

**SJR**

**8**

<TARGET><BILL>SJR 8</BILL><SUBJECT>SJR  
8</SUBJECT><COMM>SRES28</COMM></TARGET>

## SENATE COMMITTEE REPORT First Committee of Referral

DATE: 1/30/13

FURTHER:

Date of 5-Day Notice: \_\_\_\_\_  
(in accordance with Uniform Rule 23)

DATE TURNED  
IN TO OFFICE: 2/14/13

**Resources Committee** considered SENATE JOINT RESOLUTION NO. 8

### SJR 8 MINING/PROCESSING OF RARE EARTH ELEMENTS

Supporting the continued and increased exploration, extraction, processing, and production of rare earth elements in the state; and urging the United States Congress to support efforts of the state to develop rare earth elements in the state for the benefit of the economic and national security of the United States.

and recommends:

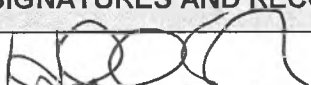
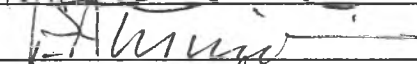
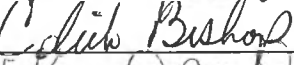
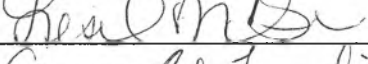
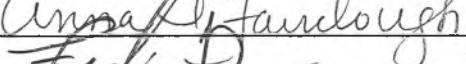
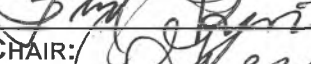

- be replaced with CS SJR ( RES )  Same Title [ ] New Title
- [ ] adopt previous CS \_\_\_\_\_ ( \_\_\_\_\_ ) [ ] Same Title [ ] New Title
- [ ] attached amendment(s)
- [ ] adopt \_\_\_\_\_ Letter of Intent
- [ ] further referral to \_\_\_\_\_ Committee

Dept Abbr.	
ADM	LWF
CED	LAW
COR	LEG
CRT	MVA
EED	DNR
DEC	DPS
DFG	REV
GOV	DOT
DHS	UA

NEW FISCAL NOTE(S)				
Dept.	Fiscal	Indet.	Zero	FN #
S.RES			✓	

PREVIOUS FISCAL NOTE(S)				
Dept.	Fiscal	Indet.	Zero	FN #

[ ] APPROPRIATION - no fiscal note

SIGNATURES AND RECOMMENDATIONS:	PRINTED LAST NAME	DO PASS	DO NOT PASS	NO REC	AMEND
	French	✓			
	MICCICHE	✓			
	Bishop	✓			
	McBride	✓			
	FAIRCLOUGH	✓			
	Dyson	✓			
CHAIR: 	Giessel	✓			

# Alaska State Legislature

Session:  
State Capitol 103  
Juneau, AK 99801  
Phone: (907) 465-2995  
Fax: (907) 465-6592

Rules Committee



Interim:  
716 W 4<sup>th</sup> Avenue, Suite 300  
Anchorage, AK 99501-2133  
Phone: (907) 269-0250  
Fax: (907) 269-0249

Committee on Committees

## Senator Lesil McGuire

**TO:** Senator Cathy Giessel, Chair  
Senate Resources Committee

**FROM:**  Senator Lesil McGuire

**DATE:** February 1, 2013

**SUBJECT:** Request to Schedule SJR 8: Mining/Processing of Rare Earth Elements

---

Madam Chair,

I respectfully request the scheduling of SJR 8: Mining/Processing of Rare Earth Elements in the Senate Resources Committee on February 13<sup>th</sup>, 2013, or, at your earliest convenience. February 13<sup>th</sup> coincides with the Alaska Miners Association Convention in Juneau and would be a great time to educate the members and the public on this issue.

Attached is a bill packet that contains the following:

1. Sponsor Statement
2. Current Version of Resolution: SJR 8 (28-LS0324A)
3. Supporting Documents
  - a. Letter of Support from Ucore Rare Metals. 2013.1.30
  - b. Rare-Earth Elements: A brief overview including uses, worldwide resources, and known occurrences in Alaska. (Szumigala, D.J. and Werdon, M.B., Alaska Division of Geological and Geophysical Survey. 2011)
  - c. Recent Press: North of 60 Mining News. 2013.1.31
4. Request for AV Equipment for a power point presentation

To Testify:

Ken Collison, Chief Operating Officer, Ucore Rare Metals, Inc.

Jesse Logan in my office will be the staff contact for this bill. His number is 465-5159. Please call if you have any questions.

# Alaska State Legislature

Session:  
State Capitol 103  
Juneau, AK 99801  
Phone: (907) 465-2995  
Fax: (907) 465-6592

Rules Committee



Interim:  
716 W 4<sup>th</sup> Avenue, Suite 300  
Anchorage, AK 99501-2133  
Phone: (907) 269-0250  
Fax: (907) 269-0249

Committee on Committees

Senator Lesil McGuire

## Sponsor Statement

### Senate Joint Resolution 8

***“Supporting the continued and increased exploration, extraction, processing, and production of rare earth elements in the state; and urging the United States Congress to support efforts of the state to develop rare earth elements in the state for the benefit of the economic and national security of the United States.”***

Rare Earth Elements possess unique chemical, electrical, and physical properties that make them indispensable for a wide variety of emerging critical technologies. These include national defense, clean energy, and other consumer and industrial uses.

China currently produces 95 percent of the world's rare earth elements and has reduced the export quotas of these elements consistently over the last 7 years. Currently, the United States has no domestic supply of rare earth elements. This poses significant risks to national security and energy security.

Mineral resources make up a major portion of the state's economic assets and Alaska has at least one world class deposit of rare earth elements. Increased exploration for these elements along with the establishment of secondary processing and research facilities can create new career opportunities for Alaskans. Alaska is well positioned to become the United States' leading supplier of these critical elements.

SJR 8 supports the continued and increased exploration, extraction, processing and production of rare earth elements. This Resolution urges state agencies to expedite consideration of permits required to achieve this, and also urges the United States Congress to support these efforts to develop the rare earth elements industry in Alaska.

# FISCAL NOTE

**STATE OF ALASKA**  
**2013 LEGISLATIVE SESSION**

Bill Version CSSJR 8(RES)  
 Fiscal Note Number 1  
 (S) Publish Date 2/15/13

Identifier (file name) \_\_\_\_\_ Dept. Affected \_\_\_\_\_  
 Title SJR 8 MINING/PROCESSING OF RARE EARTH Appropriation \_\_\_\_\_  
 Allocation \_\_\_\_\_  
 Sponsor Senator McGuire  
 Requester Senate Resources Committee OMB Component Number \_\_\_\_\_

**Expenditures/Revenues** (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

	FY14 Appropriation Requested	Included in Governor's FY14 Request	Out-Year Cost Estimates				
			FY15	FY16	FY17	FY18	FY19
<b>OPERATING EXPENDITURES</b>	<b>FY14</b>	<b>FY14</b>	<b>FY15</b>	<b>FY16</b>	<b>FY17</b>	<b>FY18</b>	<b>FY19</b>
Personal Services							
Travel							
Services							
Commodities							
Capital Outlay							
Grants, Benefits							
Miscellaneous							
<b>TOTAL OPERATING</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

<b>FUND SOURCE</b>		(Thousands of Dollars)					
1002	Federal Receipts						
1003	GF Match						
1004	GF						
1005	GF/Prgm (DGF)						
1037	GF/MH (UGF)						
1178	temp code (UGF)						
<b>TOTAL</b>		<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

<b>POSITIONS</b>							
Full-time							
Part-time							
Temporary							

<b>CHANGE IN REVENUES</b>							

Estimated **SUPPLEMENTAL (FY13) operating costs** \_\_\_\_\_ (separate supplemental appropriation required)  
 (discuss reasons and fund source(s) in analysis section)

Estimated **CAPITAL (FY14) costs** \_\_\_\_\_ (separate capital appropriation required)  
 (discuss reasons and fund source(s) in analysis section)

**ASSOCIATED REGULATIONS**

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? \_\_\_\_\_  
 If yes, by what date are the regulations to be adopted, amended, or repealed? \_\_\_\_\_ Discuss details in analysis section.

**Why this fiscal note differs from previous version (if initial version, please note as such)**

Initial version.

Prepared by Senate Resources Committee Phone 465-4843  
 Division \_\_\_\_\_ Date/Time 2/13/13 12:00 AM  
 Approved by /s/ Senator Giessel, Chair Date 2/13/2013

FISCAL NOTE ANALYSIS #1

STATE OF ALASKA  
2013 LEGISLATIVE SESSION

BILL NO. CSSJR 8(RES)

**Analysis**

A large, empty rectangular box with a thin black border, occupying most of the page. It is intended for the analysis content.

# FISCAL NOTE

**STATE OF ALASKA**  
**2013 LEGISLATIVE SESSION**

Bill Version SJR 8  
 Fiscal Note Number \_\_\_\_\_  
 () Publish Date \_\_\_\_\_

Identifier (file name) \_\_\_\_\_ Dept. Affected \_\_\_\_\_  
 Title SJR 8 MINING/PROCESSING OF RARE EARTH Appropriation \_\_\_\_\_  
 Allocation \_\_\_\_\_  
 Sponsor Senator McGuire  
 Requester Senate Resources Committee OMB Component Number \_\_\_\_\_

**Expenditures/Revenues** (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

	FY14 Appropriation Requested	Included in Governor's FY14 Request	Out-Year Cost Estimates				
			FY15	FY16	FY17	FY18	FY19
<b>OPERATING EXPENDITURES</b>	<b>FY14</b>	<b>FY14</b>	<b>FY15</b>	<b>FY16</b>	<b>FY17</b>	<b>FY18</b>	<b>FY19</b>
Personal Services							
Travel							
Services							
Commodities							
Capital Outlay							
Grants, Benefits							
Miscellaneous							
<b>TOTAL OPERATING</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

<b>FUND SOURCE</b>		(Thousands of Dollars)					
1002	Federal Receipts						
1003	GF Match						
1004	GF						
1005	GF/Prgm (DGF)						
1037	GF/MH (UGF)						
1178	temp code (UGF)						
<b>TOTAL</b>		<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

<b>POSITIONS</b>							
Full-time							
Part-time							
Temporary							

<b>CHANGE IN REVENUES</b>							

Estimated **SUPPLEMENTAL (FY13) operating costs** \_\_\_\_\_ (separate supplemental appropriation required)  
 (discuss reasons and fund source(s) in analysis section)

Estimated **CAPITAL (FY14) costs** \_\_\_\_\_ (separate capital appropriation required)  
 (discuss reasons and fund source(s) in analysis section)

**ASSOCIATED REGULATIONS**

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? \_\_\_\_\_  
 If yes, by what date are the regulations to be adopted, amended, or repealed? \_\_\_\_\_ Discuss details in analysis section.

**Why this fiscal note differs from previous version (if initial version, please note as such)**

Initial version.

