SMART MINING

Resources for a Connected World

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SME 2019 SME ANNUAL CONFERENCE & EXPO

CMA 121st NATIONAL WESTERN MINING CONFERENCE

Lithium Brine Deposits: Challenges of Finding, Evaluating, and Reporting Mineral Resources

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Denver, CO

February 25, 2019

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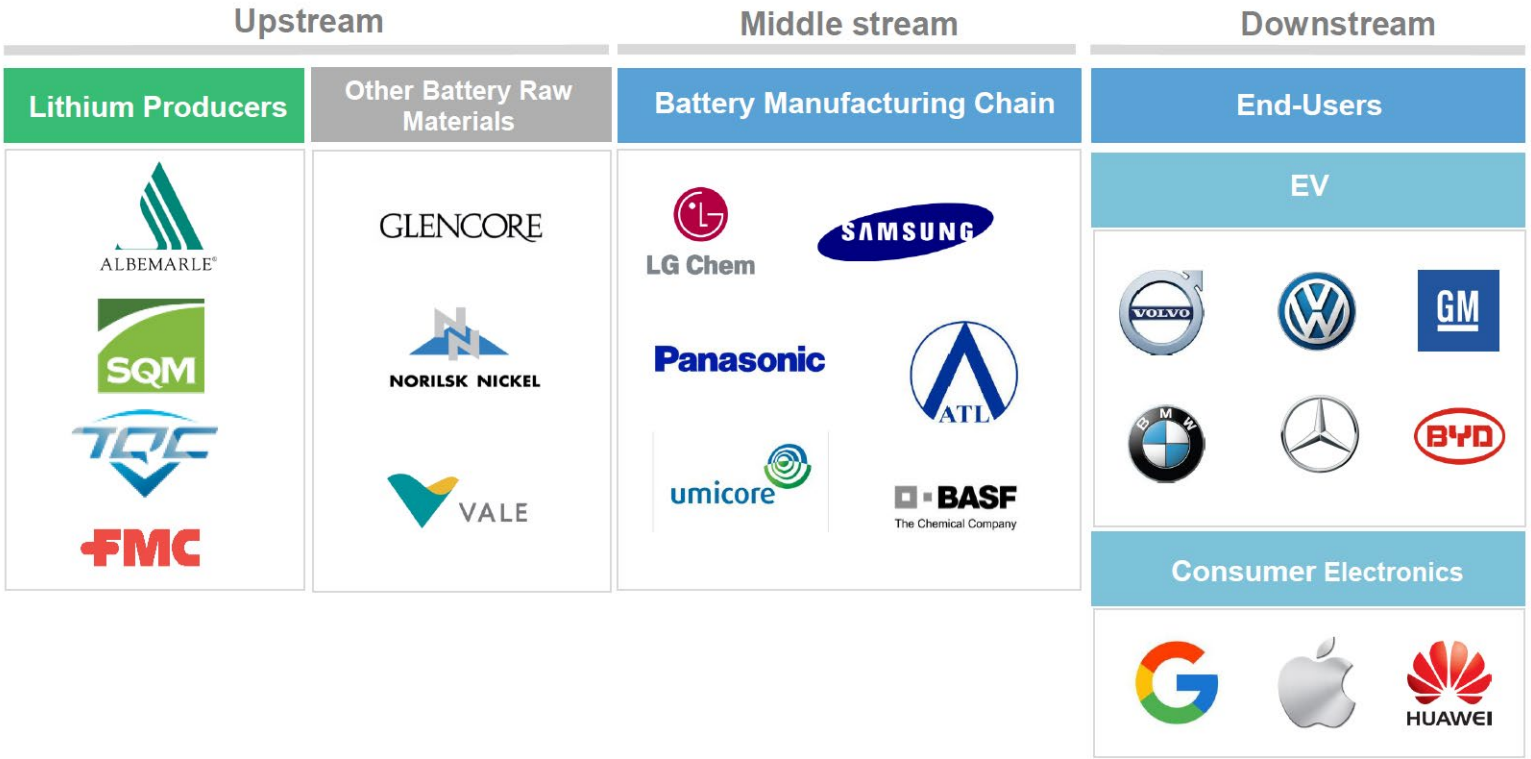
Background

