# Delivering critical technology metals to the EV evolution





North American Roadshow

December 2017

#### Disclaimer



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#### Compliance Statement

The information in this presentation that relates to the Mineral Resource Estimates of the Wolverine deposit is extracted from the report entitled "Increased Mineral Resource delivers more good news" dated 23 February 2015 and is available to view on the Company's website (www.northernminerals.com.au). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcement.

The information in the announcement that relates to the Mineral Resource Estimates of the Cyclops and Banshee deposits is extracted from the report entitled "Further Increase in Brown Range Mineral Resource" dated 15 October 2014 and is available to view on the Company's website (www.northernminerals.com.au). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcement.

The information in the announcement that relates to the Mineral Resource Estimates of the Gambit, Gambit West and Area 5 deposits is extracted from the report entitled "Wolverine Total Resource Doubled in a Major Upgrade of Browns Range HRE Mineral Resource Estimate" dated 26 February 2014 and is available to view on the Company's website (www.northernminerals.com.au). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcement.

The information in the announcement that relates to Ore Reserves is extracted from the report entitled Increased Ore Reserve for Browns Range created on 2 March 2015 and is available to view on the Company's website (northernminerals.com.au). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcement.

The information in this report that relates to Exploration Results or Exploration Targets is based on information compiled by Mr Robin Wilson, a full-time employee of Northern Minerals, a Competent Person, who is a member of the Australasian Institute of Mining and Metallurgy. Robin Wilson has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Wilson consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

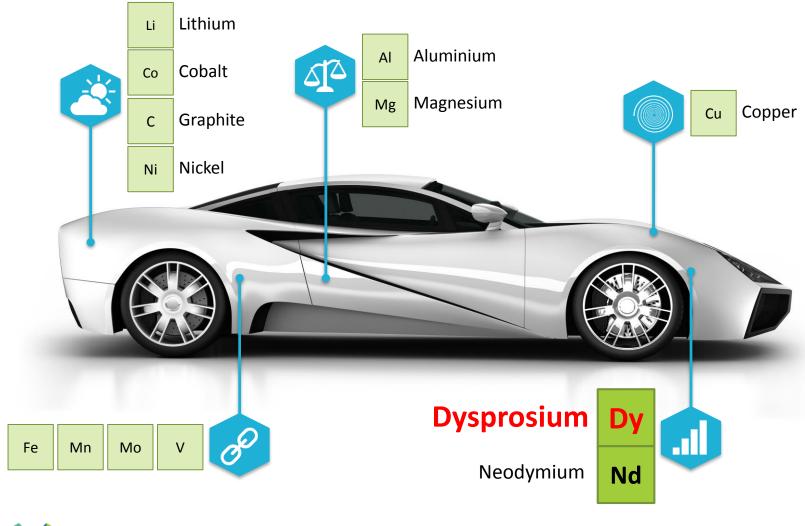
The potential quantity and grade of the Exploration Target is conceptual in nature. There has been insufficient exploration completed in the areas of the Exploration Target and it is uncertain if further exploration will result in the estimation of a Mineral Resource.

The information in the announcement that relates to production targets is extracted from the report entitled "DFS positions Browns Range Project as next dysprosium supplier" dated 2 March 2015 and is available to view on the Company's website (<u>northernminerals.com.au</u>). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and that all material assumptions and technical parameters underpinning the production targets in the relevant market announcement continue to apply and have not materially changed.

TREO = Total Rare Earth Oxides -  $La_2O_{31}$ ,  $CeO_{22}$ ,  $Pr_6O_{13}$ ,  $Nd_2O_{32}$ ,  $Sm_2O_{32}$ ,  $Eu_2O_{33}$ ,  $Gd_2O_{33}$ ,  $Tb_4O_{72}$ ,  $Dy_2O_{32}$ ,  $Ho_2O_{33}$ ,  $Er_2O_{33}$ ,  $Tb_2O_{33}$ ,  $Lu_2O_{33}$ ,  $V_2O_{33}$ 

HREO = Heavy Rare Earth Oxides - Total of Sm<sub>2</sub>O<sub>3</sub>, Eu<sub>2</sub>O<sub>3</sub>, Ed<sub>2</sub>O<sub>3</sub>, Tb<sub>4</sub>O<sub>7</sub>, Dy<sub>2</sub>O<sub>3</sub>, Ho<sub>2</sub>O<sub>3</sub>, Er<sub>2</sub>O<sub>3</sub>, Tm<sub>2</sub>O<sub>3</sub>, Yb<sub>2</sub>O<sub>3</sub>, Lu<sub>2</sub>O<sub>3</sub>, Y<sub>2</sub>O<sub>3</sub>