Prepared by Senate Resources Committee  
 Division \_\_\_\_\_  
 Approved by /s/ Senator Giessel, Chair  
 \_\_\_\_\_

Phone 465-4843  
 Date/Time 2/13/13 12:00 AM  
 Date 2/13/2013

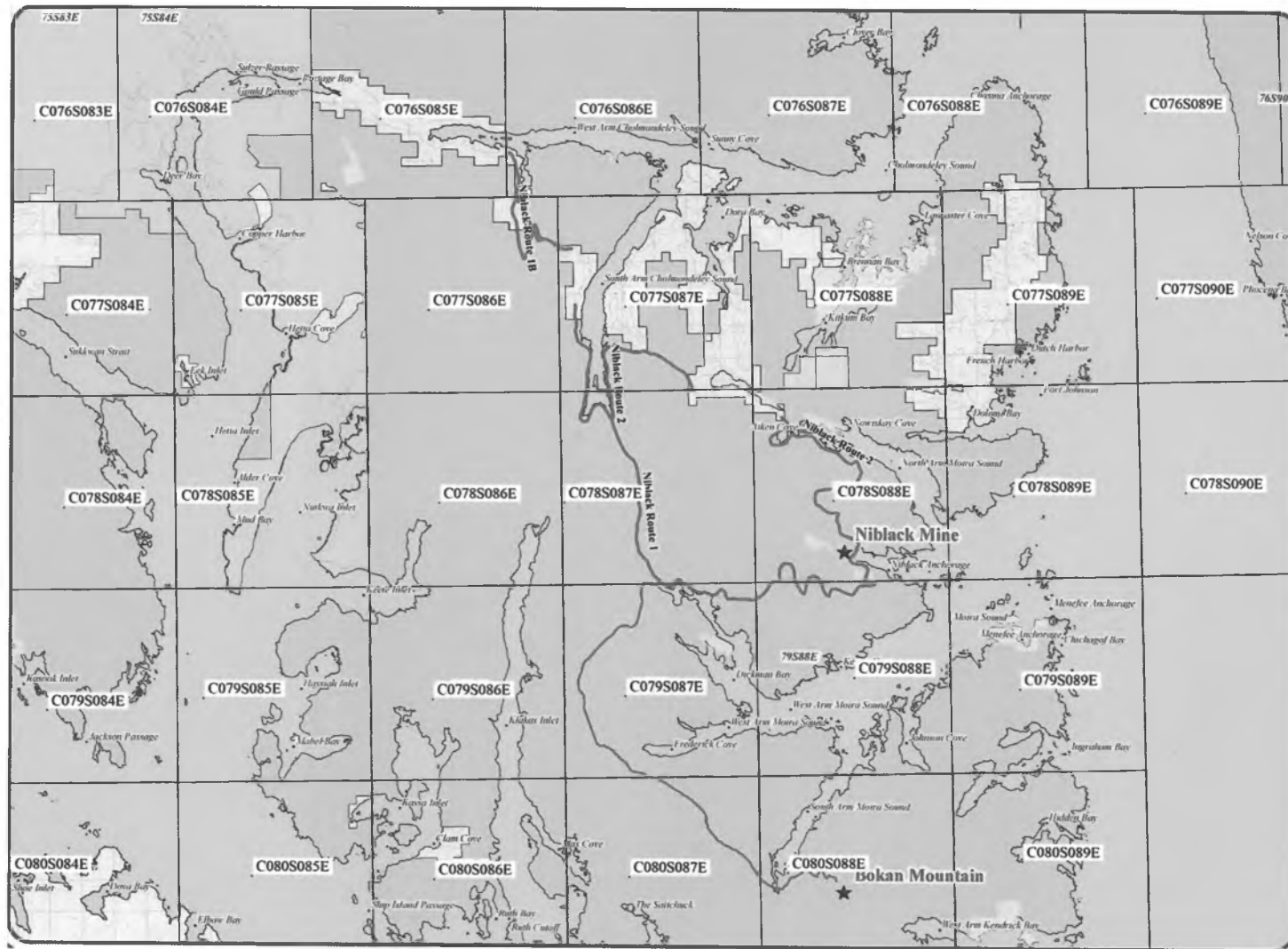
FISCAL NOTE ANALYSIS

STATE OF ALASKA  
2013 LEGISLATIVE SESSION

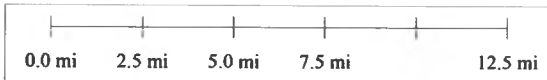
BILL NO. SJR 8

**Analysis**



SJR 8 has no financial impact



- ANCSA Land Ownership**
-  Sealaska Corporation Lands
  -  Village Corporation Lands
  -  State or Private Lands



Road to Niblack Mine and Bokan Mountain Route Extension

-  Proposed Route
-  FEATURE LABEL

South Prince of Wales Island, Alaska

113TH CONGRESS  
1ST SESSION

# S. 181

To authorize the establishment of the Niblack and Bokan Mountain mining area road corridors in the State of Alaska, and for other purposes.

---

## IN THE SENATE OF THE UNITED STATES

JANUARY 30, 2013

Ms. MURKOWSKI (for herself and Mr. BEGICH) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

---

## A BILL

To authorize the establishment of the Niblack and Bokan Mountain mining area road corridors in the State of Alaska, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*  
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “Niblack and Bokan  
5 Mountain Mining Area Roads Authorization Act”.

6 **SEC. 2. NIBLACK AND BOKAN MOUNTAIN MINING AREA**  
7 **ROAD CORRIDORS.**

8 (a) **ESTABLISHMENT.**—Notwithstanding any prohibi-  
9 tion against road construction in inventoried roadless

1 areas under the Roadless Area Conservation Rule estab-  
2 lished under part 294 of title 36, Code of Federal Regula-  
3 tions (and successor regulations), not later than 180 days  
4 after the date of enactment of this Act, the Secretary of  
5 Agriculture, acting through the Chief of the Forest Serv-  
6 ice, shall, for purposes of connecting the Prince of Wales  
7 Island road system in the State of Alaska to the area of  
8 the Niblack and Bokan Mountain patented mineral claims  
9 on the southeast side of Prince of Wales Island, estab-  
10 lish—

11 (1) a road corridor that follows 1 of the 2  
12 routes identified as “Niblack Route 1” or “Niblack  
13 Route 2” on the map entitled “Road to Niblack  
14 Mine and Bokan Mountain Route Extension”, num-  
15 bered 1, and dated June 21, 2012; and

16 (2) a road corridor to the Bokan Mountain  
17 mine that branches off the Niblack Mine road cor-  
18 ridor established under paragraph (1).

19 (b) REQUIREMENTS.—A road corridor established  
20 under subsection (a) shall—

21 (1) minimize the economic costs of the road  
22 corridor by using, to the maximum extent prac-  
23 ticable, the road network in existence on the date of  
24 the establishment;

1           (2) minimize effects of the road corridor on sur-  
2 face resources;

3           (3) prevent unnecessary or unreasonable sur-  
4 face disturbance; and

5           (4) comply with all applicable laws (including  
6 regulations).

7       (c) COOPERATING AGENCIES.—The State of Alaska  
8 and the Prince of Wales Community Advisory Council may  
9 participate as cooperating agencies during the preparation  
10 of any environmental impact statement prepared with re-  
11 spect to a road corridor under subsection (a).

12       (d) FEDERAL PERMITS.—It is the intent of Congress  
13 that any Federal permit required for construction of a  
14 road corridor established under subsection (a) be issued  
15 or denied by the date that is not later than 1 year after  
16 the date of application for the permit.

○



ucore  
RARE METALS

# Rare Earth Elements





ucore  
RARE METALS

## Cautionary Notes and Disclaimers

This presentation may contain forward-looking statements including, but not limited to, comments regarding the timing and content of upcoming work programs, geological interpretations, receipt of property titles, in-situ valuations, mining costs, potential mineral recovery processes, and other related matters. Forward-looking statements address future events and conditions and therefore involve inherent risks and uncertainties. The Ucore Rare Metals Inc properties are at an early stage. More work is required before the mineralization and the Projects' economic aspects can be confidently modeled. Actual results may differ materially from those currently anticipated in this presentation. No representation or prediction is intended as to the results of future work, nor can there be any promise that the estimates and projections herein will be sustained in future work or that the Projects will otherwise prove to be economic.



ucore  
RARE METALS

# What Have We Got?

- China Controls 95% of Worlds REEs

Bokan Mtn Has:

- Deposit with a high percentage of HREOs
- Project with very robust economics
- Very small footprint and no tailings on surface at closure
- New technology results in production of individual REOs
- Great opportunity for a new industry for the State

