Overview of minerals and petroleum exploration and production 2013

Ian Scrimgeour
Executive Director, NTGS

Northern Territory Government

AUSTRALIA’S Northern Territory

NORTHERN TERRITORY GEOLOGICAL SURVEY
ANNUAL GEOSCIENCE EXPLORATION SEMINAR
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Challenging times for mineral exploration, but there is still good news

- Onshore petroleum exploration boom
- Projects moving into development (eg Roper iron field)
- Teena discovery leads resurgence of interest in shale-hosted zinc-lead
- Exciting copper results across Arunta highlight potential of central Australia

BUT

- Very little grassroots mineral exploration
- Most exploration focused on proving up known resources

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AGES2014
Mineral ELs on which significant on-ground exploration was reported to DME in 2013

Green = geophysics
Red = drilling
Blue = geochemistry

Notes:
1. This reflects exploration reported by industry in technical reports submitted in 2013. Exploration may have taken place during 2012 or 2013, and not all exploration undertaken in 2013 is included
2. Only includes exploration on ELs, not MLs
3. Excludes petroleum exploration
Fraser Institute mining survey 2013/14

• NT 9th in the world (first in Australia) for geological data
• NT 6th in the world (second after WA) for current practise mineral potential
• NT 17th in the world (second after WA) for overall investment attractiveness
• WA, NT and SA consistently higher ranked than eastern states

Escondida, Chile
(or Tennant Creek, 2025?)
Onshore petroleum in the NT

• Unprecedented boom in onshore petroleum exploration
• Driven by opportunity of unconventional oil and gas
• Many areas being explored for the first time
• Potential ‘game changer’ for the NT
• Rapid increase in tenure coverage in previous 4 years to >90% of onshore area
• NT moving to a competitive process for future acreage release
Pine Creek Orogen – Gold

Key highlights
Full production at Cosmo Deeps
New resources (541 koz) announced at Union Reefs
Thor Mining submit NOI for development of Spring Hill
4.0 Mt @ 2.32 g/t Au
Mount Todd resource upgrade: 350 Mt @ 0.81 g/t Au

Crocodile Gold operations: Measured and Indicated: 30.8 Mt @ 2.5 g/t Au
45% increase in gold production to 74,106 oz; 0.72 Mt mined at 3.57 g/t Au
Pine Creek Orogen – Copper, iron ore and uranium

Thundelarra Exploration
- Cu and U exploration at Allamber
- Sale of Hayes Creek project to private Australian company

Alligator Energy
- ongoing active exploration in western Arnhem Land
  **Gorrunghar:**
  7m @ 0.29% U₃O₈

ERA – Ranger 3 Deeps
- Ranger 3 Deeps exploration decline and drilling underway
  39m @ 0.88% U₃O₈
  10m @ 1.47% U₃O₈
  35m @ 0.55% U₃O₈

Frances Creek iron ore - ~ 1.4 Mt mined in 2012/13
Uncertain province – Rare earth elements

Spectrum Rare Earths Ltd: Stromberg, Skyfall, Largo

- Discovery of high-value heavy and magnetic end-use rare earth elements at surface
- **Stromberg** (Y-Dy rich): 4.2m @ 0.93% TREO (92% HREO/TREO)
- **Skyfall** (Dy-Tb-Nd-Pr-Gd-Sm-Eu rich): rock-chip and soil anomalies
- Similarities to ionic clay REE deposits
- Numerous deposits now identified
McArthur Basin – Zinc

Teena – a major zinc discovery

• Rox Resources – Teck Australia joint venture
• 10 km west of McArthur River
• Similar deposit to McArthur River, but deep (up to 1 km)

Hole 1: **26.4m @ 13.3% Zn+Pb**, from 1060m including **8.0m @ 21.2% Zn+Pb**
Hole 2: **20.1m @ 15.0% Zn+Pb** from 944m including **12.5m @ 19.5% Zn+Pb**
Hole 3: **16.3m @ 14.3% Zn+Pb** from 905m
Hole 4: **14.9m @ 10.4% Zn+Pb** from 676m