#### Electric Vehicles - Not just a lithium story!





#### Dysprosium

Dy 162.5

99%

Production from China



Lighter & More Efficient

20m

Forecast EV sales by 2020

100g

Dysprosium per electric vehicle

2,000tpa

EV demand for Dy by 2020



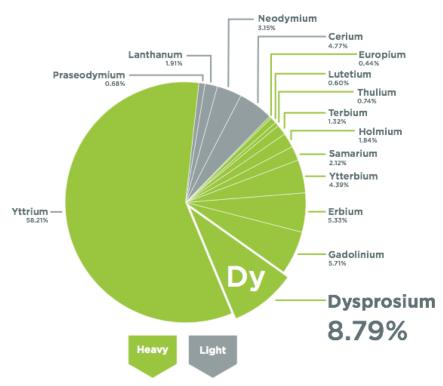
Government mandated change





#### Northern Minerals Browns Range

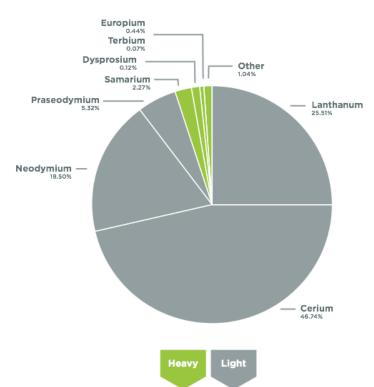
#### Rare earth distribution 1



<sup>&</sup>lt;sup>1</sup> Based on Wolverine Mineral Resource

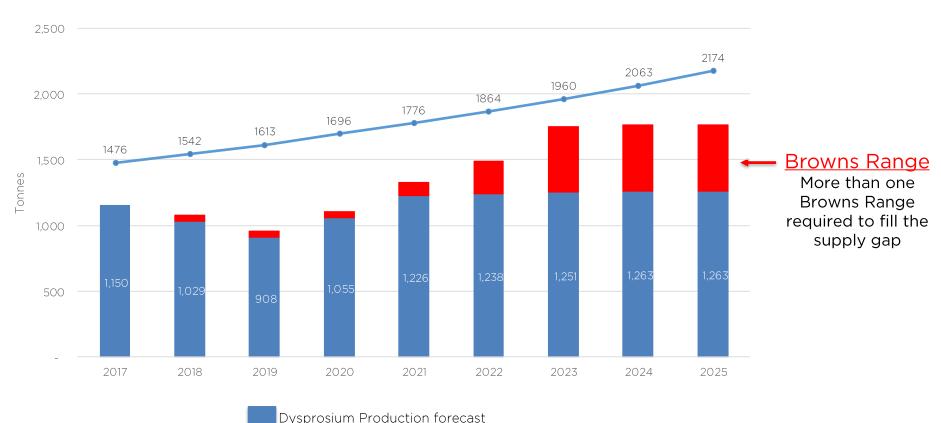
#### Lynas Mt Weld

#### Rare earth oxide composition <sup>2</sup>



<sup>2</sup> Source: Lynas Corporation website

# Browns Range - Filling the Dysprosium supply gap







Browns Range Dysprosium forecast\*

Forecast Dysprosium demand

## HRE - sustainable pricing









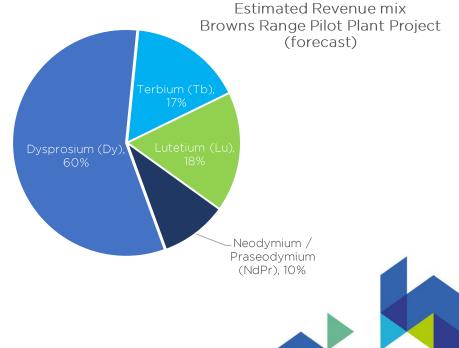
Lutetium Oxide 99.9%min China US\$/kg

6/11/2014

6/11/2015

6/11/2016





Powering Technology.