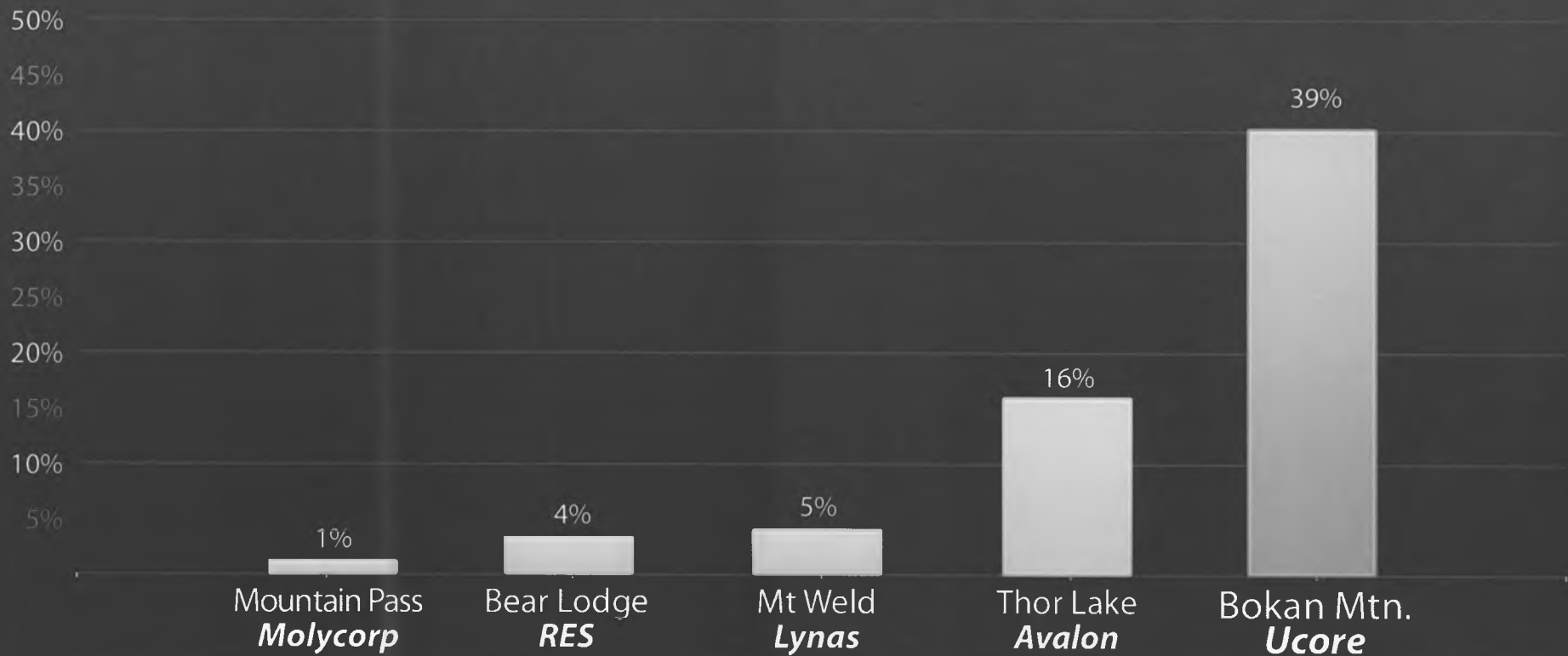


ucore  
RARE METALS

# HREO content

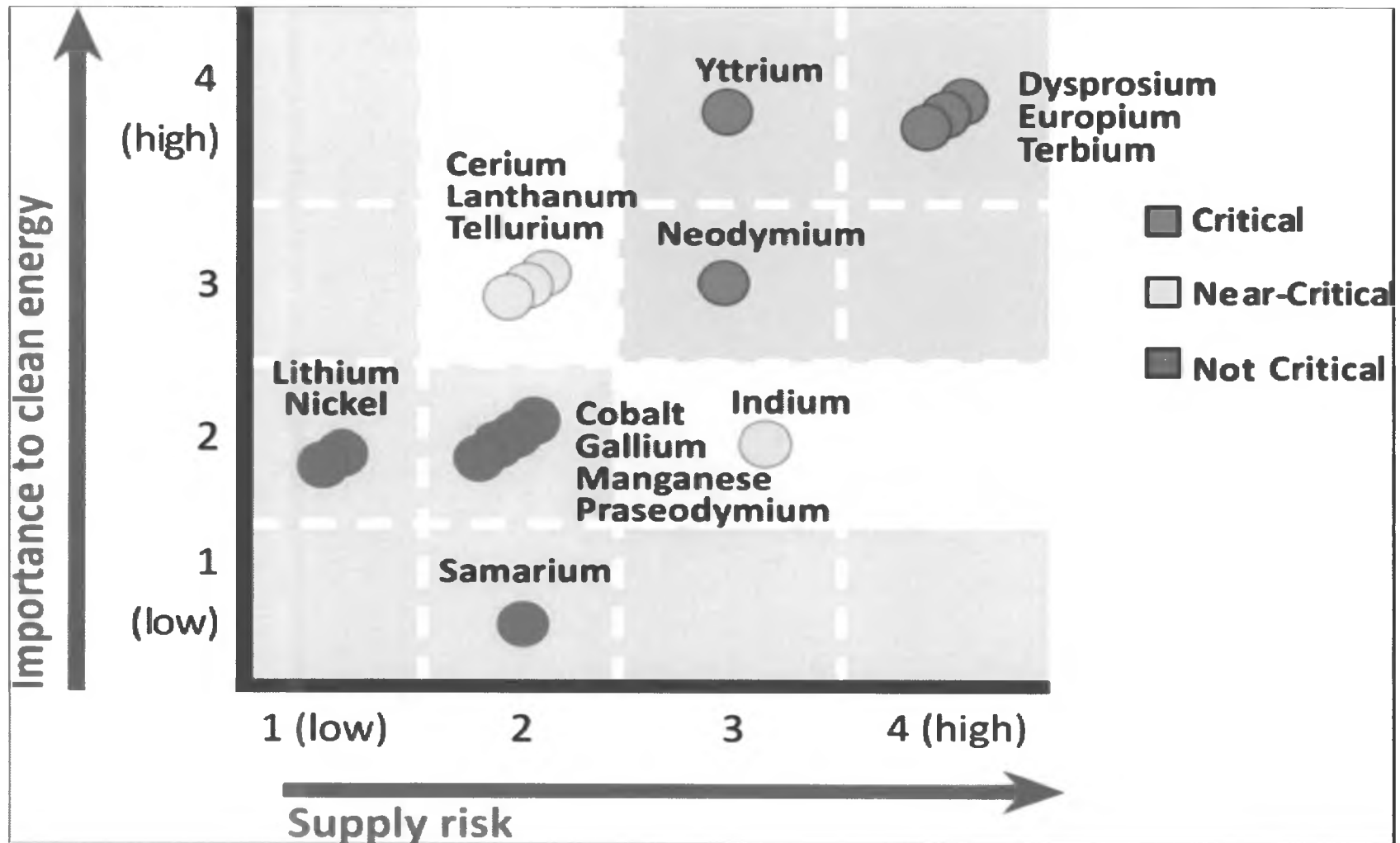
## Heavy vs Light Rare Earth Elements

HREO Content (as a percent of TREO)





ucore  
RARE METALS





ucor  
RARE METALS

# Green Technology





ucore  
RARE METALS

# Hybrid Vehicles

## 33 Pounds of REES





ucore  
RARE METALS

# Defence Applications





ucore  
RARE METALS

**TSX-V:UCU | OTCQX:UURAF**

**[www.ucore.com](http://www.ucore.com)**

**PRINCE OF WALES COMMUNITY ADVISORY COUNCIL  
RESOLUTION No. 11-02**

**A JOINT RESOLUTION BY AND BETWEEN THE COMMUNITIES OF THE PRINCE OF WALES COMMUNITY ADVISORY COUNCIL SUPPORTING DEVELOPMENT OF ROAD ACCESS TO THE NIBLACK AND BOKAN MOUNTAIN MINE PROSPECTS**

WHEREAS, the Prince of Wales Community Advisory Council acts in an advisory capacity for participating communities on Prince of Wales Island; and,

WHEREAS, Southeast Alaska has a wealth of well-managed natural resources; and,

WHEREAS, the economy of Southeast Alaska is dependent upon access to and use of natural resources; and,

WHEREAS, the timber, mining, fishing, and visitor industries all share a common need for access to natural resources; and,

WHEREAS, two promising mine prospects, Niblack and Bokan Mountain, exist on Prince of Wales Island; and,

WHEREAS, both prospects are located off the extensive Prince of Wales Island road system; and,

WHEREAS, connecting these mine prospects to the POW road system would improve the ability of Southeast Alaska residents to provide goods and services to the mines; and,

WHEREAS, increasing the range of goods and services that Southeast Alaska residents and businesses can provide to the mines results in greater social and economic benefits to the residents of the region; and,

WHEREAS, in addition to increasing the regional delivery of goods and services to the mine prospects, road access would encourage extension of the POW Island hydroelectric transmission lines to the mines, displacing the need to consume some fossil fuels to support mine operations; and,

WHEREAS, there is broad support among POW Island communities to extend the island's road system to the mines.

NOW, THEREFORE, BE IT RESOLVED that the Prince of Wales Community Advisory Council supports efforts to connect the POW Island road system to the Niblack and Bokan Mountain mine prospects.

PASSED AND APPROVED this 22nd day of November 2011 by the Prince of Wales Community Advisory Council.

A handwritten signature in black ink, appearing to read 'G.M. Powell', written over a horizontal line.

POWCAC Chair

Community Apporvals

1. POW Chamber of Commerce
2. Naukati Inc.
3. Craig Tribal Assn.
4. City of Craig
5. City of Thorne Bay
6. City of Kasaan
7. City of Coffman Cove
8. Organized Village of Kasaan
- 9.



ucore®  
RARE METALS

The Honorable Lesil McGuire  
Chair  
Senate Rules Committee  
Alaska State Senate  
State Capitol Building  
120 Fourth Street, Room 3  
Juneau, Alaska 99801

**RE: SENATE JOINT RESOLUTION #8**

Dear Senator McGuire:

Thank you for sponsoring SJR 8. We applaud your efforts to recognize the significance of rare earth elements in Alaska and their importance to the United States. Rare earth elements are necessary for applications related to national defense, clean energy and the manufacture of other high tech consumer and industrial products. The rare earth deposits in Alaska containing these critical elements are some of the richest resources in North America, particularly the resource at Bokan Mountain on Prince of Wales Island in Southeast Alaska.

There are unique aspects to the Bokan Mountain project. The deposit's proximity to a deep water port, prospective power source, available labor and its skew towards the scarcer heavy rare earth elements make this project unique among its peers. Mine production will bring new career opportunities for residents and an increase in local business activity that will occur during construction and throughout years of operation.

As supply of rare earth elements from China is subject to interruption, Alaska is poised to become a major participant as a producer of these strategic materials. Ucore offers its support of this important resolution that recognizes Alaska's contribution.

We welcome the opportunity to work together with the State of Alaska to move toward rare earth element production in Alaska.

Regards,

James McKenzie  
President & CEO  
Ucore Rare Metals Inc.

---

210 Waterfront Drive, Bedford, Nova Scotia B4A 0H3

(902) 482-5214 phone ▪ (902) 492-0197 fax ▪ [www.ucore.com](http://www.ucore.com) ▪ TSX.V: UCU ▪ OTCQX: UURAF

# RARE-EARTH ELEMENTS:

A brief overview  
including uses, worldwide  
resources, and known  
occurrences in Alaska

Information Circular 61



David J. Szumigala and Melanie B. Werdon  
STATE OF ALASKA  
DEPARTMENT OF NATURAL RESOURCES  
Division of Geological & Geophysical Surveys (DGGS)  
3354 College Road, Fairbanks, AK 99709-3707  
[www.dggs.alaska.gov](http://www.dggs.alaska.gov)



COVER PHOTO CAPTIONS:

TOP: Sheeted REE-bearing veins, Dotson Trend, Bokan Mountain property, Alaska.  
Photo from [http://www.ucoreraremetals.com/docs/SME\\_2010\\_Keyser.pdf](http://www.ucoreraremetals.com/docs/SME_2010_Keyser.pdf)

BOTTOM: Rare-earth-element-bearing quartz vein exposed in granite, Bokan Mountain, Alaska.  
Photo from [http://www.ucoreraremetals.com/docs/SME\\_2010\\_Keyser.pdf](http://www.ucoreraremetals.com/docs/SME_2010_Keyser.pdf)

# RARE-EARTH ELEMENTS:

## A brief overview including uses, worldwide resources, and known occurrences in Alaska

David J. Szumigala and Melanie B. Werdon

### DGGS Minerals Program

The Alaska Division of Geological & Geophysical Surveys (DGGS), part of the Department of Natural Resources, is charged by statute with determining the potential of Alaska's land for production of metals, minerals, fuels, and geothermal resources; the locations and supplies of groundwater and construction material; and the potential geologic hazards to buildings, roads, bridges, and other installations and structures. The Mineral Resources Section at DGGS collects, analyzes, and provides information on the geological and geophysical framework of Alaska as it pertains to the state's mineral resources. The results of these studies include reports and maps, which are used by scientists for various associated studies, by mining company geologists as a basis for their more focused exploration programs, and by state and federal agency personnel in resource and land-use management decisions.

This paper provides a brief overview of rare-earth elements, their uses, and current worldwide sources of their production. A summary of some Alaska occurrences of rare-earth elements and associated rocks is also included. This information circular is meant to be non-technical. A brief bibliography of geology papers describing Alaska rare-earth-element occurrences is included for those interested in more detailed geological information on rare-earth-element deposits in Alaska.

### Introduction to Rare-Earth Elements

Rare-earth elements and the supply of and demand for these resources are currently significant news items. The global mining industry has ramped up exploration for mineral deposits containing rare-earth elements to meet the perceived future demand. High prices for rare-earth elements continue to drive exploration.

Rare-earth elements (REEs) are a group of chemical elements that occur together in the periodic table of the elements (fig. 1). The group consists of the 15 lanthanide elements: lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), and lutetium (Lu). Yttrium (Y) is generally included with the rare-earth elements because it

Figure 1. Periodic table of the elements with rare-earth elements highlighted. Most of the rare-earth elements are in the lanthanide series of elements. Base image from [malaxo-chemistry.wikispaces.com](http://malaxo-chemistry.wikispaces.com).

**The Periodic Table of the Elements**

Common affiliation with heavy rare earth elements

Heavy rare earth element

Light rare earth element

1 <b>H</b> Hydrogen 1.00794																	2 <b>He</b> Helium 4.003	
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012182																	10 <b>Ne</b> Neon 20.1797
11 <b>Na</b> Sodium 22.989768	12 <b>Mg</b> Magnesium 24.3050																	18 <b>Ar</b> Argon 39.948
19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.955912	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938049	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933200	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.39	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.61	33 <b>As</b> Arsenic 74.92160	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.80	
37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.90584	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.94	43 <b>Tc</b> Technetium (98)	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.90550	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.60	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.29	
55 <b>Cs</b> Cesium 132.90545	56 <b>Ba</b> Barium 137.327	57 <b>La</b> Lanthanum 138.90549	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.9479	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.222	78 <b>Pt</b> Platinum 195.078	79 <b>Au</b> Gold 196.96655	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.3833	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98038	84 <b>Po</b> Polonium (209)	85 <b>At</b> Astatine (210)	86 <b>Rn</b> Radon (222)	
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89 <b>Ac</b> Actinium (227)	104 <b>Rf</b> Rutherfordium (261)	105 <b>Db</b> Dubnium (262)	106 <b>Sg</b> Seaborgium (263)	107 <b>Bh</b> Bohrium (264)	108 <b>Hs</b> Hassium (265)	109 <b>Mt</b> Meitnerium (266)	110 <b>Ds</b> Darmstadtium (269)	111 <b>Rg</b> Roentgenium (272)	112 <b>Cn</b> Copernicium (285)	113 <b>Nh</b> Nihonium (284)	114 <b>Fl</b> Flerovium (289)					
58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.90768	60 <b>Nd</b> Neodymium 144.24	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92534	66 <b>Dy</b> Dysprosium 162.50	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.26	69 <b>Tm</b> Thulium 168.93481	70 <b>Yb</b> Ytterbium 173.04	71 <b>Lu</b> Lutetium 174.967					
90 <b>Th</b> Thorium 232.0381	91 <b>Pa</b> Protactinium 231.03588	92 <b>U</b> Uranium 238.02891	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)					

Alaska Division of Geological & Geophysical Surveys  
 3354 College Road, Fairbanks, AK 99709-3707  
[dave.szumigala@alaska.gov](mailto:dave.szumigala@alaska.gov); [melanie.werdon@alaska.gov](mailto:melanie.werdon@alaska.gov)

is chemically similar to the lanthanide elements and it is generally found in minerals that also contain rare-earth elements. Scandium (Sc) also occurs in most rare-earth-element deposits and is sometimes classified as a rare-earth element. The rare-earth elements are all metals and the group is often referred to as the “rare-earth metals.” These metals have many similar properties, which often cause them to be found together in mineral deposits.

