



Rare Earth Elements Research Institute (NATEN)

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Acting Director
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Outline



What are Rare Earth Elements (REE)?

Global Supply of REE

REE Potential of Turkey

Rare Earth Elements Research Institute (NATEN)

Possible Cooperation with Japanese Institutions

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What are Rare Earth Elements?

1 H 1,00794																	2 He 4,00260				
3 Li 6,941	4 Be 9,01218															5 B 10,811	6 C 12,0107	7 N 14,0067	8 O 15,9994	9 F 18,9984	10 Ne 20,1797
11 Na 22,9897	12 Mg 24,305															13 Al 26,9815	14 Si 28,0855	15 P 30,9737	16 S 32,065	17 Cl 35,453	18 Ar 39,948
19 K 39,0983	20 Ca 40,078	21 Sc 44,9559	22 Ti 47,867	23 V 50,9415	24 Cr 51,9961	25 Mn 54,9380	26 Fe 55,845	27 Co 58,9331	28 Ni 58,6934	29 Cu 63,546	30 Zn 65,38	31 Ga 69,723	32 Ge 72,63	33 As 74,9216	34 Se 78,96	35 Br 79,904	36 Kr 83,798				
37 Rb 85,4678	38 Sr 87,62	39 Y 88,9058	40 Zr 91,224	41 Nb 92,9063	42 Mo 95,96	43 Tc (98)	44 Ru 101,07	45 Rh 102,905	46 Pd 106,42	47 Ag 107,868	48 Cd 112,411	49 In 114,818	50 Sn 118,71	51 Sb 121,76	52 Te 127,6	53 I 126,904	54 Xe 131,293				
55 Cs 132,905	56 Ba 137,327	57-71	72 Hf 178,49	73 Ta 180,947	74 W 183,84	75 Re 186,207	76 Os 190,23	77 Ir 192,217	78 Pt 195,084	79 Au 196,966	80 Hg 200,59	81 Tl 204,383	82 Pb 207,2	83 Bi 208,980	84 Po (209)	85 At (210)	86 Rn (222)				
87 Fr (223)	88 Ra (226)	89-103	104 Rf (267)	105 Db (268)	106 Sg (271)	107 Bh (272)	108 Hs (270)	109 Mt (276)	110 Ds (281)	111 Rg (280)	112 Cn (285)	113 Uut (284)	114 Fl (289)	115 Uup (288)	116 Lv (293)	117 Uus (294)	118 Uuo (294)				
			57 La 138,905	58 Ce 140,116	59 Pr 140,907	60 Nd 144,242	61 Pm (145)	62 Sm 150,36	63 Eu 151,964	64 Gd 157,25	65 Tb 158,925	66 Dy 162,5	67 Ho 164,930	68 Er 167,259	69 Tm 168,934	70 Yb 173,054	71 Lu 174,966				
			89 Ac (227)	90 Th 232,038	91 Pa 231,036	92 U 238,028	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)				

Properties of REE

(Sc) Scandium
(La) Lanthanum
(Ce) Cerium
(Pr) Praseodymium
(Nd) Neodymium
(Pm) Promethium
(Sm) Samarium
(Eu) Europium

Light REE

(Gd) Gadolinium
(Tb) Terbium
(Dy) Dysprosium
(Ho) Holmium
(Er) Erbium
(Tm) Thulium
(Yb) Ytterbium
(Lu) Lutetium
(Y) Yttrium