Other highlights–

• Teck exercise $10M option in Reward JV
• MMG enter $10M exploration JV with Sandfire
• Pacifico Minerals JV with Sandfire
• MMG drilled stratigraphic holes in southern BFZ
McArthur Basin – Iron ore and ilmenite

Sherwin Iron: Roper River
Total resource: 488 Mt @ 41.7% Fe
Includes 41.1 Mt @ 57.8% Fe
Bulk sample exported

Western Desert Resources: Roper Bar
Total resource: 611 Mt @ 40.3% Fe
Includes: 47.4 Mt @ 57.3% Fe
In production

Australian Ilmenite Resources: SILL80
Ilmenite sand sourced from weathered Derim Derim Dolerite
On hold

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Oolitic hematite ore
Batten Fault Zone: Armour Energy
- 3 wells in 2012, 2 wells in 2013
- Flows equivalent to 3.3 million standard cubic feet of gas per day from Glyde-1 well (2012)
- Live oil in shales in Lamont Pass-3 well (2013)

Beetaloo Sub-basin (east): Santos
- 500 line km of 2D seismic in 2013

Beetaloo Sub-basin: Falcon Oil and Gas
- 3490 line km of 2D seismic in 2012/13 under previous farm-in with Hess

Beetaloo Sub-basin (west): Pangaea Resources
- Previously unexplored area
- 1400 line km of 2D seismic in 2013
- Very large airborne gravity survey
Tanami Region – Gold and rare earths

Boulder Ridge - Northern Minerals Ltd

Northern Minerals intersect rock chips of up to 12% rare earths (99% heavy rare earths)

Similar to Wolverine deposit on other side of WA border (4.13 Mt at 0.68% REE [82% HREE])

Old Pirate – ABM Resources

1.88 Mt @ 10.10 g/t Au (300 g/t top cut)
1.88 Mt @ 11.96 g/t Au (no top cut)

- High-grade vein-hosted deposit with potential to be a low-cost mining operation with a simple gravity extraction process
- 9844t mined, 3200oz Au produced at 17.8 g/t Au
Warramunga Province–Copper-gold

Gecko mine corridor Cu-Au
Emmerson Resources Ltd
Maiden Resource for Goanna discovery
• 2.92 Mt at 1.8% Cu, 0.2g/t Au

Upgraded Resource for Orlando
• 2.22 Mt at 1.4% Cu, 1.8g/t Au

New resource for Chariot
• 0.17 Mt at 17.4 g/t Au

From Cuisin et al AGES 2014
Georgina Basin—Phosphate, oil

Minemakers Ltd – Wonarah P
842 Mt @ 18% P$_2$O$_5$
Revised feasibility based on using Improved Hard Process to produce superphosphoric acid

Rum Jungle Resources – Ammaroo P
Near-surface phosphate
238 Mt @ 14.6% P$_2$O$_5$
Now combined with Arganara:
310 Mt @ 15% P$_2$O$_5$

Statoil-Petrofrontier – southern Georgina Basin
304 km seismic acquired in 2013
Five vertical test wells planned for 2014
Ngalia Basin – uranium, iron, petroleum

Energy Metals – Bigrlyi/Ngalia
New resources including Camel Flat:
0.21Mt @ 0.14% U3O8

Tamboran Resources
Commencing petroleum exploration

Yalyirimbi - Ferrowest Ltd
New hematite iron ore project
13.3Mt @ 27.1% Fe
Can be upgraded to 63% Fe with crushing and gravity separation
Arunta Region – Copper

The Arunta continues to emerge as a major greenfields copper province.