The rare-earth elements are often informally subdivided into “heavy rare earths” and “light rare earths” based on the atomic number of the element. Lanthanum, cerium, praseodymium, neodymium, promethium and samarium, with atomic numbers 57 through 62, are generally referred to as the “light rare earths.” Yttrium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium, with atomic numbers 39 and 63 through 71, are generally considered the “heavy rare earths.” Although yttrium, with an atomic number of 39, is lighter than the light rare-earth elements, it is included in the heavy rare-earth group because of its chemical and physical associations with heavy rare earths in natural deposits.

REEs form iron gray to silvery lustrous metals that are typically soft, malleable, and ductile, and usually reactive, especially at elevated temperatures or when finely divided (Cordier and Hedrick, 2010). Melting points for the REEs range from 798°C for cerium to 1,663°C for lutetium. The principal REE ores contain one or more of the following minerals or material: bastnäsite, loparite, monazite, and the lateritic ion-adsorption clays (Cordier and Hedrick, 2010).

### Uses of Rare-Earth Elements

Rare-earth elements, metals, and alloys that contain them are used in common consumer goods such as computer memory, DVDs, rechargeable batteries, cell phones, vehicle catalytic converters, magnets, fluorescent lighting, and much more. The demand for REEs used in these goods has surged over the past two decades. For example, 20 years ago cell phones were not available but the number in use today has grown exponentially to more than 5 billion units. Table 1 lists the major categories of REE usage in the United States.

Many rechargeable batteries are made with rare-earth compounds. Rechargeable lanthanum–nickel–hydride (La–Ni–H) batteries are gradually replacing nickel–cadmium (Ni–Cd) batteries in computer and communications applications and could eventually replace lead–acid batteries in automobiles (Haxel and others, 2005). Although more expensive, La–Ni–H batteries offer greater energy density, better charge–discharge characteristics, and fewer environmental problems upon disposal or recycling. Demand for small, long-lasting batteries is being driven by demand for portable electronic devices such as cell phones, readers, computers, and cameras.

Several pounds of rare-earth compounds are required for batteries that power electric vehicles and hybrid-electric vehicles. Rare-earth compounds are also used for powerful magnets in a wide range of products, from computer hard drives to wind turbines. As concerns for energy independence, climate change, and other issues impact the sale of electric vehicles and “green” energy systems like wind turbines and solar power panels, the demand for batteries made with rare-earth compounds is expected to increase dramatically.

Rare earths are used as catalysts, phosphors, and polishing compounds. These are used for air pollution control, illuminated screens on electronic devices, and optical-quality glass. Demand for all of these products is expected to rise.

Other substances can be substituted for rare-earth elements in their most important uses; however, these substitutes are usually far less effective and may have a higher cost.

**Table 1. United States REE Usage\***

Use	Percent
Chemical catalysts	22
Metallurgy and alloys	21
Petroleum refining	14
Catalytic converters	13
Glass polishing and ceramics	9
Phosphors for monitors, television, lighting	8
Permanent magnets	7
Electronics	3
Other	3

\*2009 data (USGS, 2011)

## Critical Defense Uses of Rare-Earth Elements

Rare-earth elements play an essential role in modern national defense. Night-vision goggles, precision-guided weapons, and other defense technology rely on various rare-earth metals. Rare-earth metals are key ingredients for radar systems, avionics, and satellites. Substitutes can be used for rare-earth elements in some defense applications; however, those substitutes are not as effective. Several defense uses of rare-earth elements are summarized in table 2. There is also widespread use of commercial “off-the-shelf” products in defense systems, which include rare-earth metals, such as computer hard drives.

In 2010, the U.S. Government Accountability Office (GAO) assessed the likelihood of national security risks arising from the U.S.’s nearly 100 percent dependency on non-domestic sources for REEs. China, the primary source, cut its exports by 72 percent in 2010. The GAO report concluded U.S. defense systems will likely continue to depend heavily on REEs, on the basis of current technology and system designs utilizing REEs, and a lack of effective non-REE substitutes (U.S. Government Accountability Office, 2010). The lack of a domestic REE supply chain presents national security concerns for the U.S., and diminishes its ability to be a world-technology leader. For example, a 2009 National Stockpile configuration report identified lack of lanthanum, cerium, europium, and gadolinium as having caused some kind of weapon system production delay (U.S. Government Accountability Office, 2010).

## Rare-Earth-Element Abundances

Rare-earth elements are not as “rare” as their name implies. Thulium and lutetium are the two least abundant rare-earth elements—but they each have an average crustal abundance that is nearly 200 times greater than the crustal abundance of gold (Haxel and others, 2005). Figure 2 shows the relative abundance of rare-earth elements in comparison to rock-forming, industrial, and precious-metal elements. The rare-earth elements have higher commodity prices than most of the other elements shown because REEs are not usually found in concentrations high enough for economical extraction.

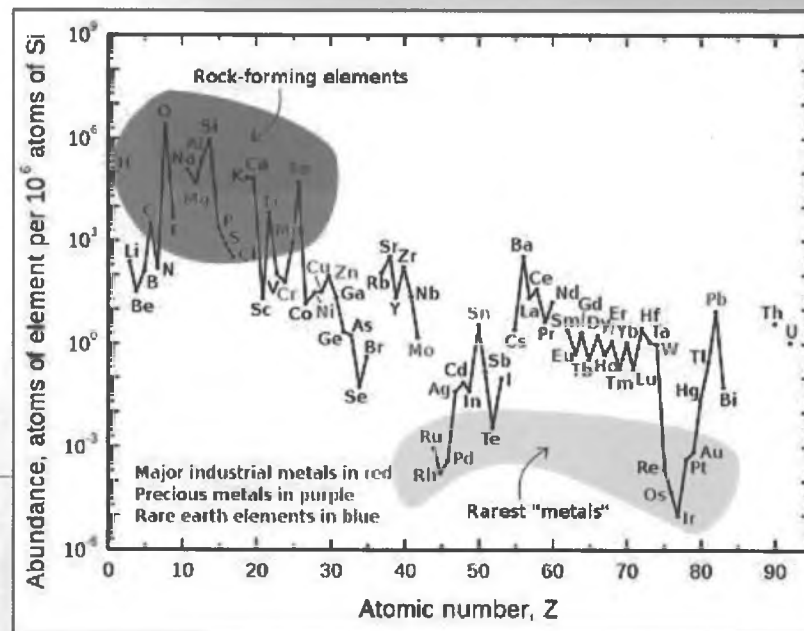
The most abundant rare-earth elements are cerium, yttrium, lanthanum and neodymium. They have average crustal abundances that are similar to commonly used industrial metals such as chromium (Cr), nickel (Ni), zinc (Zn), molybdenum (Mo), tin (Sn), tungsten (W), and lead (Pb). However, these rare-earth elements are rarely found in extractable concentrations.

Figure 2. Abundance of elements in the earth’s crust compared to one million silicon (Si) atoms (Haxel and others, 2005). Rock-forming elements are found in the green ovoid and the least-abundant (rarest) “metals” are highlighted in the golden area. The rare-earth elements have abundances in the midrange of all elements shown in this figure. Refer to figure 1 (periodic table) for an explanation of any chemical symbols not explained in text.

**Table 2. Department of Defense Uses of Rare-Earth Elements\***

Element	Use
Lanthanum	Night-vision goggles
Neodymium	Laser range-finders, guidance systems, communications
Europium	Fluorescents and phosphors in lamps and monitors
Erbium	Amplifiers in fiberoptic data transmission
Samarium	Permanent magnets stable at high temperatures
Samarium	Precision-guided weapons
Samarium	“White noise” production in stealth technology

\* (U.S. Government Accountability Office, 2010)



The principal sources of rare-earth elements are the minerals bastnäsite, monazite, and loparite and the lateritic ion-adsorption clays. Despite their high relative abundance, rare-earth elements are more difficult to extract from their ore minerals than most other metals are from their ore minerals. The rare-earth elements are also difficult to separate from one another, due in part to their similar chemical properties. These factors add to the ultimate costs of producing rare-earth metals and make them relatively expensive compared to other metals. Their industrial use was very limited until efficient separation techniques were developed, such as ion exchange, fractional crystallization, and liquid-liquid extraction during the late 1950s and early 1960s.

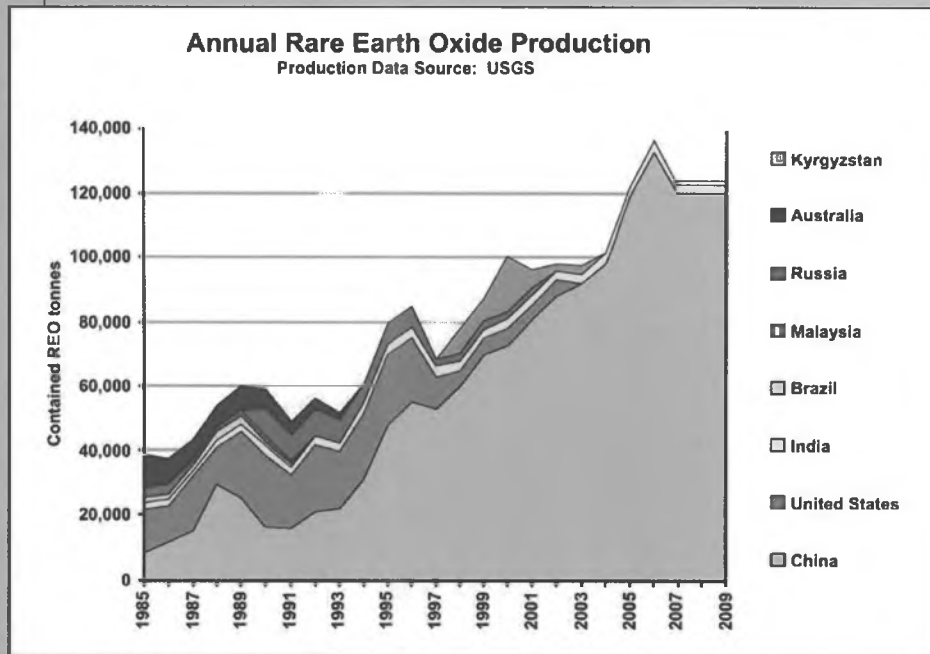
Research to create other possible extraction methods could ultimately lead to lower extraction costs of the rare-earth metals. Recycling of REEs from old equipment may add to the supply chain (Hurst, 2010). At high prices for REEs, reprocessing of tailing piles from former mining operations may also extract significant amounts of REEs (Hurst, 2010).