6/11/2013

1,400 1,300 1,200

\$\frac{\omega}{\sqrt{S}} 1,100 1,000

∃ 900

#### Three stage approach to full scale production

## Stage 1 TEST PILOT PLANT

# Stage 2 REFINE PROJECT

# Stage 3 BUILD FULL SCALE

- 10% of full scale capacity
- Production July 2018
- Develop, mining, processing & offtake experience
- 573tpa contained TREO
- 72ktpa capacity beneficiation plant
- 3,840tpa capacity hydrometallurgical plant

- Reduce mining cost modify mining method
- Boost production increase head grade
- Develop premium productyttrium rejection
- Increase reserve drilling

- 585,000tpa operation
- 1,500,000kg TREO in a premium product
- Significant dysprosium supplier
- Initial 11 year life with significant upside

measured . sustainable . achievable



Powering Technology.





## Mining completed





**Processing Plant** 

Schedule

Financing

Sales Agreement

Community

Feasibility







**Project Component: Open Pit Mining** 

Contractor: **MACA Limited** 

Status: Mining completed **Production Target:** 205,000t ore mined

**Total Cost:** A\$6 million



#### NORTHER

#### Pilot Plant Flowsheet

Mining

Processing Plant

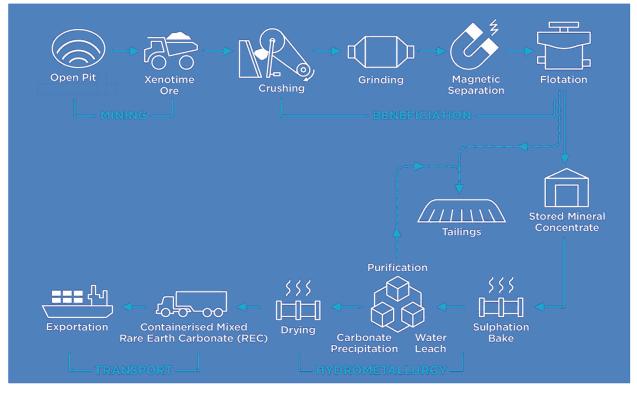
Schedule

Financing

Sales Agreement

Community

Feasibility



#### **Project Component:**

Modular processing plant

#### **Annual Production:**

60,000tpa (based on 10 operating months per year)

