
Main producing countries (2022)	China 53.1 %, Russia 12.5 %, Japan 10.9 %, Canada and Uzbekistan 7.8 %, Sweden 6.3 % (refinery production)	USGS (2023)
Technological challenges in production	Low rate of recovery at smelters. Use of solvent extraction-electrowinning processes for copper, which does not recover tellurium, will limit future supply of tellurium.	
Recycling	Present:	USGS (2023)

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Low recycling rate. A limited amount is recycled from scrapped selenium-tellurium photoreceptors employed in older photocopiers.

Future:
End-of-Life products, especially solar cells.

References

Boliden 2023. Kankberg. Boliden summary report. Mineral resources and reserves 2022.

www.boliden.com/4917db/global assets/operations/exploration/mineral-resources-and-mineral-reserves-pdf/2022/resources-and-reserves-kankberg-2022-12-31.pdf

Boliden 2022. Annual and Sustainability Report 2022. <u>Boliden Annual and Sustainability Report 2022 (alertir.com)</u> European Commission, Study on the EU's list of Critical Raw Materials (2020), Factsheets on Non-critical Raw Materials FODD 2022. Fennoscandian Ore Deposit Database. Annual update (end-2021 data). http://en.gtk.fi/informationservices/databases/fodd/index.html

Goldfarb, R.J., Hofstra, A.H. & Simmons, S.F. 2017. Critical Elements in Carlin, Epithermal, and Orogenic Gold Deposits. Reviews in Economic Geology 18, 217–244.

Kelley, K.D. & Spry, P.G. 2017. Critical Elements in Alkaline Igneous Rock-Related Epithermal Gold Deposits. Reviews in Economic Geology 18, 195–216.

Monecke, T., Petersen, S., Hannington, M.D., Grant, H. & Samson, I.M. 2017. The Minor Element Endowment of Modern Sea-Floor Massive Sulfides and Comparison with Deposits Hosted in Ancient Volcanic Successions. Reviews in Economic Geology 18, 245–306.

SCRREEN2 2023. CRMS 2023: Commodity fact sheets. https://scrreen.eu/crms-2023/

USGS 2023. Mineral commodity summaries 2023. U.S. Geological Survey. 210 p. https://doi.org/10.3133/mcs2023