### Rare-Earth Element Production

Only a few countries produce significant amounts of rare-earth elements. China is currently the dominant producer of rare-earth elements and is believed to be responsible for more than 95 percent of the world mine production on a rare-earth oxide equivalent basis (Haxel and others, 2005). Other countries with notable production in 2009 were: Brazil, India, Kyrgyzstan, and Malaysia; minor production may have occurred in Indonesia, Commonwealth of Independent States, Nigeria, North Korea, and Vietnam (USGS, 2011).

Figure 3. Worldwide production of rare-earth oxides from 1987 to 2009 (USGS Minerals Yearbooks).

China became the world's dominant producer of rare-earth elements in the early 1990s, when production at the Mountain Pass Mine in California began to decline (fig. 3). China's dominance increased rapidly and in 2000 China accounted for about 90 percent of world rare-earth production. China sold rare earths at such low prices that the Mountain Pass Mine and others throughout the world were unable to compete.



In 2009 China accounted for more than 97 percent of the world's rare-earth production (U.S. Government Accountability Office, 2010). China is also the dominant consumer of rare-earth elements, used mainly in manufacturing electronics products for domestic and export markets. Japan and the United States are the second- and third-largest consumers of rare-earth materials. The rare-earth separation plant at Mountain Pass resumed operation in 2007 and continued to operate throughout 2010 by processing previously mined rare-earth concentrates into lanthanum concentrate and didymium (75 percent neodymium, 25 percent praseodymium) products (USGS, 2011).

In 2010 China announced they would significantly restrict their rare-earth exports to ensure a supply for domestic manufacturing. This announcement triggered some panic buying and rare-earth prices shot up to record high levels. The 72 percent reduction of rare-earth exports from China in 2010 was followed by an announced 35 percent reduction in export for the first half of 2011 (Bloomberg News, 2010). The Chinese government allocated 15,919 tons of rare-earth exports for the first half of 2011, compared to exports of 24,555 tons in the first half of 2010 and 8,790 tons exported in the second half of 2010 (Bloomberg News, 2010).

China's future export policies are unpredictable, but most analysts expect the Chinese government to favor China's domestic interests, needs, and economic development. Additionally, the total expected production of REEs in China is expected to be insufficient for worldwide demand.

In 2010, U.S. House and Senate bills were introduced to encourage reestablishment of domestic REE industries. The Alaska Legislature passed House Resolution 16 in 2010 urging Congress to advance development of new REE reserves in the U.S., and continued exploration for REE deposits in Alaska.

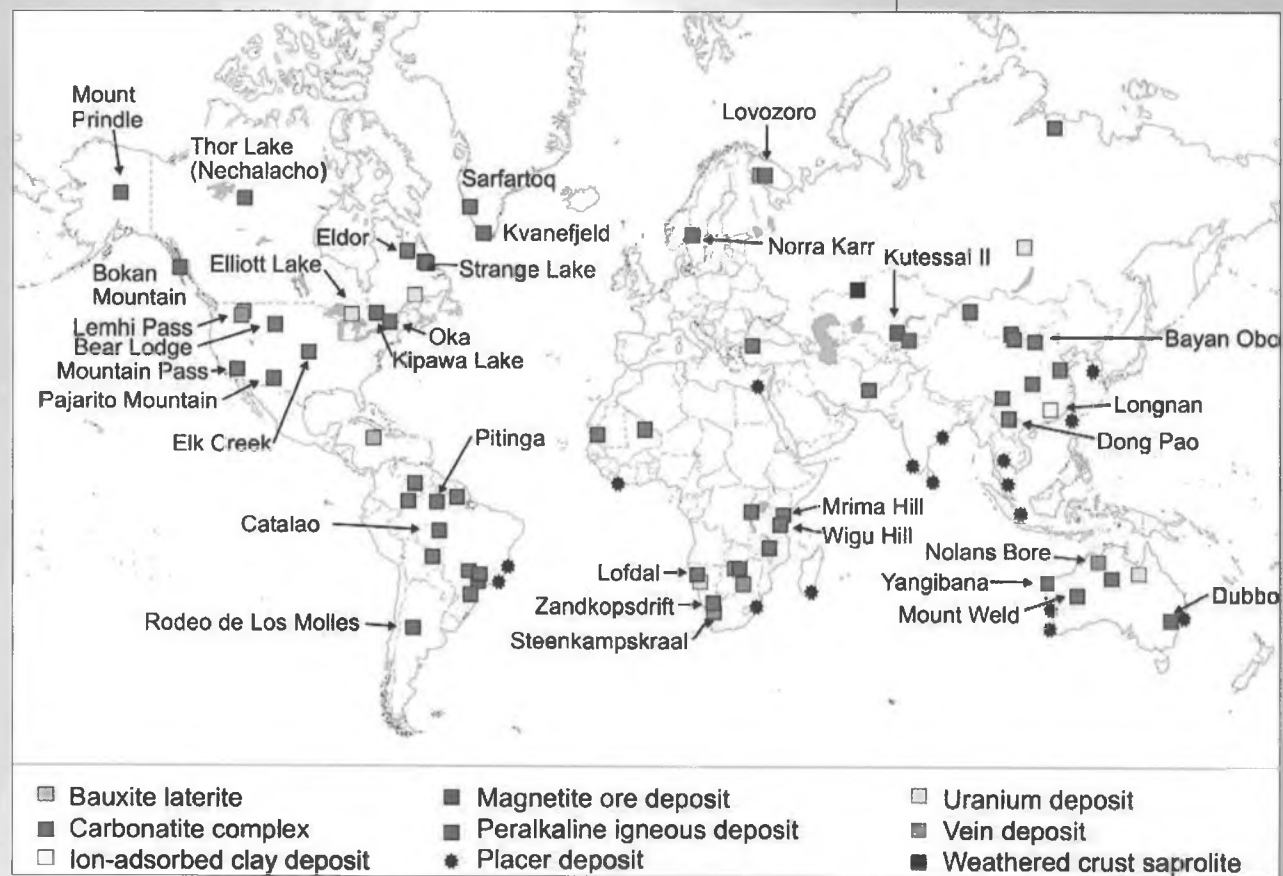
## World Rare-Earth Mineral Resources

Rare-earth elements are relatively abundant in the Earth's crust, but discovered mineable concentrations are less common than for most other ores. U.S. and world resources are contained primarily in bastnäsite and monazite. Figure 4 shows the location of some of the most important REE occurrences and deposits. Table 3 lists world mine reserves and 2010 mine production.

Bastnäsite deposits in China and the United States constitute the largest percentage of the world's rare-earth economic resources, while monazite deposits in Australia, Brazil, China, India, Malaysia, South Africa, Sri Lanka, Thailand, and the United States constitute the second-largest segment. Apatite, cheralite, eudialyte, loparite, phosphorites, rare-earth-bearing (ion adsorption) clays, secondary monazite, spent uranium solutions, and xenotime make up most of the remaining resources. Undiscovered resources are thought to be very large relative to expected demand (U.S. Geological Survey, 2011).

Mount Weld in Western Australia is probably the most promising mine development project with its higher-grade rare-earth ore and easier accessibility compared to the Canadian projects at Thor Lake in the Northwest Territories and Hoidas Lake in Saskatchewan (Hurst, 2010). Although construction and operations have begun for Mount Weld, there are still a number of hurdles to overcome. In addition, operations for Mount Weld will likely be costlier because the minerals will have to be transported to Malaysia, where they

Figure 4. Global distribution of known rare-earth-element resources. Figure from Mariano and others, 2010, modified by Kaiser Research Online (<http://www.kaiserbottomfish.com/s/Education.asp?ReportID=362761>).



**Table 3. World Mine Reserves and 2010 Mine Production**

Country	Reserves <sup>a</sup> (tons of REE oxide)	Production (tons of REE oxide)
United States	14,300,000	0
Australia	180,000	0
Brazil	53,000	600
China	60,600,000	140,000
Commonwealth of Independent States (CIS) <sup>b</sup>	20,900,000	NA <sup>c</sup>
India	3,400,000	2,900
Malaysia	33,000	385
Other Countries	24,000,000	NA <sup>c</sup>
<b>World Total (rounded)</b>	<b>121,000,000</b>	<b>143,000</b>

Source: USGS Mineral Commodity Summaries, 2011

<sup>a</sup> As defined by the USGS, that part of the reserve base which could be economically extracted or produced at the time of determination. The term reserves need not signify that extraction facilities are in place and operative.

<sup>b</sup> Regional association of former Soviet republics.

<sup>c</sup> Not available

will be further processed into separate rare-earth elements (Hurst, 2010). Steenkampskraal is a former operating rare-earth mine in South Africa, which has been restarted. Production dates for some REE mines are projected to be: 2010—Steenkampskraal; 2011–2012—Mount Weld; 2012—Hoidas Lake; and 2013—Thor Lake (Hurst, 2010).

Exploration efforts to develop rare-earth-element projects surged in 2010, and investment and interest increased dramatically. Economic assessments continued in North America at Bokan Mountain in Alaska; Bear Lodge in Wyoming; Diamond Creek in Idaho; Elk Creek in Nebraska; Hoidas Lake in Saskatchewan, Canada; Lemhi Pass in Idaho–Montana; and Nechalacho (Thor Lake) in Northwest Territories, Canada. Other economic assessments took place in other locations around the world, including Dubbo Zirconia in New South Wales, Australia; Kangankunde in Malawi; Mount Weld in Western Australia, Australia; and Nolans Project in Northern Territory, Australia (U.S. Geological Survey, 2011).

### Assessing Alaska's Rare-Earth-Element Potential

Mineral resources comprise a major part of Alaska's economic assets. Alaska is considered highly prospective with regard to strategic and critical minerals needed for domestic uses. Alaska's diverse geology hosts a wide range of mineral deposit types. Figure 5 shows a graph of mineral commodities imported into the United States as of 2009. Alaska currently produces some of these minerals, has produced some in the past, and has the potential to produce some quantity of most of these imported mineral commodities in the future. However, the location and magnitude of these resources are largely unknown. The State of Alaska cannot efficiently manage or develop assets that are unknown and not quantified. The benefits

of a thorough mineral-resource information base include: (1) Enhancing community and local government economies and revenue opportunities; (2) Stimulating private-sector exploration and competitive development of Alaska's mineral resources; (3) Developing transportation corridors and infrastructures to known resources; and (4) Providing sound scientific information to support long-term decisions on management of state-interest lands.

The USGS compiled worldwide data on rare-earth-element mines, deposits, and occurrences from a variety of sources (Orris and Grauch, 2002). The report classifies the known occurrences by a number of geological criteria. The North American occurrences cited in Orris and Grauch (2002) and Long and others (2010) are summarized in table 4, including Alaska's Bokan Mountain property. Many of the occurrences have not been well studied and their economic potential is not really known (Orris and Gauch, 2002).

Evaluation of Alaska's REE potential is hindered by a lack of basic geologic data and compilation of existing data. Alaska has more than 70 known REE mineral occurrences (fig. 6, table 5) and millions of acres of selected or conveyed lands with the potential to contain REEs, but the mineral-resource potential of these occurrences and lands is poorly understood. The Bokan Mountain, Mount Prindle, and Tofty REE occurrences are briefly described below.