#### **Contractor:**

Sinosteel MECC

#### Capital Cost:

A\$39 million

#### Status:

+95% completed in China Transport to site underway



## Pilot Plant Equipment



Mining

Processing Plant

Schedule

Financing

Sales Agreement

Community









Fabrication works +95% complete in China

## Project development schedule

Mining

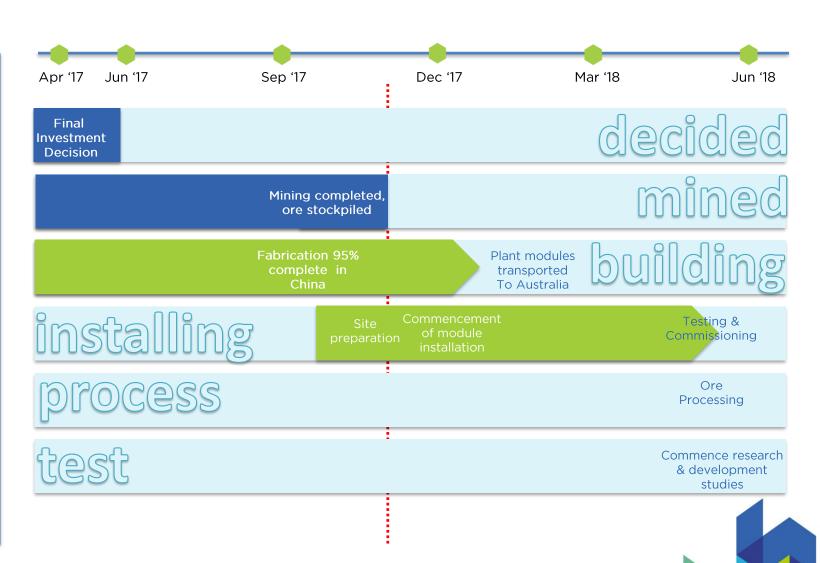
**Processing Plant** 

Schedule

Financing

Sales Agreement

Community





## Pilot Plant financing

Mining

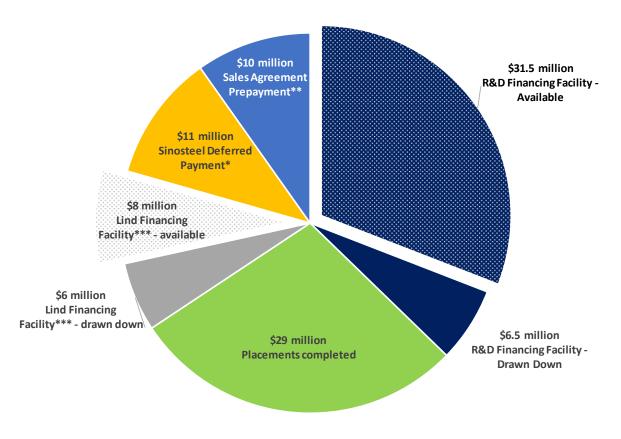
**Processing Plant** 

Schedule

Financing

Sales Agreement

Community



<sup>\*</sup> Sinosteel MECC has agreed to defer 20% of its contract amount for 24 months, with the ability to convert into Northern Minerals' shares at a conversion price of the lessor of \$0.15 per share or 20 day VWAP prior to conversion notice

<sup>\*\*</sup> JFMAG has agreed to prepay \$10m (expected payment Q1 2018). JFMAG will be issued 40m unlisted options upon receipt of the loan advance with a \$0.25 exercise price.

<sup>\*\*\*</sup> Northern Minerals has drawn down 6m of a 14m financing facility.

## Secure sales agreement





Direct shipping

route from Wyndham or

Darwin to

Lianyungang, China

Mining

**Processing Plant** 

Schedule

Financing

Sales Agreement

Community

Feasibility

100% of Browns Range Pilot Plant production to be purchased by Lianyugang Zeyu New Materials Sales Co Ltd (JFMAG), a 51% owned subsidiary of Guangdong Rare Earths Group.

10 with pricing ge of quoted prices w Information

Terms based off CIF Incoterms 2010 with pricing referenced from a 2-month average of quoted prices on Asian Metals and Beijing Ruidow Information Technology.

Includes A\$10 million pre-payment, receivable in early 2018 and 40 million unlisted options at \$0.25 exercise price.

 Representative to join Northern Minerals' Board upon receipt of funds.





## Training-to-Work Facility



Mining

**Processing Plant** 

Schedule

Financing

Sales Agreement

Community



- Northern Minerals has partnered with The Wunan Foundation for the establishment of an \$8.1 million indigenous training-to-work facility at Browns Range.
- The Federal Government, under the Building Better Regions Fund (BBRF) has provided funding of \$4.8 million towards the programme.
- Construction of the facility will commence soon.

## Full scale feasibility



#### Mining

**Processing Plant** 

Schedule

Financing

Sales Agreement

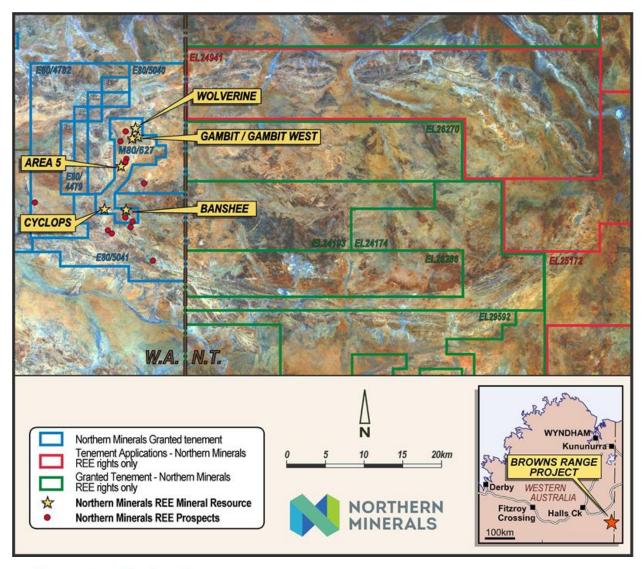
Community

- The three-year pilot project has been designed to assess the technical and economic feasibility of the proposed full-scale development.
- Key aspects of assessment during the Pilot Plant phase:
  - Mining and ore variability;
  - Flowsheet and recovery optimisation;
  - Water and environmental considerations;
  - Transport and shipping logistics;
  - End user product specifications; and
  - Long term dysprosium market dynamics.
- These determining factors will be incorporated into an updated feasibility study for the proposed full-scale operation.



