## Manufacturing aligned with the Earth

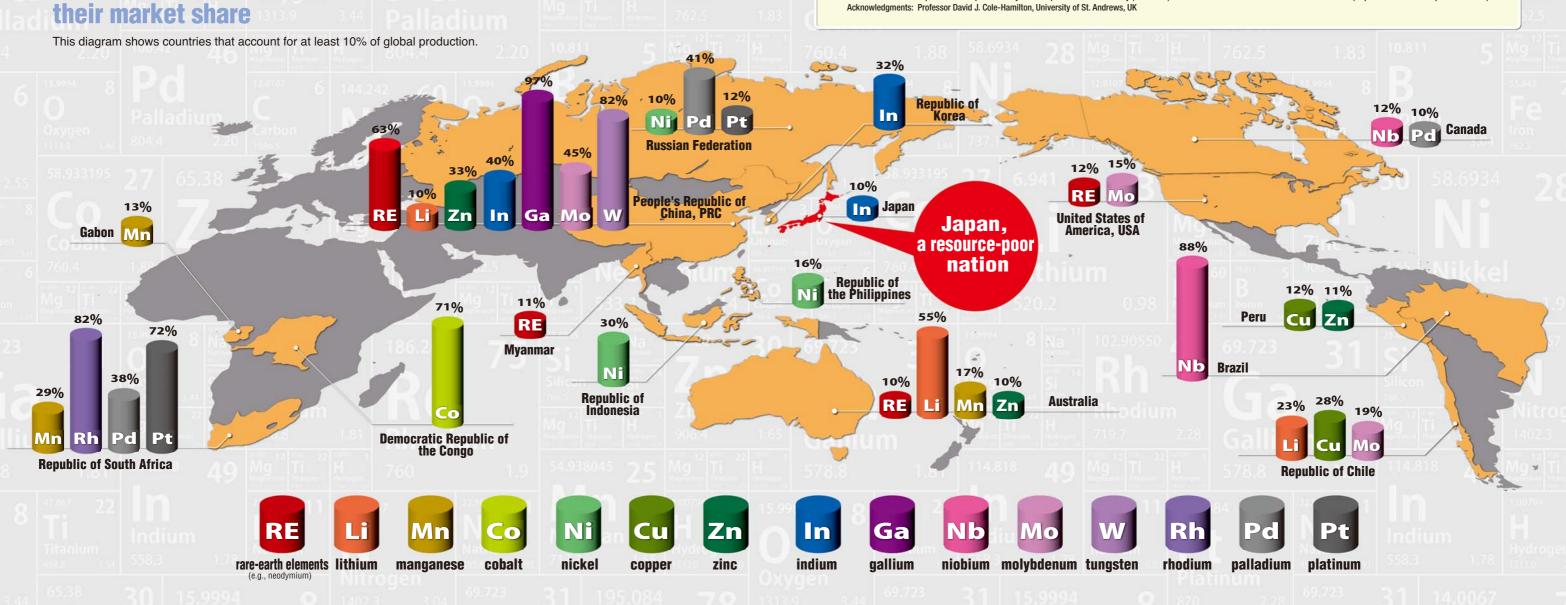
The Earth has limited deposits of mineral resources. Yet the demand for critical materials will continue to increase, and there is concern that we will be faced with a shortage of many elements a few decades from now (refer to the chart on the right). Moreover, mineral resources cannot be produced anywhere on Earth as their reserves are severely unbalanced regionally (see the lower diagram).

Balancing the supply and demand of mineral resources is a challenge the entire world now faces. Solving this problem will require developing technologies for the global circulation of resources and innovative uses for elements that do not impact the environment.

Important mineral-producing countries and

## **Element Scarcity** Serious threat in the next 100 years 📃 Rising threat Li Limited availability, future risk to supply Plentiful supply for current usage Synthetic eleme Mg Ca Sc Zr Τс Sr Y Nb Мо Ru Rh Hf Та W Cs Ва Os Bh Rf Db Sg Hs Mt An lanthanoid Nd Pm An actinide C Th Np Pu

Denotes the precious metals and rare-earth elements that are constituents of the component materials introduced on pages 2 and 3. The production rates of these elements are represented by the height of their columns in the map of "Important element resource-producing countries and their market share." Source : Based on the periodic table published by the European Chemical Society (EuChemS) for the International Year of the Periodic Table 2019 (https://www.euchems-periodic-table/). Acknowledgments: Professor David J. Cole-Hamilton, University of St. Andrews, UK



Sources : The United States Geological Survey (USGS) "Mineral Commodity Summaries 2020" and the Japan Oil, Gas and Metals National Corporation (JOGMEC) "Material Flow of Mineral Resources 2019" Contributors : Tomohiro Nakayama and Satoshi Miyashita (Japan Science and Technology Agency (JST) Center for Research and Development Strategy)

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from in	creased	use	в	С	N	ο	F	Ne
ents			AI	Si	Р	S	CI	Ar
Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Pd	Ag	Cd	In	Sn	Sb	Те	I	Хе
Pt	Au	Hg	TI	Pb	Bi	Ро	At	Rn
Ds	Rg	Cn	Nh	FI	Mc	Lv	Ts	Og
Eu	Gd	Tb	Dy	Но	Er	Tm	Yb	Lu
Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

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