The Bokan Mountain property, located 37 miles southwest of Ketchikan on Prince of Wales Island, is Alaska's most significant REE prospect. Preliminary assessments suggest the area contains one of the larger REE deposits in North America, with significant enrichments in heavy REEs. The Bokan Mountain area contains 11 uranium–thorium occurrences, and the Ross–Adams pit is the site of Alaska's only past uranium–thorium mining (MacKevett, 1963; Thompson, 1997). The uranium, thorium, and rare-earth-element mineralization is hosted in the Jurassic Bokan Granite Complex, a crudely circular ring dike complex consisting of nine

different phase of peralkaline granitic rocks (Thompson, 1997). Mineralization is found in irregular cylindrical “pipes,” steep shear-zone-localized pods or lenses, and quartz veins. Exploration for uranium and rare-earth elements began a new phase when Ucore Uranium Inc. (subsequently Ucore Rare Metals Inc.) acquired 100 percent interest in the Bokan Mountain property in 2007, through staking federal mining claims and option agreements with claim holders. Ucore conducted extensive exploration, including geological mapping, geochemical sampling, geophysical surveys (airborne and ground), and drilling since acquiring the Bokan Mountain property. The exploration has identified additional mineralization on the property and changed the conceptual model for the formation of rare-earth-element mineralization in this area.

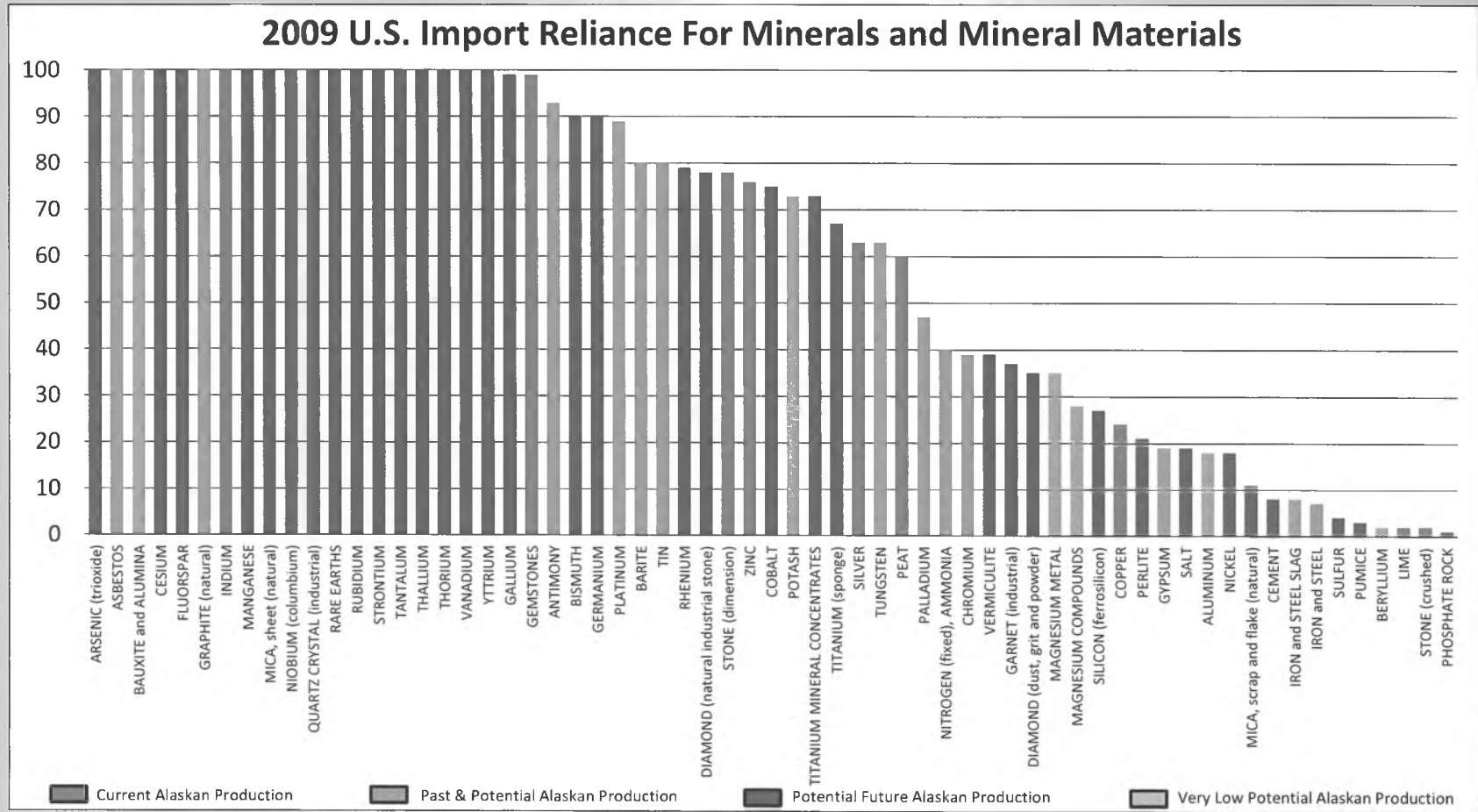


Figure 5. The United States relies on imports of critical minerals to satisfy current needs. Alaska has the potential to produce many of these minerals and materials. Alaska currently and historically has produced 21 of the 63 shown in this figure. Figure modified from U.S. Geological Survey, 2010.

**Table 4. U.S. and Canada Rare-Earth-Element Deposit Reserves and Resources (excluding placer deposits)**

Deposit Name	Location	Tonnage (tons)	Grade (percent total rare-earth oxides)	Contained total rare-earth oxides (tons)	Rank by tons of rare-earth oxides	Resource Type	Resource Reliability
Iron Hill	Colorado	2,671,248,000	0.40	10,684,992	1	Unclassified Resource	Low
Thor Lake (Lake Zone)	NW Territories	193,874,860	1.43	2,772,632	2	MI&I Resource <sup>a</sup>	Mod High <sup>b</sup>
Strange Lake	Labrador	151,678,178	0.97	1,471,170	3	MI&I Resource <sup>a</sup>	Mod High <sup>b</sup>
Mountain Pass	California	14,973,976	8.24	1,234,240	4	Proven and Probable reserve	High
Bear Lodge	Wyoming	11,767,156	3.60	423,168	5	Inferred Resource	Moderate
Oka	Quebec	231,420,000	0.13	294,234	6	Unclassified Resource	Low
Thor Lake (Lake Zone)	NW Territories	13,235,020	1.70	224,808	7	Proven and Probable reserve	High
Mineville	New York	9,918,000	0.90	88,160	8	Unclassified Resource	Low
Pea Ridge	Missouri	661,200	12.00	79,344	9	Unclassified Resource	Low
Diamond Creek	Idaho	6,391,600	1.22	78,022	10	Unclassified Resource	Low
Hick's Dome	Illinois	16,199,400	0.42	68,324	11	Unclassified Resource	Low
Wet Mountains	Colorado	15,380,614	0.42	65,018	12	Unclassified Resource	Low
Hoidas Lake	Saskatchewan	3,137,394	2.00	62,814	13	MI&I Resource <sup>a</sup>	Mod High <sup>b</sup>
Scrub Oaks	New Jersey	11,020,000	0.38	41,876	14	Unclassified Resource	Low
Bokan Mountain	Alaska	4,044,375	0.75	30,163	15	Inferred Resource <sup>c</sup>	Moderate
Bald Mountain	Wyoming	19,836,000	0.08	15,869	16	Unclassified Resource	Low
Thor Lake (North T)	NW Territories	1,251,872	0.71	8,816	17	MI&I Resource <sup>a</sup>	Mod High <sup>b</sup>
Music Valley	California	55,100	8.60	4,739	18	Unclassified Resource	Low
Zeus (Kipawa Lake)	Quebec	2,501,540	4.24	2,755	19	MI&I Resource <sup>a</sup>	Mod High <sup>b</sup>
Lemhi Pass	Idaho	551,000	0.33	1,818	20	Unclassified Resource	Low
Gallimas Mountains	New Mexico	50,692	2.95	1,543	21	Unclassified Resource	Low
Hall Mountain	Idaho	110,200	0.05	55	22	Unclassified Resource	Low
Pajarito	New Mexico	2,644,800	0.18	4,408	23	Unclassified Resource	Low
Elk Creek	Nebraska	43,418,800	unknown	unknown	24	Unclassified Resource	Low

<sup>a</sup>MI&I Resource = Measured, Indicated & Inferred Resource

<sup>b</sup>Mod High=Moderately High

<sup>c</sup>Resource type, tonnage, and rank for Bokan Mountain were updated from Long and others (2010) with figures from a March 7, 2011, Ucore Rare Metals Inc. press release.

Rare-earth-element prospects are known to occur along the length of Prince of Wales Island in alkaline complexes including peralkaline granite–syenite, carbonate, and pegmatites at Salmon Bay, Cholmondeley Sound, Dora Bay, Moira Sound, McLean Arm, and Stone Rock Bay (Thompson, 1997). Very little exploration has been conducted on these prospects.

Another significant REE occurrence is found in an igneous complex near Roy Creek, about 18 miles west of Mount Prindle in interior Alaska. The property is approximately 16 miles north of Mile 44 of the Steese Highway and is currently within the White Mountain National Recreation Area; the area is closed to mining. The Mount Prindle syenite complex was originally staked for uranium in 1978 by MAPCO Inc. MAPCO sampled and drilled the Roy Creek property and identified several small deposits that are extremely high in thorium and rare-earth elements (Armbrustmacher, 1989). Mineralization occurs as fissure veins containing allanite, bastnäsite, monazite, thorianite, thorite, uraninite, and xenotime with fluorite in a Cretaceous-age granitic igneous complex with five types of granitic-type igneous rocks dominated by syenite (Freeman and Schaefer, 1998). Rock samples contain up to 0.1 percent uranium oxide and 15 percent rare-earth elements (Freeman and Schaefer, 1998). Samples of a mineralized fracture zone from a drill core sample at the Roy Creek prospect contained more than 0.2 percent thorium, the upper limit of determination by emission spectrography, and a concentrate sample from sediment in Roy Creek contained thorite, allanite, cassiterite, scheelite, and sapphire corundum (Weber and others, 1988).

A slightly different type of rare-earth-element occurrence is found near Manley Hot Springs in interior Alaska in a Triassic carbonatite sill with a strike length of at least 6 miles (Reifenstuhel and others, 1998). The Tofty Ridge prospect has been explored since 1978, including approximately 5,300 feet of core drilling by the U.S. Bureau of Mines and industry (Szumigala and others, 2004). Best known results from the exploration are 30 feet of trench rock sampling that average more than one percent REE (as cerium and lanthanum) and 0.15 percent niobium. Portions of the core were geochemically anomalous for niobium, REE, and yttrium (Szumigala and others, 2004). Nearby creeks may have placer REE resources.