Lithium Supply Chain



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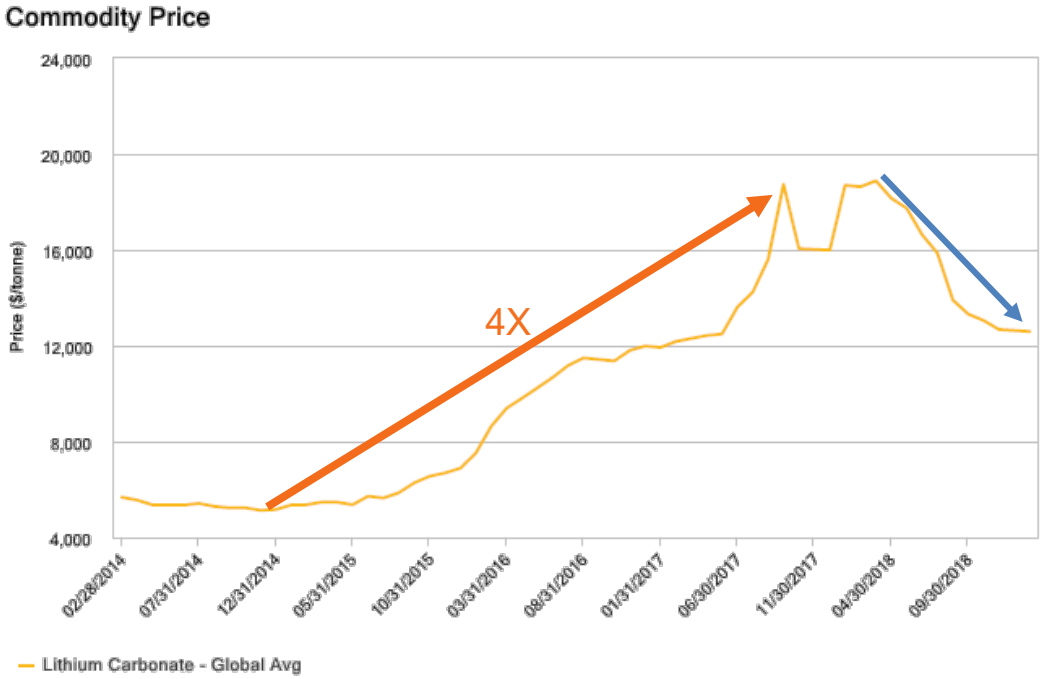
Lithium Pricing



Source: S&P Global (Feb. 25, 2019)

- Bubble?
- Speculation?

- Restart of two shuttered lithium mines
- Redevelopment of four current or formerly operating tantalum / phosphate operations to produce lithium
- Eight new operations developed or under construction
- Every existing producer is expanding

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Finding Lithium Brine Deposits