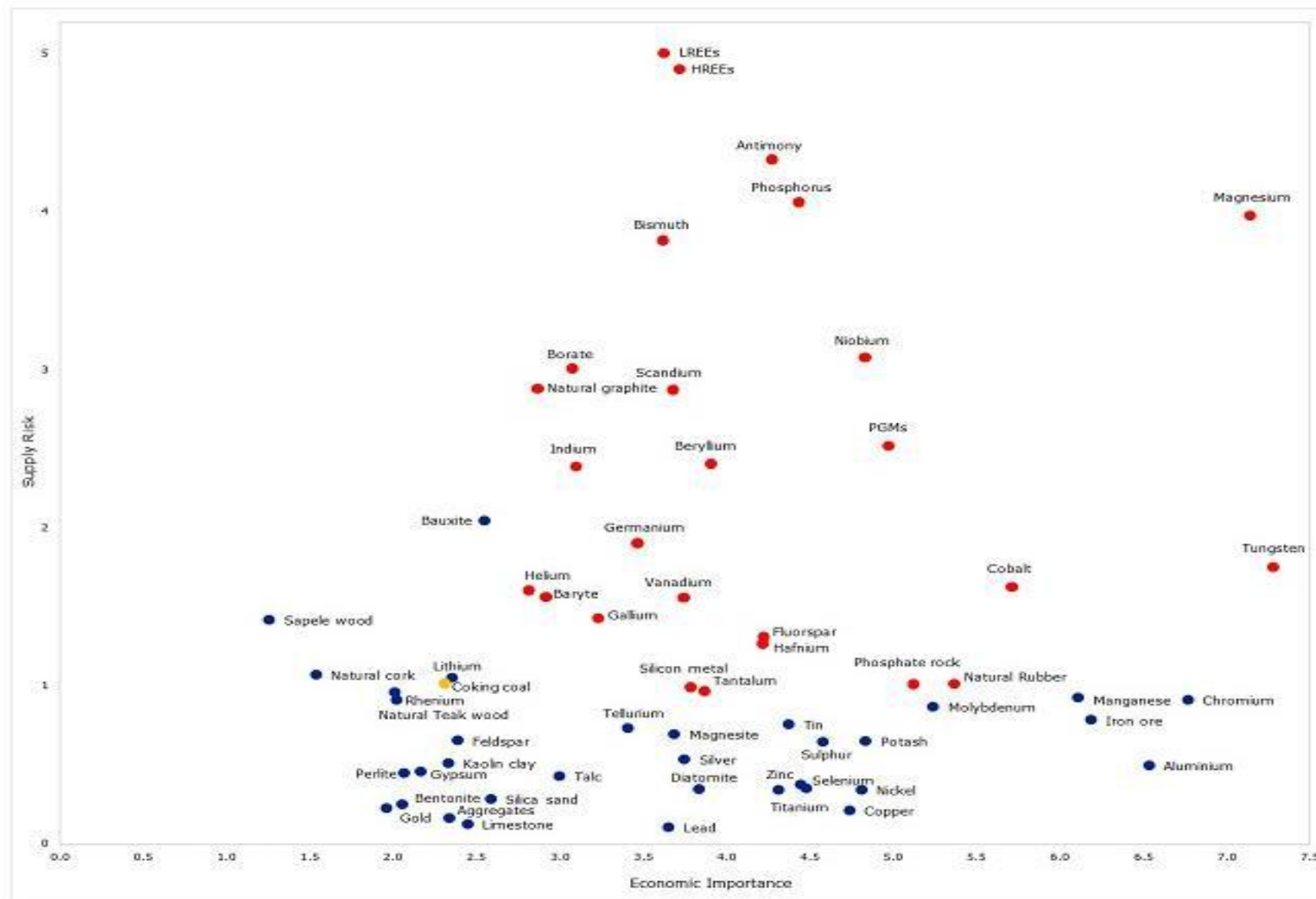
Heavy REE



Properties of REE

- Iron gray/silvery in color
- Typically soft, malleable and ductile
- Usually reactive
- Reactivity especially strong at elevated temperature
- High electrical conductivity
- High melting and boiling points
- Reacts with H_2O and releases H_2

Why REE are Important?



Source: 2017 EU
Critical Raw Materials
Report

Why REE are Important?