## Blue Sky potential





The Browns Range dome is a massive geological feature covering 1,500km<sup>2</sup> and stretching 60km x 30km most of which hasn't been effectively explored

- JORC Resource supporting an 11 year full scale operation
- Exploration target to add additional 9 years of JORC Resources (under review)
- 170 defined targets yet to be drilled
- John Galt and Boulder Ridge Additional HRE projects with upside potential

## Key Personnel and Partners







Key Site Personnel: Eben Van Rooyen – Resident Manager Louis de Klerk – R&D Manager























## Key Highlights



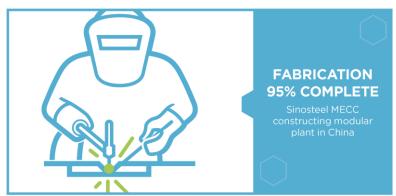










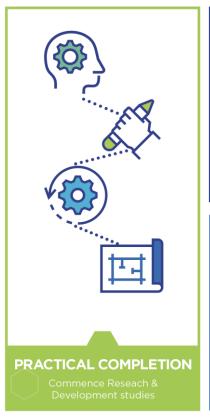


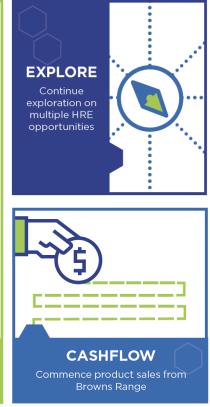


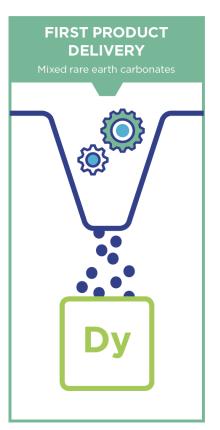
## 2018 - Delivering on potential













#### Corporate Overview



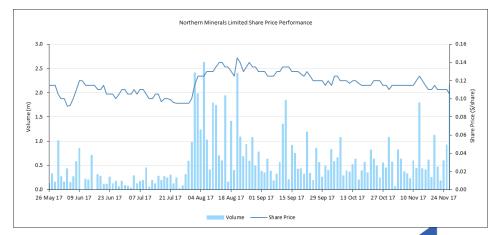


Major shareholders	30 November 2017
ACIIG	24.9%
Huatai Mining	20.3%
Jien Mining	3.4%
Board & Management	2.3%
Remaining Top 20	20.6%
Other	28.5%

## Market capitalisation \$88M

#### (at 29 November 2017 @ \$0.11)

Ordinary Shares	798M
Options and Performance Rights	72M
Cash (30 September 2017)	\$5.0M
12 month low - high	\$0.092 -\$0.145
Average daily volume (12 month avg)	505,000
Average daily volume (3 month avg)	602,000





## NORTHERN MINERALS

Delivering critical technology metals to the EV evolution



## Appendices





## Heavy rare earths crucial to growth of electric vehicle sector



- NdDyFeB permanent magnets used by major electric vehicle (EV) manufacturers require Dysprosium and Terbium as key additives for high performance
- Changing policy settings by European governments and future development plans by global carmakers have resulted in demand for EVs reaching an inflection point
- Permanent magnets account for 25% of rare earth demand in tonnes and 80% in value and the increasing rate of market acceptance has translated into significantly higher prices for heavy rare earth elements specifically
- UBS has increased forecasts on EV production as a consequence of earlier than expected EV cost parity, with EV sales expected to grow from 1.2 million in 2015 to >20 million by 2020
- Each electric vehicle contains approximately 100g of Dysprosium



#### Browns Range - A Seven Year Journey

	2010	2011	2012	2013	2014	2015	2016	2017	
	DISCOVERY	EXPLORATION	EVALU	ATION AND APPE	ROVALS	DFS	NEW PLAN	DEVELOPMENT	
( <del>-</del> Th	NTU shifts focus to HRE  John Galt acquisition  Rock Chip samples  Bench scale NAGROM benefication results	Maiden drilling campaign at Browns Range	Bench scale NAGROM/ ANSTO hydro- metallurgy results  Maiden JORC Resource released	Discovery of Boulder Ridge Upgraded JORC Resource \$26 million capital raised	Ore Reserve  EPA approval granted  Mining Licence granted  Native Title agreement  Pre-Feasilbility Study finished  JORC Resource doubled	Definitive Feasibility Study released	Divestment of non-core HRE assets  Commitment to the new three stage Business Plan  Pilot Plant Project approved for Browns Range	95% completed in China  Mining campaign completed  Financial Investment Decision (Pilot Plant)  Offtake Agreement signed with JFMAG  \$29.0 million capital raised	
					80t bulk sample processed Maiden JORC			\$38m R&D Financing Facility executed  \$14m Lind Facility executed	