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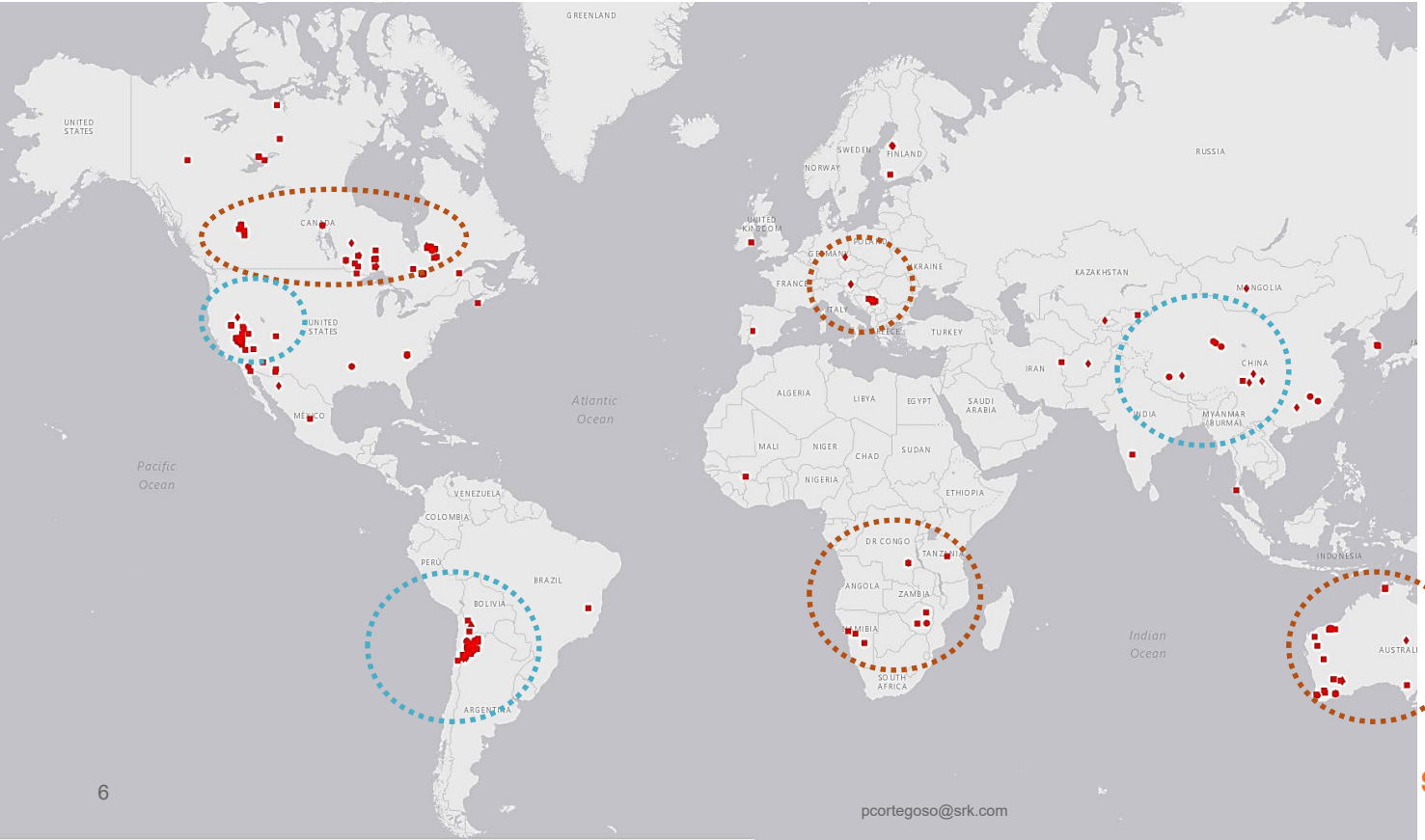
Lithium Deposits Worldwide



Primary Commodity

- Lithium

Mining Properties

Development Stage

- Exploration
- Operating
- Grassroots
- Reserves Development
- Target Outline
- Advanced Exploration
- Feasibility
- Prefeas/Scoping
- Preproduction
- Expansion
- Satellite
- Limited Production
- Construction Started
- Feasibility Complete
- Feasibility Started
- All Others
- NA

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Why brines?

Byproduct potential

Low surface impact

No mining engineers

No “miners”

Low OPEX

Low environmental impact

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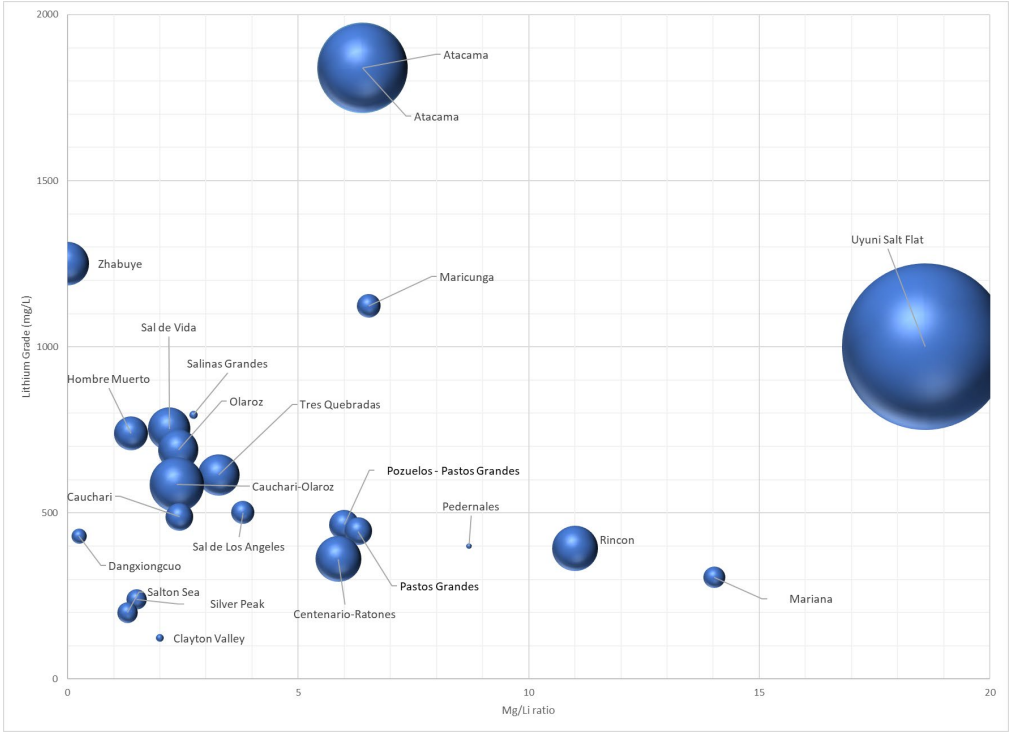
Global Lithium Brine Resources