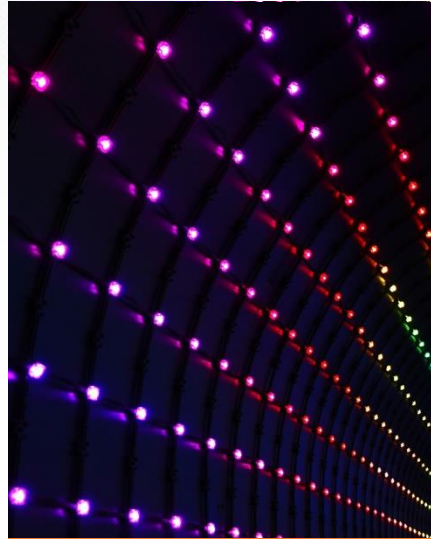
Renewable Energy

- ✓ Praseodymium
- ✓ Neodymium
- ✓ Dysprosium



Digital Technology

- ✓ Yttrium
- ✓ Europium
- ✓ Terbium



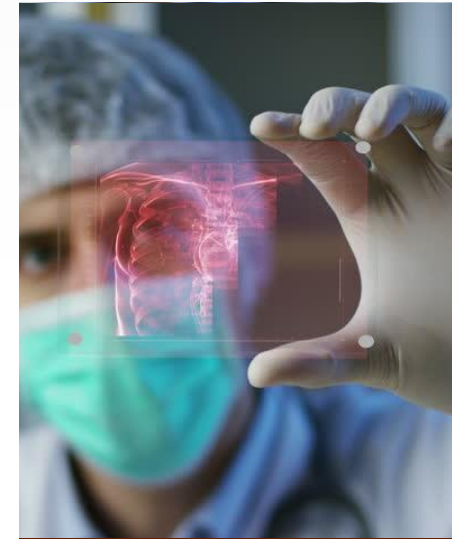
Lighting

- ✓ Yttrium
- ✓ Europium
- ✓ Terbium



Military and Industry

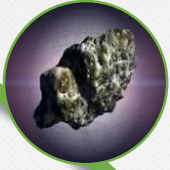
- ✓ Lanthanum
- ✓ Cerium
- ✓ Dysprosium



Medical Applications

- ✓ Neodymium
- ✓ Gadolinium
- ✓ Dysprosium

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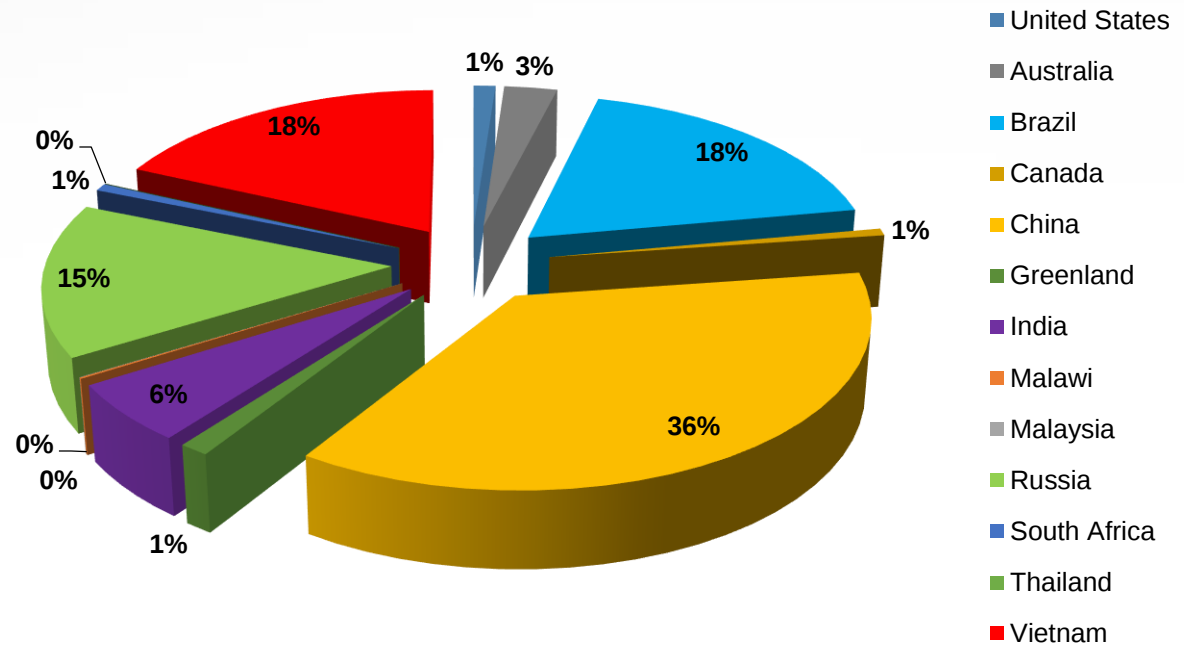
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Global Rare Earth Reserves

COUNTRY	REE RESERVES (t)
United States	1.400.000
Australia	3.400.000
Brazil	22.000.000
Canada	830.000
China	44.000.000
Greenland	1.500.000
India	6.900.000
Malawi	140.000
Malaysia	30.000
Russia	18.000.000
South Africa	860.000
Thailand	NA
Vietnam	22.000.000
World total (rounded)	121.000.000