## Global EV growth drivers



Battery technology eliminating range technology







Regulatory support for lower emission vehicles



Consumer demand reaches inflection point



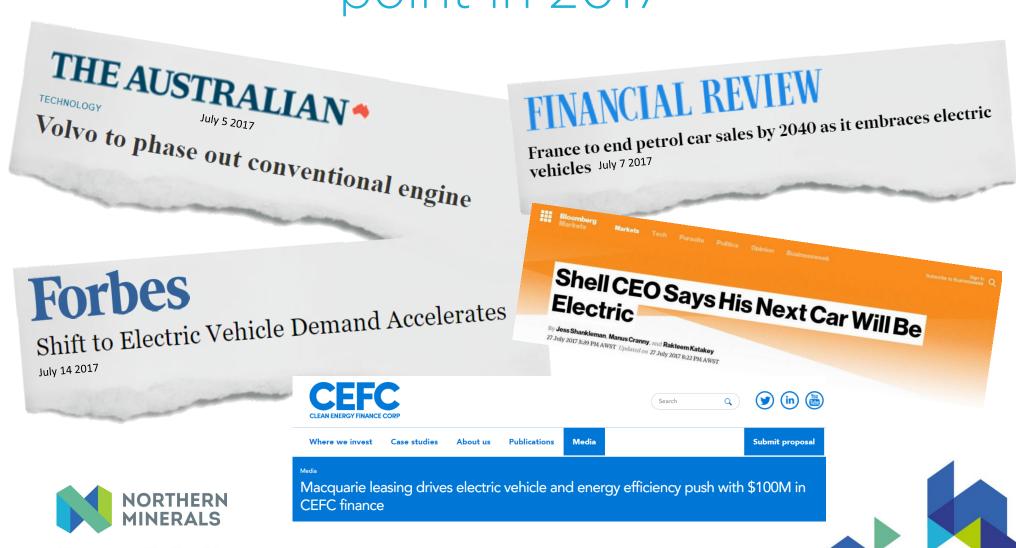




EVs approaching price parity with combustion vehicles



# EV acceptance reaches inflection point in 2017



#### Chinese carmakers to dominate EV production

















































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## Mineral Resources



Deposit	Category	Mt	TREO	Dy <sub>2</sub> O <sub>3</sub>	$Y_2O_3$	Tb₄O <sub>7</sub>	HREO	TREO	
			%	Kg/t	Kg/t	Kg/t	%	Kg	
Wolverine	Indicated	2.99	0.83	0.73	4.86	O.11	89	24,952,000	
	Inferred	1.97	0.89	0.76	5.13	O.11	88	17,609,000	
	Total <sup>1</sup>	4.97	0.86	0.74	4.97	0.11	89	42,560,000	
Gambit West	Indicated	0.27	1.26	1.07	7.06	0.14	90	3,424,000	
	Inferred	0.12	0.64	0.54	3.67	0.07	85	753,000	
	Total <sup>1</sup>	0.39	1.07	0.91	6.04	0.12	89	4,177,000	
Gambit	Indicated	0.05	1.06	0.92	6.62	0.12	97	533,000	
	Inferred	0.06	1.2	1.01	6.8	0.15	95	671,000	
	Total <sup>1</sup>	O.11	1.13	0.97	6.72	0.13	96	1,204,000	
Area 5	Indicated	1.38	0.29	0.18	1.27	0.03	69	3,953,000	
	Inferred	0.14	0.27	0.17	1.17	0.03	70	394,000	
	Total <sup>1</sup>	1.52	0.29	0.18	1.26	0.03	69	4,347,000	
Cyclops	Indicated	120	-	2	-	(47)	-	-	
	Inferred	0.33	0.27	0.18	1.24	0.03	70	891,000	
	Total <sup>1</sup>	0.33	0.27	0.18	1.24	0.03	70	891,000	
Banshee	Indicated	-	-	-	11-1	-	0=	-	
	Inferred	1.66	0.21	0.16	1.17	0.02	87	3,484,000	
	Total <sup>1</sup>	1.66	0.21	0.16	1.17	0.02	87	3,484,000	
Total <sup>1</sup>	Indicated	4.69	0.70	0.59	3.95	0.09	87	32,862,000	
	Inferred	4.28	0.56	0.46	3.15	0.07	87	23,802,000	
	Total <sup>1</sup>	8.98	0.63	0.53	3.56	0.08	87	56,663,000	

<sup>1 -</sup> Rounding may cause some computational discrepancies (TREO (metal) tonnes estimated from Mt x TREO%)