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Evaluating Lithium Brine Deposits

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What makes/breaks a lithium brine project

- Process
  - Grade
  - Impurities
- Hydrogeology/Resources
- Logistics/Infrastructure
- Climate
- Land Tenure

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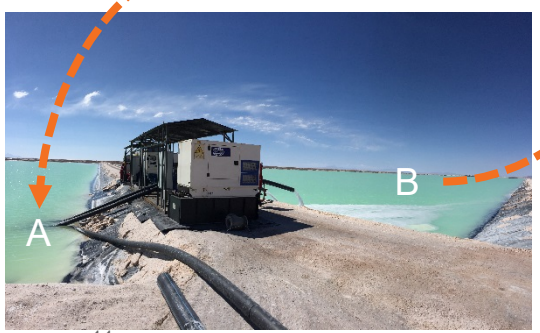
Intro to Brine Extraction Process

Brine extraction from wellfield



Pre-concentration Ponds

Process Plant

Reagents

Power

Fresh Water

Final Product

- Li_2CO_3
- LiOH
- KCl

Byproducts

Spent Brine

Salts - Sludge

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Lithium Grade

- Capital Cost
  - Evaporation Pond Size
- Operating Cost
  - Impurities
  - Reagent Consumption
  - Energy Consumption
- Brine Volume to be pumped

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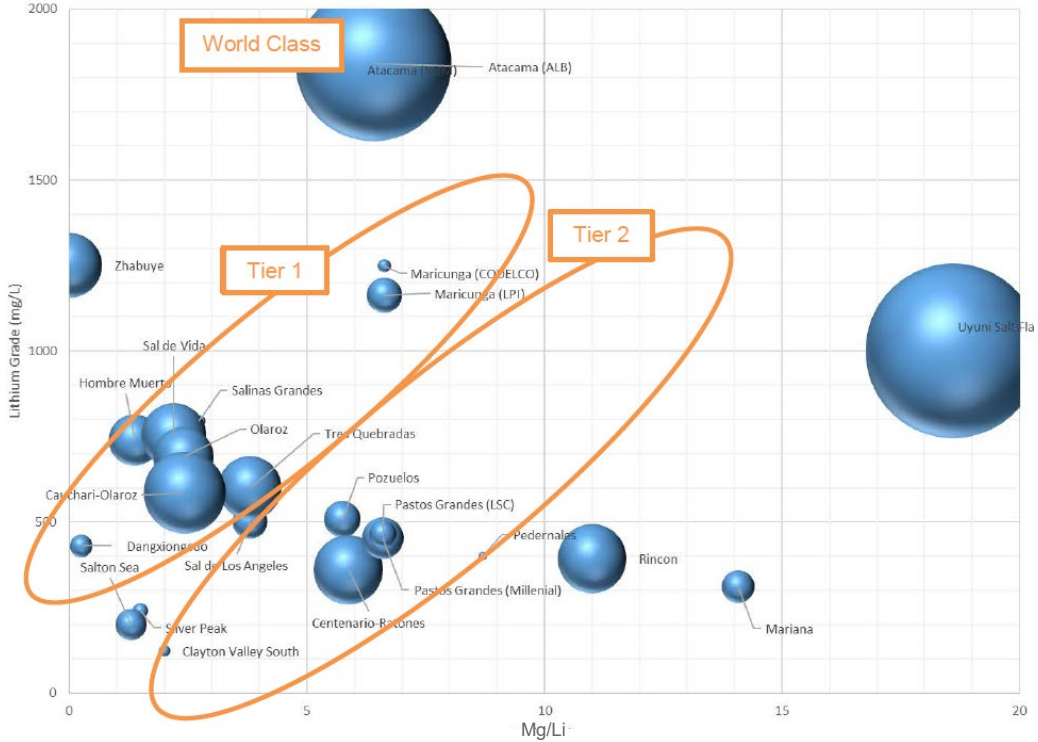
Brine Chemistry