Country REE Reserves

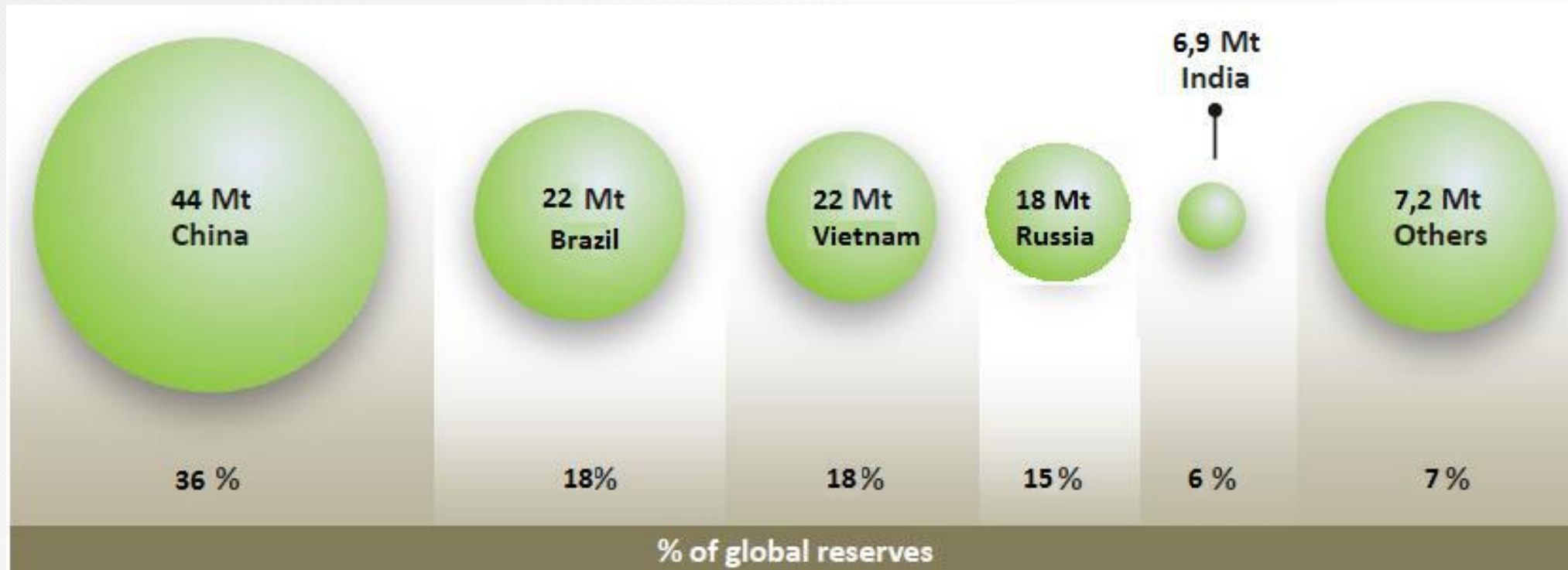


Source:USGS Mineral Commodity Summaries 2018.



2017 Global Rare Earth Reserves were determined as 121 Million Tones

| Global Rare Earth Reserves



China ranks first with 36% in REE reserves. It follows Brazil and Vietnam by 18% and then fourth place is Russia with 15%.

Events in the WORLD



✓ In China, the rare -earth mining production quota for 2017 was set at 105,000 tons, unchanged from that in 2016.



✓ In Nebraska, one company commissioned an operation that produced separated rare-earth oxides from an initial production feedstock material from recycled fluorescent light bulbs. The company planned to ramp up production to 18 tons per month using a specific technology.



✓ Through September 2017, China had exported 39,800 tons of rare-earth materials, a 10% increase compared with exports for the same period in 2016.

