Panu Lintinen (Geological Survey of Finland), 13 December 2022

Commodity	**Lithium (Li)**	**Data source**
Significance for the EU (2023)	*Critical; Strategic if battery grade*	
Uses of the commodity	Main uses: *Batteries, ceramics, glass, lubricating greases, mold flux powders in (steel) continuous casting* Minor uses: *Polymer production, air treatment, primary aluminium production, rubber and thermoplastics, light-weight metal alloys, pharmaceuticals, drilling mud* Future uses: Demand in batteries assumed to increase many fold.	Warren (2016), USGS (2023)
Resources and potential in Nordic countries	Finland: *Known resources 80,061 t Li. Assumed ('undiscovered') additional resources: 510,000 t Li. Production is scheduled to start in 2024 at Kaustinen, central western Finland.* Greenland: *Known resources 232,000 t Li. Resource potential is much higher than what the known resources suggest.* Norway: *Resources unknown, probably small (in pegmatites).* Sweden: *Known resources 3,180 t Li. Potential resources probably reasonably large but no assessments been done.*	Kunzendorf et al. (1982), Rasilainen et al. (2018), Gautneb et al. (2020), Eilu et al. (2022), Keliber (2022 a,b), Rosa et al. (2023)
Anthropogenic resources and potential in Nordic countries	*Spent Li-ion batteries*	Church & Wuennenberg (2019)
Main deposit types in Nordic countries	*LCT (lithium–caesium–tantalum) type granitic pegmatites*	Jonsson et al. (2022)
Main global deposit types	*LCT granitic pegmatites, continental brines*	Latunussa et al. (2020)
Global production (2022)	*130,000 t, calculated to lithium metal (mines 2022, excludes US production). No statistics available on the production of refined lithium.*	Latunussa et al. (2020), USGS (2023)
Nordic production (2022)	*None. In Finland, production is scheduled to start in 2024 at Kaustinen Li province, Central Ostrobothnia region.*	Keliber (2022b)
Main producing countries (2022)	*Australia 46.9 %, Chile 30 %, China 14.6 %, Argentina 4.8 %*	Latunussa et al. (2020), USGS (2023)
Technological challenges in production	*Li-ion battery recycling is complex and, currently, not cost-effective for Li*	Latunussa et al. (2020)
Recycling	Present: *Only non-industrial scale recycling of Li-ion batteries with poor total recovery of lithium*	Latunussa et al. (2020)

Future:
Rate of recycling will increase due to the laws and regulations, and due to hydro- and pyrometallurgic processes allowing economic recovery of lithium.

References

Church, C. & Wuennenberg, L. 2019. Sustainability and second life: The case for cobalt and lithium recycling. International Institute for Sustainable Development. 68 p. https://www.iisd.org/system/files/publications/sustainability-second-life-cobalt-lithium-recycling.pdf

Eilu, P., Hallberg, A., Bergman, T., Bjerkgård, T., Klyucharev, D., Lauri, L.S. & Sandstad, J.S. 2022. Fennoscandian Ore Deposit Database. Annual update (end-2021 data). Online: http://en.gtk.fi/informationservices/databases/fodd/index.html

Gautneb, H., Gloaguen, E. & Törmänen, T. 2020. Develop and/or review models for the formation of natural graphite, lithium and cobalt in Europe. Deliverable report D5.2. FRAME- GEOERA Project.

Jonsson, E., Törmänen, T., Keiding, J., Bjerkgård, T., Eilu, P., Pokki, J., Gautneb, H., Reginiussen, H., Rosa, D., Sadeghi, M., Sandstad, J. & Stendahl, H. 2022. Critical metals and minerals in the Nordic countries of Europe: diversity of mineralization and green energy potential. Geol. Soc. London Spec. Publ. 526. https://doi.org/10.1144/SP526-2022-55

Keliber 2022a. Mineral Resources from Keliber's New Tuoreetsaaret Lithium Deposit. www.keliber.fi Company Announcement / Press release 23.6.2022. |

Keliber 2022b. Construction of Keliber's Lithium Project to Start – Investment of 588 M€. www.keliber.fi. Company Announcement / Press release 28.11.2022.

Kunzendorf, H., Nyegaard, P. & Nielsen, B.L. 1982: Distribution of Characteristic Elements in the Radioactive Rocks of the Northern Part of Kvanefjeld, Ilimaussaq Intrusion, South Greenland. Grønlands Geologiske Undersøgelse Rapport 109, 32.

Latunussa, C.E.L., Georgitzikis, K., Torres de Matos, C., Grohol, M., Eynard, U., Wittmer, D., Mancini, L., Unguru, M., Pavel, C., Carrara, S., Mathieux, F., Pennington, D. & Blengini, G.A. 2020. European Commission, Study on the EU's list of Critical Raw Materials, Factsheets on Critical Raw Materials. 819 p.

Rasilainen, K., Eilu, P., Ahtola, T., Halkoaho, T., Kärkkäinen, N., Kuusela, J., Lintinen, P. & Törmänen, T. 2018. Quantitative assessment of undiscovered resources in lithium–caesium–tantalum pegmatite-hosted deposits in Finland. Geological Survey of Finland, Bulletin 406, 31 p. Online at: http://tupa.gtk.fi/julkaisu/bulletin/bt_406.pdf

Rosa, D., Kalvig, P., Stendal, H. & Keiding, J.K. 2023. Review of critical raw material resource potential in Greenland. MiMa rapport 2023/1. 121 p. https://doi.org/10.22008/gpub/32049

USGS 2023. Mineral commodity summaries 2023. U.S. Geological Survey. 210 p. pubs.usgs.gov/periodicals/mcs2023

Warren, J.K. 2016. Evaporites, a Geological Compendium. 2nd Edition. Springer, Switzerland. 1813 p.