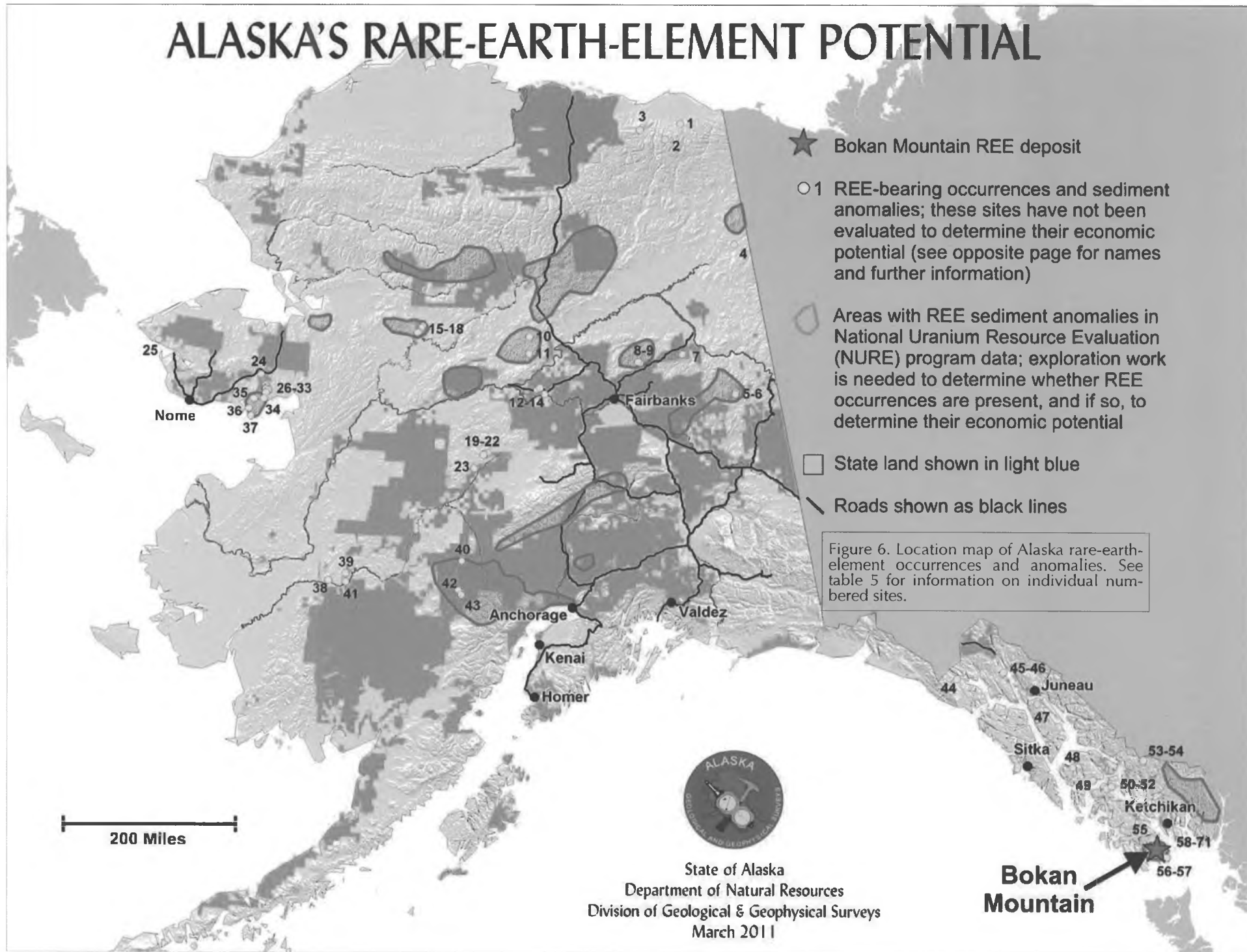
Additional geological, geochemical, and geophysical studies are required to understand Alaska's REE occurrences and to determine the size and grade of these deposits. Additional exploration and study may lead to additional mineral discoveries.

**Table 5. Alaska rare-earth-element occurrences and anomalies.**

Map No.	ARDF No.	Historical site name(s)	Elements (minor elements)	Map No.	ARDF No.	Historical site name(s)	Elements (minor elements)
1	DP003	Aichilik River	Y, Yb, REE	37	SO001	Cape Darby	REE, U, W
2	ML015	Okpilak River	Mo, U (F, possibly REE)	38	RM020	Unnamed (southern Russian Mountains)	Sb (Nd, Ta, U)
3	ML013	Fire Creek	P (REE)	39	SM005	Unnamed (northeast of head of Getmuna Creek)	Ce, Hg, Nb, Zn (Au, Cr, Cu)
4	CO027	Unnamed	Pb, REE	40	MG036	Eudialyte	REE, Zr (Th, U)
5	EA037	Unnamed (on Slate Creek)	REE, Th	41	SM037	Unnamed (northeast of lower Sue Creek)	Ce, La, Sm, Th, U, W, Zr (Au, Cu, Hg, Pb)
6	EA039	Ruby Creek	REE, Th	42	LH006	Unnamed (near Swift River)	REE
7	CI027	Hot Springs Creek	U?, REE, Th?, W	43	LH007	Unnamed (near Swift River)	REE
8	CI078	Unnamed (near head of Hope Creek)	F (Cu, Mo, Pb, REE?, Sb, W, Zn)	44	MF026	Monarch No. 1 and No. 2	Au (Ag, Pb, REE)
9	CI051	Roy Creek; Little Champion Creek	U (REE)	45	JU060	William Henry	Cu, Pb, REE, Zn (Au)
10	BT018	Unnamed (southeast of Sithylemenkat Lake)	Sn (As, Bi, Cs, Cu, Nb, Pb, Rb, REE, Ta, W)	46	JU057	Lucky Six Creek; William Henry	Cu, Pb, REE, Th, U, Zn
11	TN009	Unnamed (Spooky Valley)	Ag, Pb, Zn (Bi, La, Mo, Sn, U, W)	47	JU254	Unnamed (near Salmon River)	REE (Y, Zr, Nb, Th, La, Ce, Pr, Nd)
12	TN083	Unnamed (upper Idaho Gulch)	Ce, Nb (Ag, REE, U)	48	PE001	Unnamed (near mouth of Port Camden)	Th, U (Ce, La)
13	TN099	Tofty Ridge	Ce, Nb, Y (Ag, REE, U)	49	PE021	Unnamed (near Totem Bay)	Th, U (Ce, La, Nd)
14	TN115	Karshner Creek	REE	50	PE056	Unnamed (near Salmon Bay)	REE, Th, U (Mo)
15	HU008	Boston Ridge	REE, Th, U	51	PE055	Paystreak Vein; Marker Vein	U, Th, REE (Mo)
16	HU011	Unnamed (northeast ridge of Caribou Mountain)	REE, Th, U	52	PE060	Unnamed (along Snow Passage)	F (Au, Ba, Ce, La)
17	HU016	Unnamed (in Zane Hills, south of upper Caribou Creek)	REE, Th, U	53	BC004	Unnamed (near Cone Mountain)	U? (Ce, La, Mo, Nd, Th)
18	SH010	Unnamed (northeast of Solsmunket Lake)	W (REE, Th, U)	54	BC090	Unnamed (near Black Crag)	Ag, Au, Cu, Mo, Zn (Ce, La, Nd, Sm, Th, U)
19	MD003	Unnamed	Th, U (REE)	55	CR172	Unnamed (at head of Dora Bay)	Nb, REE, Y
20	MD002	Unnamed	Th, U (Ce, REE)	56	DE042	Unnamed (near Mallard Bay)	Au, Ce, Cu, La, U (Y, Zr)
21	MD004	Unnamed	Nb, Th, U (Ce, REE, W)	57	DE043	Unnamed (north shore, Stone Rock Bay)	Au, Ce, Cu, La, U (Y, Zr)
22	MD005	Unnamed	Th, U (Ce, Rb)	<b>BOKAN MOUNTAIN PROPERTY (named sites listed below)</b>			
23	MD012	Unnamed	Zn (Ce, Rb)	58	DE020	Little Jim; Little Joe No. 1, Little Joe No. 2	(Nb, REE, Th, Ti, U, Zr)
24	BN094	Windy Creek	Mo, Pb, Zn (Ag, Ba, La, Sn)	59	DE030	Shore	Be, Nb, REE, Th, Ti, U, Y, Zn, Zr
25	TE042	Unnamed (on Tin Creek, tributary to Lost River)	Be, Sn, F	60	DE028	Upper Cheri	Be, Nb, REE, Th, U, Y, Zr
26	SO044	Unnamed (on Rock Creek)	REE, U	61	DE029	Cheri; Cheri No. 1	Be, Nb, REE, Th, U, Y, Zr
27	SO043	Unnamed (tributary to Vulcan Creek)	REE, U	62	DE031	Geoduck	Be, Nb, REE, Th, U, Y, Zr
28	SO042	Unnamed (tributary to Clear Creek)	REE, U	63	DE015	Geiger	Nb, REE, Ta, Th, U, Y, Zr (F, Ge, Pb, Zn)
29	SO040	Unnamed (tributary to Clear Creek)	REE, U	64	DE019	Wennie (Lazo Group); I and L No. 1 and 2	Nb, REE, Th, U
30	SO041	Unnamed (tributary to Clear Creek)	REE, U	65	DE017	Sunday Lake	Nb, REE, Th, U, Y, Zr
31	SO039	Unnamed (tributary to Clear Creek)	REE, U	66	DE027	Carol Ann; Carol Ann No. 1; Carol Ann No. 2; Carol Ann No. 3; Dotson	Nb, REE, Th, U, Y
32	SO038	Unnamed (tributary to Clear Creek)	REE, Sn, U, W	67	DE021	I, L, and M; ILM: I, L, and M Nos. 1-3	Nb, REE, Th, Y, U, Zr
33	SO037	Clear Creek	REE, U	68	DE022	Irene-D	Nb, REE, U, Y, Zr
34	SO036	Kwiniuk River	Cu, REE, W	69	DE023	I and L; I and L Nos. 3-5	Nb, Th, U (Ce, Dy, Er, F, Gd, Ho, La, Nd, Pb, Y, Yb, Zn, Zr)
35	SO159	Unnamed (east of Eagle Creek)	REE, Th, U	70	DE016	Boots	REE, Th, U
36	SO003	Golovnin Bay	REE, U, W	71	DE025	Historic Ross-Adams Mine	U (REE, Th)

Sources: Modified from <http://ardf.wr.usgs.gov/>; NURE sediment data from [http://pubs.usgs.gov/of/1997/ofr-97-0492/state/nure\\_ak.htm](http://pubs.usgs.gov/of/1997/ofr-97-0492/state/nure_ak.htm)