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Brine vs Hard Rock Resource Estimaiton

Hard Rock

- Tonnes
- Grade

Brines

- Extractable brine volume = $V_{aquifer}$ x Sy
- Average brine chemistry
- Permeability which determines brine hydraulic conductivity and transmissivity, to factor how fast the brine can be extracted

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Hydrogeology

What are we looking for?

- ✓ **Brine Volume**
  - ✓ Lateral boundaries
  - ✓ Vertical distribution
  - ✓ Specific Yield (Sy) or specific storage (Ss) for confined zones
  - ✓ Effective porosity (ηe)
- ✓ **Transmissivity, Hydraulic Conductivity** (lateral and vertical)
- ✓ **Dispersivity** (longitudinal and transversal)
- ✓ **Assays** (Li, K, B, etc.)
- ✓ **Dilution** (e.g. presence of fresh water, brackish, low grade)

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Brine Resource Estimate Model

$$Resource = S_y \cdot Concentration \cdot Volume$$

- Sy: Specific yield (varies within and between lithologies)
  - RBRC, core sampling, long term pump tests
- Concentration: Li, K, Cl, Mg, etc. (varies within and between lithologies)
  - Brine samples
- Volume of Lithologic Unit
  - Lithology, thickness, transmissivity

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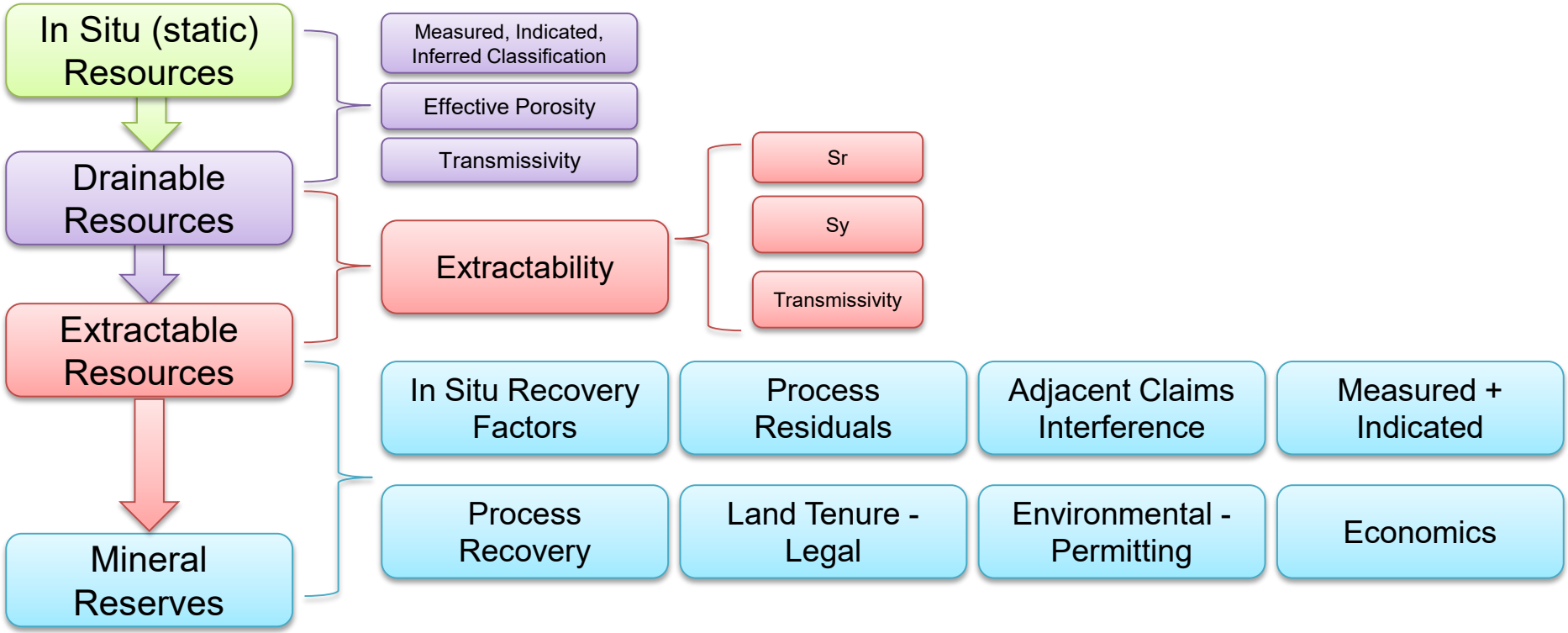
Brine Resources to Reserves