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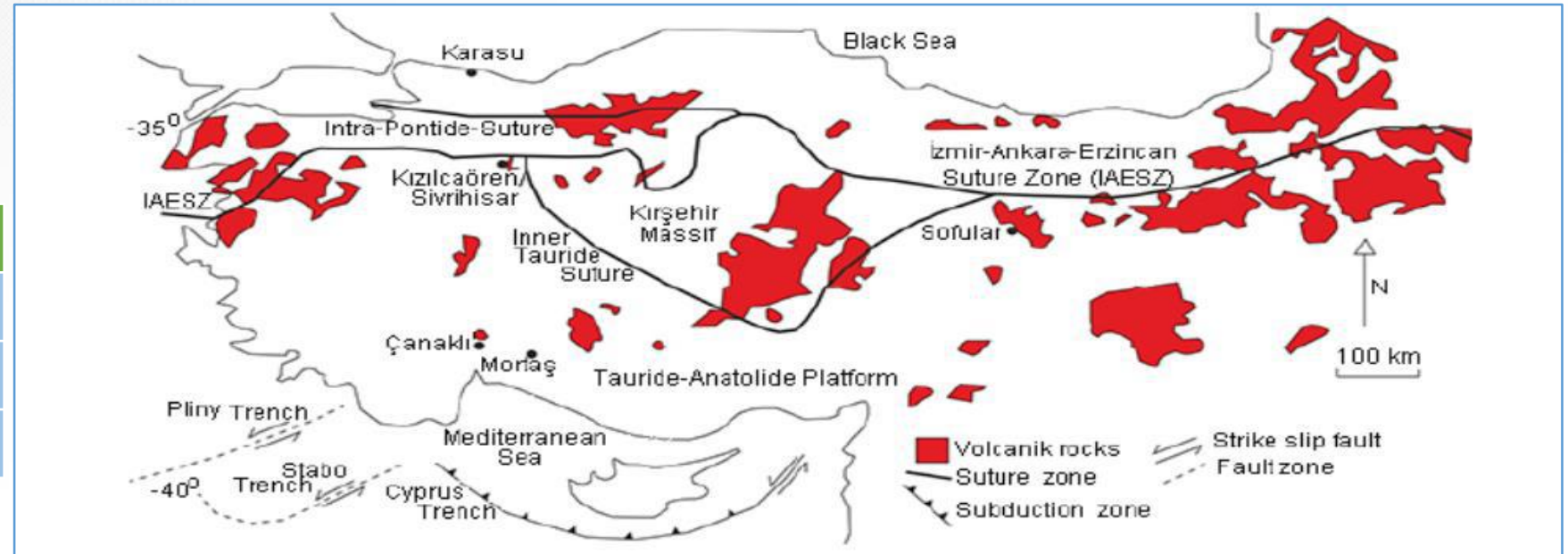
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REE Potential of Turkey

Potential REE reserves/resources in Turkey;

Location	Status
Eskişehir	Proven
Sivas	Possible
Malatya	Possible



Eskişehir – Beylikova - Kızılcaören

Biggest Deposit in Turkey

The ore deposit;

- ✓ in Eskişehir,
- ✓ 35 km away from Ankara-Eskişehir highway and 12 km away from railway,