#### Ore Reserves

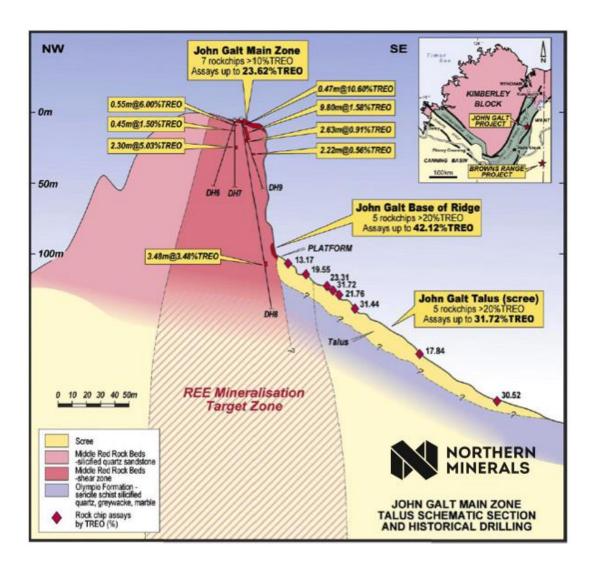


			TREO		Dy <sub>2</sub> O <sub>3</sub>		Tb₄O <sub>7</sub>		Y <sub>2</sub> O <sub>3</sub>	
Deposit	Classification	Ore Tonnes	kg/t	kg Contained	kg/t	kg Contained	kg/t	kg Contained	kg/t	kg Contained
OPEN PIT										
Wolverine	Probable	833,000	6.15	5,124,000	0.55	460,000	0.08	66,000	3.59	2,989,000
Gambit West	Probable	219,000	10.10	2,212,000	0.83	182,000	O.11	25,000	5.52	1,209,000
Gambit	Probable	37,000	8.05	298,000	0.68	25,000	0.09	3,000	4.74	176,000
Area 5	Probable	467,000	2.24	1,048,000	0.14	65,000	0.02	10,000	0.99	463,000
UNDERGROUN	D									
Wolverine	Probable	2,104,000	8.00	16,833,000	0.70	1,483,000	0.10	221,000	4.71	9,908,000
Gambit West	Probable	90,000	9.54	860,000	0.88	79,000	O.11	10,000	5.78	521,000
RESERVE										
Total	Probable <sup>1</sup>	3,750,000	7.03	26,375,000	0.61	2,294,000	0.09	335,000	4.07	15,266,000

<sup>&</sup>lt;sup>1</sup> Rounding may cause some computational discrepancies

## Beyond Browns Range: John Galt MINERALS

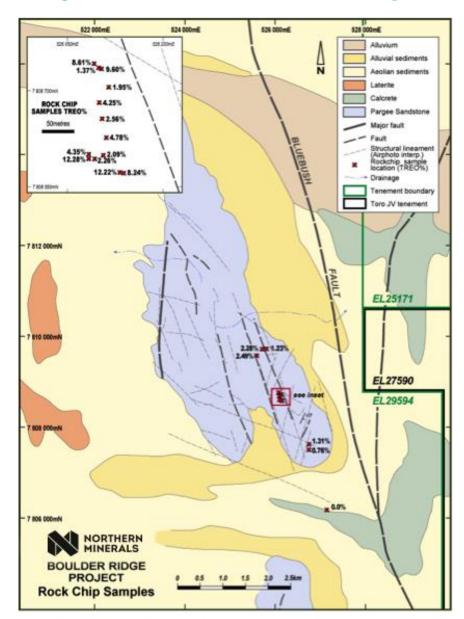




- Rock chip samples up to 42% TREO with approximately 95% Heavy REO
- Preliminary metallurgical tests indicate excellent recovery rates (>90%)
- Potential for concentrate grades >40%
- High grade mineralisation in talus (scree) material
- Hard-rock source of scree is the primary target

#### Beyond Browns Range: Boulder Ridge





- Rock chip samples from the Boulder Ridge project confirm high-grade Heavy Rare Earths (HRE)
- Best results exceed 12% TREO, including up to 1.15% Dysprosium, with a dominance of HRE - up to 99%.
- Reinforces significant growth potential in Browns Range and Tanami regions.