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Infrastructure/Logistics

- Remote Location
- High Elevation
- Reagent Transport
- Fresh/Process water
- Power Availability
  - “New” Processes

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Climate

OROCOBRE

ASX / TSX ANNOUNCEMENT

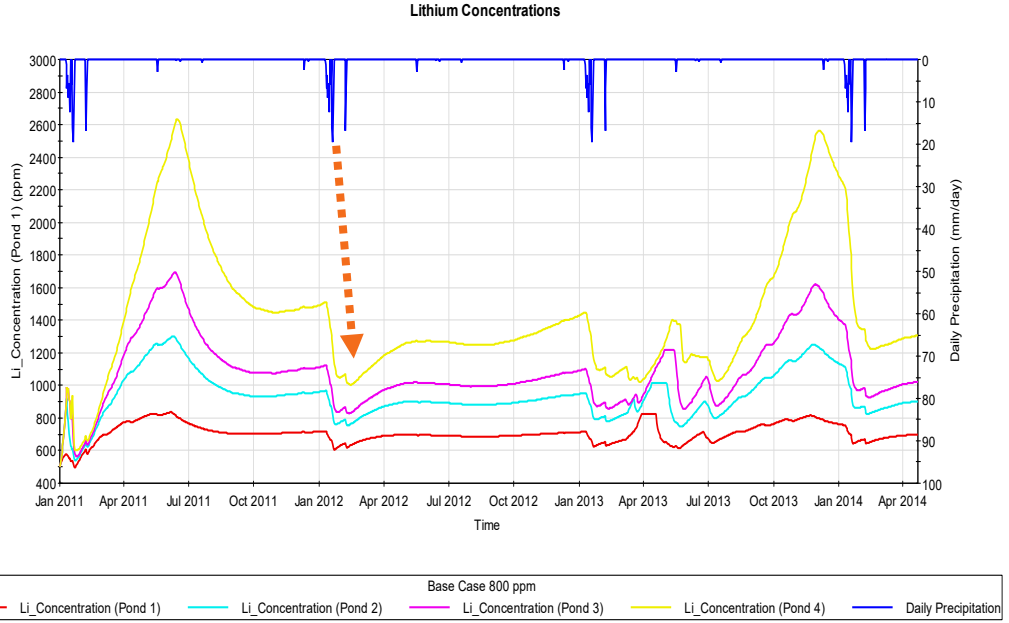
19 February 2019

Recent weather at Olaroz Lithium Facility

Orocobre Limited **(ASX: ORE, TSX: ORL) ("Orocobre" or "the Company")** provides the following update on recent weather at the Olaroz Lithium Facility in Jujuy Province, north west Argentina after completing an internal review of expected production for the remainder of the financial year.

Recent rainfall at the Olaroz Lithium Facility has exceeded that which occurred in 2017 and 2018. There have not been any material production stoppages, nor disruption to the import of supplies or the export of finished product. However, production has been lower due to dilution of the brine feedstock.

Orocobre now expects FY19 production to be approximately the same as that achieved in FY18.