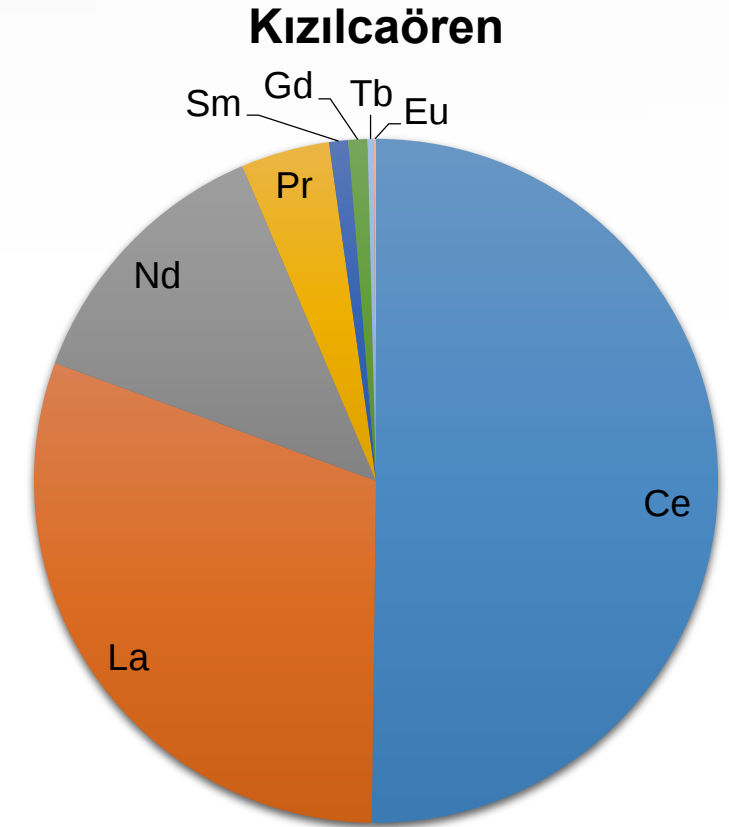
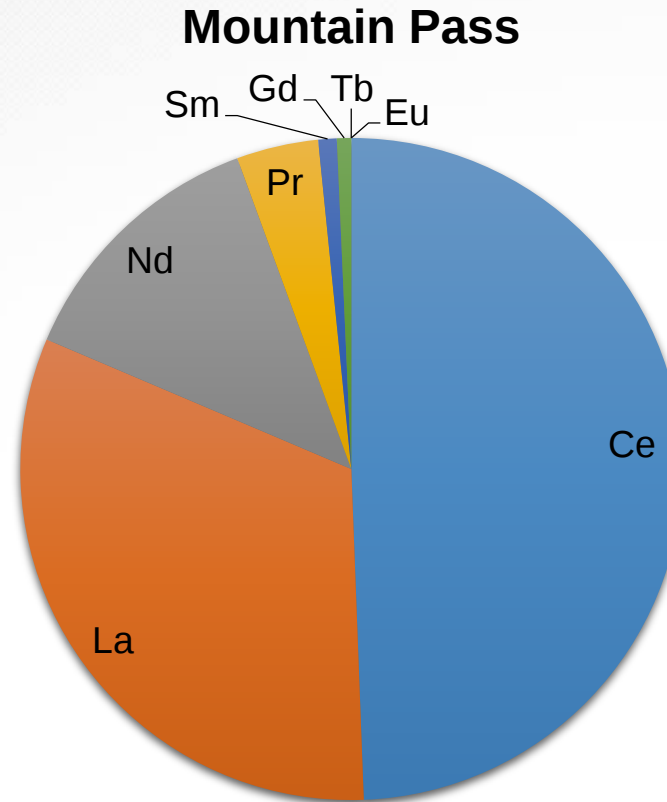
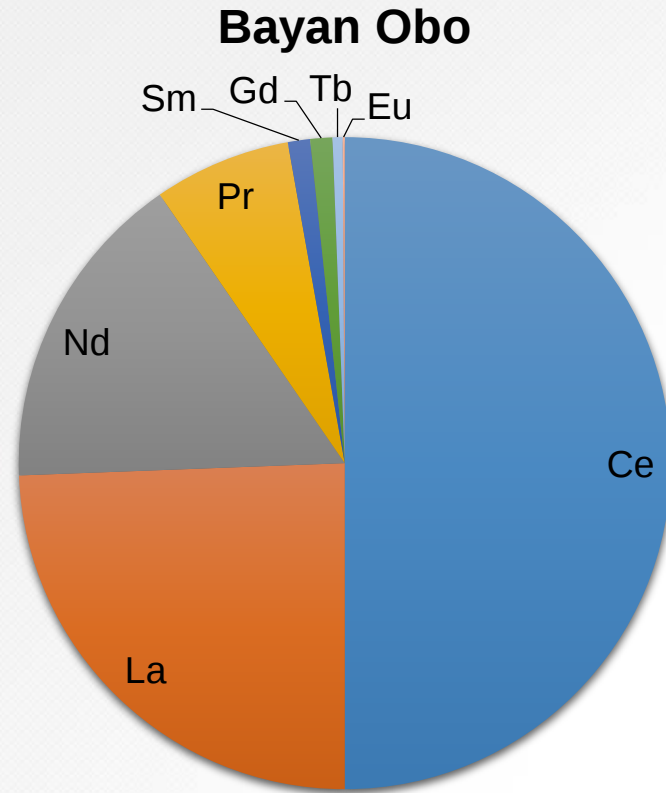
Reserve (t)

Proven	53 Million
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- ✓ has average 3.14% grade.

