Anders Hallberg (Geological Survey of Sweden) 18 April 2012
Update by Jakob Keiding (Geological Survey of Denmark and Greenland), 10 January 2023

Commodity	**Rare Earth Elements (REE = La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y)**	**Data source**
Significance for the EU (2023)	*Critical; Dy, Gd, Nd, Pr, Tb are also Strategic as are used in magnets*	
Uses of the commodity	Main uses: *Catalyst, magnets, glass, metallurgy* Minor uses: *Batteries, steel, polishing powder, ceramics, phosphorescence* Future uses: *Fuel cells, superconductors, magnets, catalysts in hydrogen economy*	USGS (2019), Latunussa et al. (2020), Kalvig (2022)
Resources and potential in Nordic countries	*Known resources: Finland 41,000 t REE, Greenland 36,100,000 t REE, Norway 935,000 t REE, Sweden 1,880,000 t REE* *Resource potential:* Finland: *Additional 'undiscovered' resources 1.5 Mt REE. REE endowment in the Sokli carbonatite assumed to be very large, but figures are not published.* Greenland: *The Ilimaussaq intrusion hosts two of world's largest known REE's deposits (Kringlerne and the Kvanefjeld deposits) with total resources of 33 Mt REE. Other important deposits with resource estimations include the Motzfeldt and the Sarfartoq deposits. Several important occurrences have been identified in carbonatites and alkaline intrusions, that may contain additional REE resources.* Norway: *The Fen carbonatite is a major European REE-deposit currently undergoing exploration. A JORC-compliant exploration target of 1.4−3.3 Gt containing 0.4−2 % TREO was defined in 2022 and a resource assessment is expected in 2023. Additional resources may be hosted by REE-rich apatite in Norwegian phosphate deposits.* Sweden*: Additional potential is large and includes additional apatite-iron oxide ores and related mine tailings.*	Paulick et al. (2015), Steenfelt et al. (2016), Lauri et al. (2018), Golder Associates (2021), LKAB (2021, 2023), Eilu et al. (2022), Kalvig (2022), Rosa et al. (2023)
Anthropogenic resources and potential in Fennoscandia	*Waste from phosphoric acid production, waste from apatite, skarn iron and iron oxide-apatite ores. Used magnets.*	
Main deposit types in Nordic countries	*Carbonatite, peralkaline and alkaline intrusions, fenites, alkaline gneiss, greisens, shale, black schist, kaolin deposits, iron oxide-apatite deposits, albite rocks*	Al Ani et al. (2018), Lauri et al. (2018), Jonsson et al. (2022)
Global production (2022)	*300,000 t (REE, mine production)*	USGS (2023)

Nordic production	*None*	
Main producing countries (2022)	*China 70 %, USA 14.3 %, Australia 6 %, Burma 4 % (Burma: a significant part of global HREE production, exact figures not known)*	USGS (2023)
Main global deposit types	*Carbonatite and peralkaline intrusions, ion-exchange clay deposits, heavy mineral sands (HMS), sedimentary phosphorites, pegmatites, coal fly ash*	London (2017), Pufahl & Groat (2017), Sanematsu & Watanabe (2017), Verplanck et al. (2017), Latunussa et al. (2020), Kalvig (2022)
Technological challenges in production	*All REEs commonly occur in the same minerals in a deposit. Complicated process to separate the individual REEs and produce pure elements. Removal and disposing of radioactive minerals from the ore an environmental and SLO issue.*	Verplanck et al. (2017), Latunussa et al. (2020)
Recycling	Present: *Industrial scrap from permanent magnet manufacturing, small quantities from old scrap. Recycling from end-of-life is very low, currently from batteries, permanent magnets, and fluorescent lamps, because of the way that REE are incorporated as small components in complex items or are part of complex materials. The processes required are energy intensive and complex* Future: *Recycling from end-of-life products*	USGS (2019), Latunussa et al. (2020)

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