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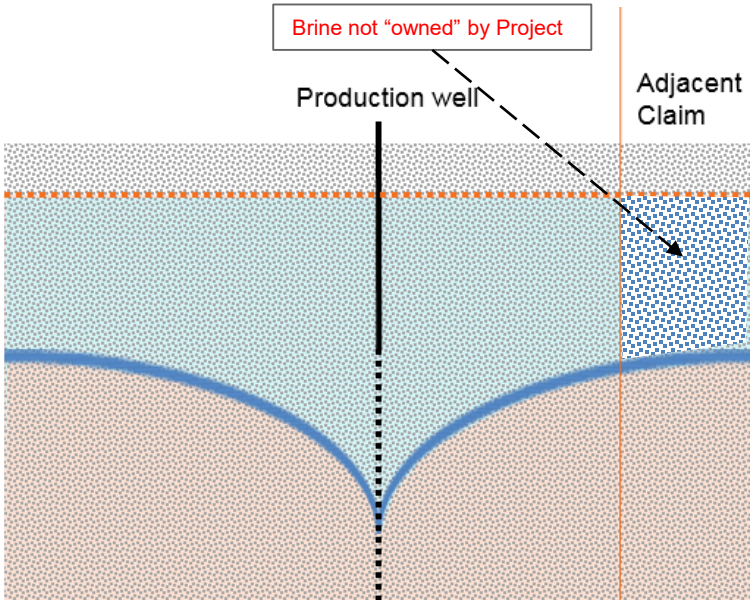
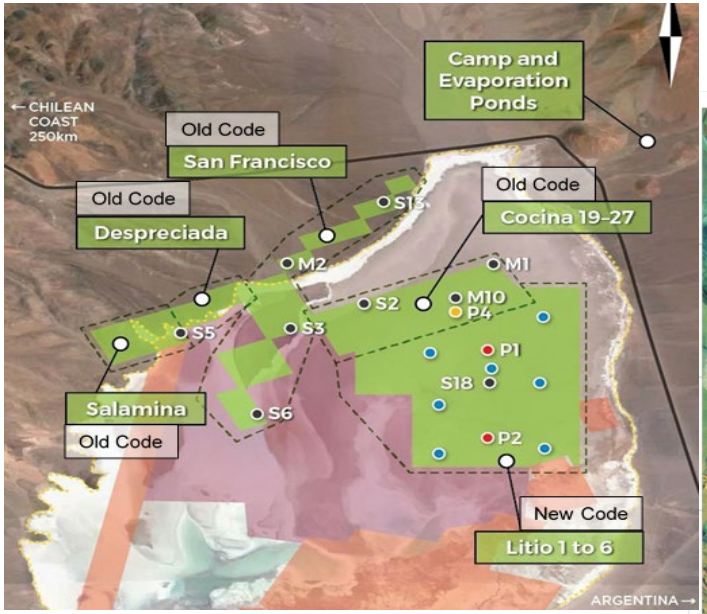
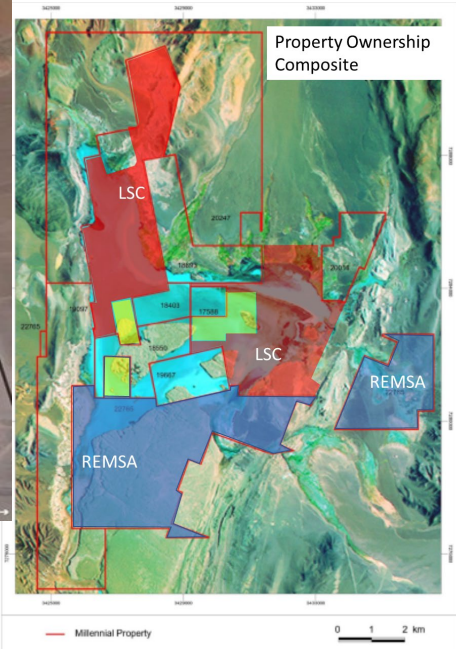
Land Tenure







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Take Home Message

- Brine moves!
- Technically complex to explore and estimate resources
- Transition from Static Resource to Dynamic Resource using the continuum of geologic stratigraphy through the use of sequence stratigraphy and onto the final use of HSU's
- Strong conceptual/dynamic GW models are key to project success
- Choice of process that fits the situation, brine chemistry, weather, etc.
- Be cautious about fractured ownership within a Salar
- Take good care of your hydrogeologist, you will thank them later

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