# Pilot plant: targeted production

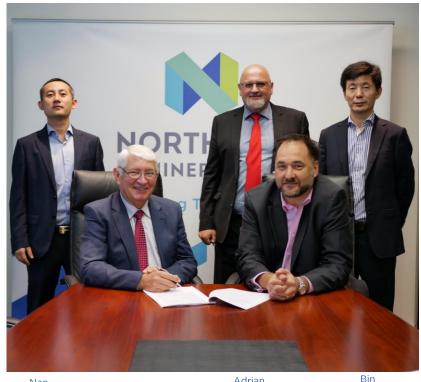
- Mixed RE carbonate (REC) produced
- Product specification available for REC
- REC samples validated by several downstream separators
- REC suitable for solvent extraction separation
- Low thorium and uranium levels

REO contained in mixed RE carbonate	Annual production (000s kg)
Lanthanum	5.8
Cerium	15.2
Praseodymium	2.8
Neodymium	10.6
Samarium	11.4
Europium	2.4
Gadolinium	34.8
Terbium	6.7
Dysprosium	49.4
Holmium	13.5
Erbium	39.3
Thulium	5.6
Ytterbium	33.1
Lutetium	4.5
Yttrium	337.6
Total TREO produced	573
Total carbonate produced	1,100

Figures may not add due to rounding TREO = Total Rare Earth Oxides- Total of  $Dy_2O_3$ ,  $La_2O_3$ ,  $CeO_2$ ,  $Pr_6O_{11}$ ,  $Nd_2O_3$ ,  $Sm_2O_3$ ,  $Eu_2O_3$ ,  $Gd_2O_3$ ,  $Tb_4O_7$ ,  $Ho_2O_3$ ,  $Er_2O_3$ ,  $Tm_2O_3$ ,  $Yb_2O_3$ ,  $Lu_2O_3$ ,  $Y_2O_3$ 

#### NTU Board





Nan Yang

Colin McCavana Adrian Griffin

George Bauk Cai

#### Colin McCavana - Non-executive Chairman (appointed 2006)

Mr McCavana has more than 35 years of management experience worldwide in the earthworks, construction and mining industries.

#### **George Bauk - Managing Director / CEO (appointed 2010)**

George is an experienced executive, with over 25 years' experience in the resources industry. Prior to Northern Minerals, George held global operational and corporate roles with WMC Resources, Arafura Resources and Indago Resources. Mr Bauk is Vice President of the Chamber of Minerals and Energy, WA.

#### Adrian Griffin - Non-executive Director (appointed 2006)

An Australian trained mining professional with exposure to metal mining and processing throughout the world, Mr Griffin has been involved in the development of extraction technology for platinum group metals and agricultural commodities.

#### Nan Yang - Non-executive Director (appointed 2017)

Mr Yang is an Australian mining engineer with more than 10 years' experience in mine planning, design, and mergers and acquisitions.

#### Yanchung Wang - Non-executive Director (not in photo) (appointed 2013)

Ms Wang acts as a strategic investor for a number of Chinese based companies. Ms Wang is Vice Chairman of Conglin Baoyuan International Investment Group and also a Director of Huachen.

#### Bin Cai - Non-executive Director (alternate) (appointed 2013)

Bin is the MD of Conglin International Investment Group Pty Ltd based in Brisbane. He has a record of successful strategic investments in emerging Australian resources companies.

#### Executive Team





Mark Tory
Chief Financial Officer
Mark is a Chartered
Accountant with 25 years of
professional experience in
the mining industry and
accounting professions. Prior
to Northern Minerals, Mark
held senior positions at
Crescent Gold Limited, Anglo
American Exploration and
Homestake Gold (now
Barrick Gold).



Robin Jones
Chief Operating Officer
Robin has more than 20
years experience in the
mining industry, the majority
of which has been in the
assessment and
development of resource
projects from scoping study
level through to operation.
Robin has held senior
management positions in
PGM, nickel, copper, gold
and uranium projects in
Australia, RSA and China.



Robin Wilson
Exploration Manager
Robin has held senior
exploration positions in
several exploration and
mining companies, including
Polaris Metals, Tanganyika
Gold, Troy Resources and
CRA Exploration. In addition,
he spent 5 years working in
oil and gas exploration for
Woodside Energy.

Robin was instrumental in the discovery of the Browns Range Project, including Wolverine and Gambit West.



Resident Manager
Mr Van Rooyen is a Project
Manager with an electrical
and mechanical engineering
background with more than
35 years experience in the
mining industry. Eben has
significant gold industry
experience in brownfields
projects from concept and
feasibility through to
commissioning.

Eben Van Rooyen



#### The Northern Minerals SPIRIT





37