# ALASKA'S RARE-EARTH-ELEMENT POTENTIAL



## References

- Armbrustmacher, T.J., 1989, Minor element content, including radioactive elements and rare-earth elements, in rocks from the syenite complex at Roy Creek, Mount Prindle area, Alaska: U.S. Geological Survey Open-File Report 89-146. 11 p. Available at <http://www.dggs.alaska.gov/webpubs/usgs/of/text/of89-0146.PDF>
- Bloomberg News L.P., 2010, China cuts export quotas for rare earths by 35%: Bloomberg News December 28, 2010, available at <http://www.bloomberg.com/news/2010-12-28/china-cuts-first-round-rare-earth-export-quotas-by-11-correct-.html>.
- Cordier, Daniel J., and Hedrick, James B., 2010, Rare Earths [Advance Release], 16 p., in U.S. Geological Survey Minerals Yearbook 2008, available at [http://minerals.usgs.gov/minerals/pubs/commodity/rare\\_earth/myb1-2008-raree.pdf](http://minerals.usgs.gov/minerals/pubs/commodity/rare_earth/myb1-2008-raree.pdf).
- Freeman, C.J., and Schaefer, J.R., 1998, Alaska resource data file; Circle Quadrangle: U.S. Geological Survey Open-File Report 98-783. 207 p., available at [http://ardf.wr.usgs.gov/ardf\\_data/Circle.pdf](http://ardf.wr.usgs.gov/ardf_data/Circle.pdf)
- Hazel, Gordon B., Hedrick, James B., and Orris, Greta J., 2005, Rare Earth Elements—critical resources for high technology: U.S. Geological Survey Fact Sheet 087-02, 4 p., available at <http://pubs.usgs.gov/fs/2002/fs087-02/fs087-02.pdf>
- Hurst, Cindy, 2010, China's rare earth elements industry—What can the West learn?: Institute for the Analysis of Global Security (IAGS), 42 p., available at <http://fmso.leavenworth.army.mil/documents/rareearth.pdf>
- Long, K.R., Van Gosen, B.S., Foley, N.K., and Cordier, Daniel, 2010, The principal rare earth elements deposits of the United States—A summary of domestic deposits and a global perspective: U.S. Geological Survey Scientific Investigations Report 2010-5220, 96 p., available at <http://pubs.usgs.gov/sir/2010/5220/>
- MacKevett, E.M., 1963, Geology and ore deposits of the Bokan Mountain uranium–thorium area, southeastern Alaska: U.S. Geological Survey Bulletin 1154, 125 p., available at <http://dggs/pubs/id/3620>.
- Mariano, Anthony, Cox, Clint, and Hedrick, James, 2010, Economic Evaluation of REE and Y Mineral Deposits—Presentation at the 2010 Annual Meeting of the Society for Mining, Metallurgy & Exploration [SME], Phoenix, Arizona, available at [http://www.smenet.org/rareEarthsProject/SME\\_2010\\_Mariano.pdf](http://www.smenet.org/rareEarthsProject/SME_2010_Mariano.pdf), 33 p.
- Orris, Greta J., and Grauch, Richard I., 2002, Rare earth element mines, deposits, and occurrences: U.S. Geological Survey Open-File Report 02-189, 174 p., available at <http://pubs.usgs.gov/of/2002/of02-189/of02-189.pdf>
- Reifenstuhel, R.R., Dover, J.H., Newberry, R.J., Clautice, K.H., Pimney, D.S., Liss, S.A., Blodgett, R.B., and Weber, F.R., 1998, Geologic map of the Tanana A-1 and A-2 quadrangles, central Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 98-37A v. 1.1, 19 p., 1 sheet, scale 1:63,360, available at <http://www.dggs.alaska.gov/pubs/id/1863>
- Szumigala, D.J., Graham, G.E., and Athey, J.E., 2004, Alaska resource data file: Tanana quadrangle: U.S. Geological Survey Open-File Report 2004-1386, 309 p., available at <http://pubs.usgs.gov/of/2004/1386/>
- Thompson, Tommy B., 1997, Uranium, thorium, and rare metal deposits of Alaska, in Goldfarb, R.J., and Miller, L.D., eds., Mineral deposits of Alaska: Economic Geology Monograph 9, p. 466–482.
- U.S. Geological Survey, 2011, Rare earths, Mineral Commodity Summaries, 2 p., available at [http://minerals.usgs.gov/minerals/pubs/commodity/rare\\_earth/mcs-2011-raree.pdf](http://minerals.usgs.gov/minerals/pubs/commodity/rare_earth/mcs-2011-raree.pdf).
- U.S. Geological Survey, 2010, Mineral commodity summaries 2010: U.S. Geological Survey, 193 p., available at <http://minerals.usgs.gov/minerals/pubs/mcs/2010/mcs2010.pdf>
- U.S. Government Accountability Office, 2010, Rare earth materials in the defense supply chain: Government Accountability Office Report GA-10-617R, 38 p., available at <http://www.gao.gov/new.items/d10617r.pdf>.
- Weber, F.R., McCammon, R.B., Rinehart, C.D., Light, T.D., and Wheeler, K.L., eds., 1988, Geology and mineral resources of the White Mountains National Recreation Area, east-central Alaska: U.S. Geological Survey Open-File Report 88-284, 234 p., 31 sheets, scale 1:63,360, available at <http://dggs.alaska.gov/pubs/id/11727>.

## About the Authors...

David Szumigala, a DGGGS geologist for the Mineral Resources Section, has 26 years of experience (24 in Alaska) in bedrock geologic mapping, mineral exploration, and ore deposit research. He is also senior author of the state's annual report on Alaska's Mineral Industry.



Melanie Werdon, Chief of DGGGS Mineral Resources Section, has 22 years of experience (20 in Alaska) in bedrock geologic mapping, mineral exploration, and ore deposit research.

Drs. Szumigala and Werdon work with three other DGGGS geologists in the Mineral Resources section with a goal of mapping the geology and assessing the mineral potential of Alaska; their maps and reports generally cover State-owned or other land with mineral potential. They work cooperatively with geologists from other agencies, such as the U.S. Geological Survey, the University of Alaska Fairbanks, DNR's Division of Mining, Land & Water, and industry.





## WEEKLY ONLINE NEWS STORY

You are receiving this weekly newsletter at no additional cost as part of your subscription to Petroleum News. If you do not want to receive this newsletter, email Shane Lasley at [publisher@miningnewsnorth.com](mailto:publisher@miningnewsnorth.com) to be removed from the list.

January 31, 2013 --- Vol. 07, No. 05

January 2013

### Alaska News Nuggets

**GOLD – TNR Gold Corp.** Jan. 31 said it has added 50 claims (8,000 acres) to its land position at the Shotgun Gold project in Southwest Alaska. The company converted another 16 claims from traditional to MTRSC mining claims (meridian, township, range, section and claim). The traditional claims were located over the Shotgun Ridge deposit and the company elected to convert these to MTRSC Mining Claims to simplify administration of the land titles. TNR said ground geophysical surveys conducted in 2011 and 2012 helped to identify structural controls on mineralization at Shotgun Ridge. Drilling in 2012 confirmed the structural model of mineralization with two holes returning mineralized intervals in excess of 200 meters – SR12-56 cut 242 meters averaging 1.25 grams per metric ton gold and SR12-57 cut 209 meters averaging 1.02 g/t gold. Extrapolating the known mineralized structures into the area surrounding Shotgun Ridge, TNR said it has identified additional areas where similar mineralization may be present and as a result acquired the mineral rights to these adjacent targets. A portion of future exploration work will be conducted in these new areas beginning by revisiting previously identified gold showings in respect of the new structural models. The company is targeting a large tonnage low-grade porphyry system at Shotgun Ridge. TNR said structural repeats, as interpreted from airborne magnetic data and ground geophysical surveys, provide the company with encouraging targets for future drill testing.

**RARE EARTHS – Sen. Lesil McGuire, R-Anchorage,** Jan. 30 introduced a resolution aimed at boosting the exploration and production of rare earth elements in Alaska. Senate Resolution 8 calls on congress to support the efforts of Alaska to develop REEs for the benefit of the economic and national security of the United States. "We need to move now to become a dominant world player in the development of rare earth elements which are critical for military and economic security, as well as renewable energy systems," said McGuire. China, which currently produces 95-percent of the world's rare earths, reduced the exports of those elements by 54 percent between 2005 to 2010, and then by nearly another 50 percent from 2010 to 2011. "As China continues to withdraw its supply of rare earth

**Industrial Strength Expertise.**

- Remote Satellite Communications
- Fiber Optic and Network Cabling
- 2-way Radio and RoIP
- LAN / WAN Network
- VoIP PBX / Voice Networks

Design, Implementation and 24 x 7 x 365 Support.

**GCI INDUSTRIAL TELECOM**

1 877 411 1484 or 907 868 0400 www.gci.com

29  
**Cu**  
63.55

THE pebble PARTNERSHIP

elements from the world market, we need to be ready to fill those supplies or we will see devastating economic consequences," said McGuire. "On the flip side, building rare earth element research and production facilities here in the 49th state will create new job and career opportunities for Alaskans." The resolution also calls for the state to work with several federal agencies including the United States Geological Survey, to identify REE deposits in the state, develop an REE information database, and promote the development of Alaska's REE industry. Additionally, the resolution calls on state agencies that deal with permitting to expedite consideration and issuance of REE permits. "So far, we have identified at least 70 sites in Alaska that contain rare earth elements. Several experts have said it is likely that Alaska has one of the most significant rare-earth prospects in North America," said Senator McGuire. "If we play our cards right, this could secure our future as the lead supplier of America's rare earth mineral needs."

**MANAGEMENT** – Goldspan Resources, Inc. Jan. 29 announced it has appointed a new board of directors and officers. Goldspan accepted the resignations of Robert W. George II, director and president; James McLaughlin, director and chief financial officer; and David Saykally, director and secretary. Goldspan appointed: Phillip L. Allen, director and president; Iain Stewart, director and corporate secretary, treasurer and acting CFO; Robert Carey, director and vice president of marketing; and Ron Ruby, director. David Hedderly-Smith continues as Goldspan CEO and chairman. Allen is President and Founder of Strategic Development Partners, a capital consulting firm targeting start-up and development stage companies seeking funding, strategic development planning and marketing assistance. He has, for over two decades, provided leadership to start-up companies as a senior management, founder or consultant and has been involved at the senior management or consulting levels of a number of hi-tech companies that he facilitated taking public through reverse mergers. Stewart, a physicist by training, brings 32 years of progressive technical and management experience deploying voice, data & broadband capabilities worldwide over a variety of media including wireless, fiber, cable and power-line. Early in his career he designed and coded mainframe operating system software and data communications protocols. More recently he has been lead architect and technical project manager for deployments in the U.S., Europe and the Far East involving fiber, digital cellular, 4G and broadband wireless and has led business case analysis and funding procurement with GE Capital, Bank of America, and Blackstone Associates for multi-million dollar projects. Carey, a strategic consultant and principal partner for several startup projects for which he has raised several million dollars, has helped pioneer new technologies in heavy metal extraction and waste cleanup. He has been instrumental in devising creative solutions to help clients worldwide to avoid costly missteps and has a network of current and former clients whom he continues to support. Early in his career, he gained valuable experience at a Wall Street brokerage where he honed his skills in evaluating new opportunities in the high-tech arena. Ruby has over 20 years of experience in the heavy equipment industry. He and his team at ETI Equipment and Trucks of Loveland, CO, have taken ETI from a small, local equipment dealer to a company that has repeat customers across the United States and in all corners of the world. Hedderly-



Smith, a consulting geologist with 40 years of experience in the minerals industry, was previously an officer and director of Goldspan in 2009-2010 and re-joined the executive team again in 2012 in light of the Company's continued goal for locating desirable gold resources, developing feasible mining plans and ultimately commencing mining operations. He has worked extensively throughout Alaska, western United States and western Canada as a consultant to major and junior mining and energy companies, Alaskan native corporations, and governmental entities on base and precious metal, uranium, specialty metal, coal, tar sands and water projects.

MANAGEMENT – Bluestone Resources Inc. Jan. 29 said its board of directors has appointed David McAdam to the role of president, CEO and a director. "We are pleased to have Mr. McAdam join Bluestone in the role of President, CEO and director and the Board looks forward to working with Mr. McAdam as the company advances its Alaskan based Shorty Creek and Richardson Projects," said Bluestone Chairman John Robins. Bluestone said McAdam has a proven track record as a transformation and operational executive with experience in the domestic and international mining sector. As the CFO of Eastern Platinum Ltd. and finance director of Barplats Investments Ltd., he was the financial lead in the consolidation of Eastern and Barplats including the offer to minorities and the successful inward listing of Eastern onto the JSE. McAdam has held numerous director and officer positions on domestic and overseas entities, from CFO of start-up TSX.V entities through to Finance Director of a Fortune 150 company based in Houston, Texas. McAdam replaces Bruce Counts who remains with the company as a director and continues with the Aurora group Bluestone's Shorty Creek and Richardson projects are both located within 125 kilometers (77 miles) of Fairbanks and within 2 kilometers (1.2 miles) of all season highways. The company is planning a phased drill program at Shorty Creek and an initial evaluation of the Richardson historical data to establish future exploration targets.

---

Mining News North - Phone: 1-907 522-9469 - Fax: 1-907 522-9583  
[Publisher@MiningNewsNorth.com](mailto:Publisher@MiningNewsNorth.com) --- <http://www.MiningNewsNorth.com>  
SUBSCRIBE

# Alaska State Legislature

*Session:*  
State Capitol 103  
Juneau, AK 99801  
Phone: (907) 465-2995  
Fax: (907) 465-6592

**Rules Committee**



*Interim:*  
716 W 4<sup>th</sup> Avenue, Suite 300  
Anchorage, AK 99501-2133  
Phone: (907) 269-0250  
Fax: (907) 269-0249

**Committee on Committees**

## Senator Lesil McGuire

**TO:** Senator Cathy Giessel, Chair  
Senate Resources Committee

**FROM:** Senator Lesil McGuire

**DATE:** January 31, 2013

**SUBJECT:** Request for AV Equipment for the hearing of SJR 8:  
Mining/Processing of Rare Earth Elements

---

Madam Chair,

I respectfully request the availability of AV equipment for a power point presentation during the hearing of SJR 8: Mining/Processing of Rare Earth Elements.

Jesse Logan in my office will be the staff contact for this bill. His number is 465-5159. Please call if you have any questions.