Eskişehir – Beylikova - Kızılcaören

Biggest Deposit in Turkey



Eskişehir – Beylikova - Kızılcaören

Biggest Deposit in Turkey



- ✓ There are still ongoing studies on the field.
- ✓ After those studies, the proven reserve is expected to be much more than current estimates.

| Related Corporations



General Directorate of
Mining and Petroleum
Affairs
(MAPEG)



General Directorate of
Mineral Research
and Exploration
(MTA)



General Directorate of
Eti Mining Operations
(ETİ Maden)



National Boron
Research Institute
(BOREN)

NATEN

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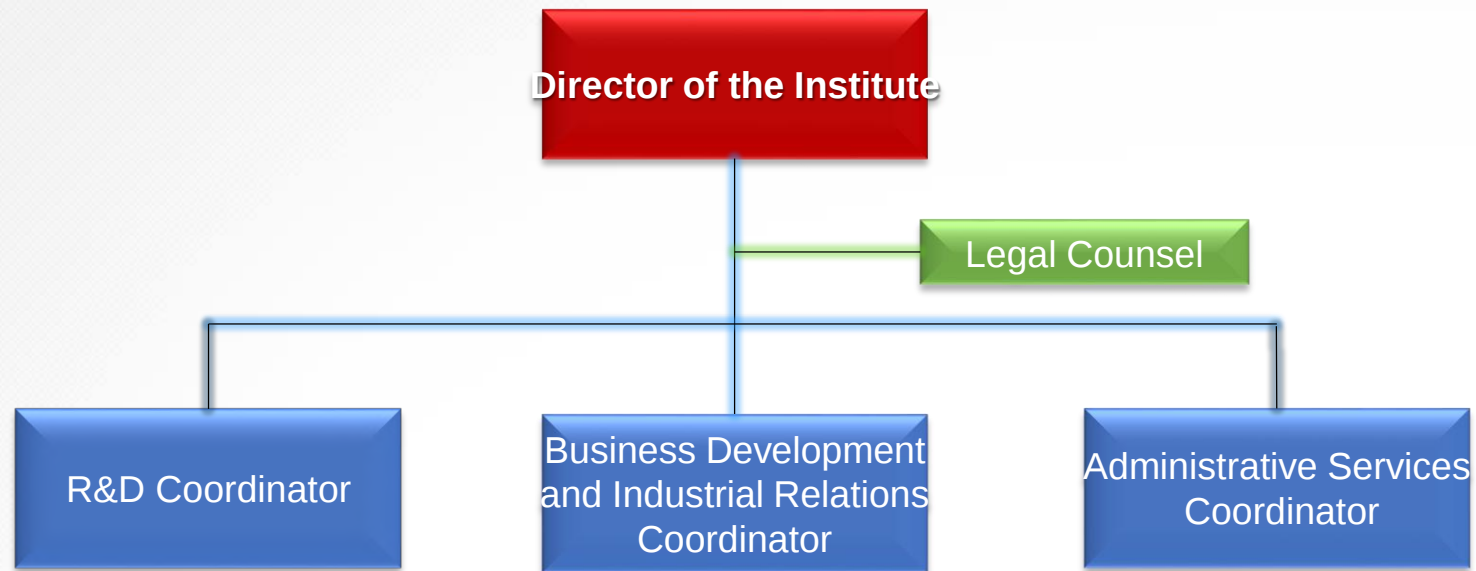
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Rare Earth Elements Research Institute (NATEN)

Organizational Structure

- The Institute was established on July 15, 2018 with the Presidential Decree No: 4.



Rare Earth Elements Research Institute (NATEN)

The Objectives:

- ✓ To make basic and applied researches in order to develop technologies and produce related products
- ✓ To provide necessary scientific environment and infrastructure
- ✓ To provide the necessary information for short, medium and long term policy and strategies about REE and other elements
- ✓ To establish laboratories and research centers



Rare Earth Elements Research Institute (NATEN)

The Objectives:

- ✓ To provide coordination between public and industrial institutions and universities,
- ✓ To make researches about the effects of REE and other elements on the environment and human health
- ✓ To carry out studies regarding the cooperation between international institutions,
- ✓ To carry out R&D projects and other scientific studies in cooperation with public institutions and organizations



Rare Earth Elements Research Institute (NATEN)

The Objectives:

- ✓ To carry out book and journal publishing activities and cooperate with national and international organizations
- ✓ To carry out and/or support international research and development activities
- ✓ To support, organize and participate in scientific meetings and events



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Potential Cooperation Between NATEN & Japanese Institutions

- ✓ Cooperation in technology development
- ✓ Collaboration on R&D studies between related institutions from both sides
- ✓ Technology transfer
- ✓ Working on common pilot projects to share know-how



- ✓ Cooperation on investments for REE reserve utilization

THANKS FOR YOUR LISTENING

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