A New Metal From An Old Mining Area
Lithium Exploration in South West England

Adam Matthews (Exploration Geologist, Cornish Lithium — a.matthews@cornishlithium.com)

1: Introduction

Cornish Lithium Ltd. is undertaking one of the largest unified exploration projects in the history of South West England.

The Company is targeting lithium enriched hot springs with boreholes. The springs correspond to geothermal fluids naturally circulating within permeable faults at depth within Cornwall’s meta-sediment and granite.

Anomalously high concentrations of lithium were first identified within hot springs intercepted by mine workings at United Mines, by Professor Miller, 1864 (Fig. 1).

Demand for lithium is increasing year on year, this project could provide a domestic source of a critical battery metal for the UK, helping to sustain the growth of the battery (Li ion) storage and electric vehicle revolution.

2: Data

During 2018 Cornish Lithium has utilised its access to private and public mining archives, and academic journals, to obtain:

- Hot spring geochemistry (Fig. 2) and temperature data recorded within old mines.
- Mine plans and sections.
- Geological reports.
- Hydrogeological parameters of the fracture network from the Hot Dry Rocks (1980’s (geothermal)) project.
- Joint spacing and orientation data across Cornwall.

“The hot water issuing in great quantities at these depths is rich in Lithia”

3: 3D Geological Modelling

The initial modelling area was defined for its high concentration of hot spring occurrences within mines (Fig. 3).

Geothermal fluids are confined to permeable geological structures, and were seen as hot springs in the mines (Fig. 7 & 8).

Anomalously elevated fluid temperature suggests that convection occurs within the fracture network, and thus deep seated permeability and conductivity can be inferred.

The hottest fluids are commonly mature waters, which have interacted with the lithium enriched granites. Lithium is scavenged from micas (zinnwaldite) and brought into solution; increasing the metal’s concentration within the geothermal fluids.

Temperature logs from boreholes drilled in the late 1960s indicate the continued presence of circulating geothermal fluids 100 years after the structure was last mined (Fig. 7).

“Lithium Exploration in South West England”

4: 4D Geological Modelling

The 3D model is a tool helping to define drill targets for summer 2019. The programme will be designed to target permeable geological structures and prove the projects concept.

The Company aims to obtain fluid and hydrogeological information during drilling, to inform the fluid flow, mass transport and chemical interactions over time within the permeable fault.

The Company aims to construct a 4D geological model using Leapfrog Geothermal’s compatibility with major flow modelling packages towards the end of 2019.

A conceptual 4D flow model has been constructed, using parameters recorded during the Hot Dry rocks geothermal project in the 1980’s (Gmedley et al., 1989).

- Understand the parameters which affect model calibration
- Understand the parameters which affect flow and production predictions
- Define the 4D geological model to decrease exploration risk and delineate a resource

5: Summary

Cornish Lithium is an exploration company targeting lithium enriched geothermal fluids circulating at depth within a fractured basement reservoir.

The Company has access to public and private mining archives which has increased exploration efficiency in 2018.

The Company has collated an extensive geothermal fluid temperature and geochemistry database from historic literature.

A comprehensive 3D geological model has been constructed from historic mine plans and sections, without the need for extensive drilling; a benefit of brownfield exploration.

Drilling in summer 2019 aims to obtain a geothermal fluid sample, and hydrogeological and production data to feed into and calibrate their 4D geological model.

Using a 4D geological model to understand the flow paths, mass transfer and production sensitivity of hot springs, will reduce exploration risk and further inform the resource.