TNG Ltd - Mount Hardy
• 13m @ 1.17% Cu, 1.82% Zn and 0.46% Pb
• 10.3m @ 1.35% Cu

Kidman Resources – Home of Bullion Cu-Zn-Pb-Ag-Au
• 10m @ 8.5% Cu, 0.6% Pb, 4.35% Zn and 40.9 g/t Ag
• 10.5m at 3.8% Cu, 2.0% Zn, 1.2% Pb and 53.3g/t Ag

KGL Resources Ltd – Jervois Cu-Ag-Au(-Pb-Zn)
• 13.5 Mt @ 1.3% Cu, 25.8g/t Ag
• 20,000m drilling program
Arunta Region – Vanadium, tungsten, REE

TNG Ltd - Mount Peake V-Ti-Fe
160 Mt @ 0.28% V₂O₅, 5.3% TiO₂, 23% Fe
Now in DFS

Arafura Resources Ltd – Nolans
47 Mt @ 2.6% REO, 11% P₂O₅, 0.02% U₃O₈
Significant reductions in capex

Crossland Strategic Metals – Charley Creek
Monazite and xenotime sand in alluvial fans
*Indicated resource* – 387 Mt @ 295ppm REO for 114,000t REO
*Inferred resource* – 418 Mt @ 289 ppm REO for 121,000t REO
Scoping study completed

Thor Mining – Molyhil
4.71 Mt at 0.28% WO₃, 0.22% MoS₂, 18.1% Fe
Arunta Region – Grassroots exploration

Core Exploration – Blueys-Inkheart
- rock chips up to 4,065 g/t Ag, 8% Cu and 25% Pb
- Silver anomalies in soil sampling, up to 25,000ppb Ag
- Drilling planned in 2014

MMG Ltd – Harts Range and Huckitta JVs
- Following up NTGS mapping
- $9M committed to nickel-copper sulfide exploration
- Regional geophysics and drilling in 2013

Mithril Resources Ltd – Illogwa IOCG
- Greenfields discovery of potential new regional-scale iron-oxide Cu-Au (IOCG) system, following up NTGS mapping
- 13 holes drilled in 2013
Independence Group - Lake Mackay
- In August ABM Resources farmed out extensive area in Lake Mackay region to Independence Group
- Major greenfields soil sampling campaign already undertaken
- 3592 soil samples over 2000km²

MetalsX Ltd - Warumpi
- Greenfields area west of Papunya
- MetalsX undertaking soil and rock chip sampling. Anomalous nickel and gold being followed up
Amadeus Basin – Oil and gas
1.426 bscf gas and 0.2 mmbbl oil produced at Mereenie
0.224 bscf gas produced at Palm Valley

Surprise: Central Petroleum
• oil discovery in western Amadeus Basin
• exploration well flowed 200-400 barrels per day of light sweet crude
• first new production licence granted in NT in >30 years

Amadeus Basin: Santos-Central Petroleum
• 1587 km of regional 2D seismic
• exploration well in progress targeting Neoproterozoic petroleum system

Dingo: Central Petroleum
• Production licence application
Amadeus Basin – Potash and salt

Rum Jungle Resources – Karinga Lakes
Upgraded resource: 8.4 Mt $K_2SO_4$ (19 Mt schoenite)
• Resources in brines in aquifers beneath salt lakes (in lake sediments and Devonian siltstone)
• China International Chemical Consulting Corp undertaking prefeasibility study

Tellus Holdings – Chandler salt
• >200m flat lying salt unit within Chandler Formation
• Two cored salt wells drilled in late 2013
CORE (Creating Opportunities for Resource Exploration)

- Successor to Bringing Forward Discovery
- A better resourced NTGS with more geoscientists
- Accelerated coverage of gravity data
- Increased focus on basin studies and petroleum geoscience
- Ongoing collection of baseline datasets
- Continued collaborative drilling and geophysics
- Major new programs commencing
Summary

• Despite a major downturn in exploration, there are positive signs in the NT
• Recent exploration boom has generated a pipeline of new mining projects
• New discoveries and emerging mineral fields in the McArthur and central Australia
• Onshore gas and oil exploration and development is emerging as a major industry
• NTGS is ramping up programs to support and grow the exploration industry