Historic drill core underpins high quality lithium discovery

Date: 11 June 2024

ASX Code: MAN

Capital Structure
Ordinary Shares: 616,759,920
Current Share Price: 3.1c
Market Capitalisation: $19.1M
Cash: $15.0M (Mar. 2024)
EV: $4.1M
Debt: Nil

Directors

Lloyd Flint
Non-Executive Chairman
Company Secretary

James Allchurch
Managing Director

Roger Fitzhardinge
Non-Executive Director

Contact Details
First Floor
10 Outram Street
West Perth WA 6005
Australia

Tel: +61 9200 3743

mandrakeresources.com.au

Highlights

- **Mandrake has identified over 16 existing drill cores from oil and gas wells previously drilled within the Utah Lithium Project area**
- **The core, stored at the Utah Core Research Center (UCRC), has been analysed for rock-quality characteristics including porosity and permeability and is also available for further testing if required**
- **The analysis of core for porosity and permeability is the gold standard in the determination of reservoir characteristics**
- **Exceptional porosity and permeability data from the project area demonstrates the high deliverability of the brine-host reservoir rock, indicating good brine yield (production rates)**
- **The core data greatly improves the quality and confidence of the maiden JORC 2012 Mineral Resource Estimate, which is on target for delivery early in Q3 2024**

Mandrake Resources Limited (ASX: MAN) (Mandrake or the Company) has identified core samples from 16 historic (several still in production) oil and gas wells within Mandrake's Utah Lithium Project area. The core samples reside at the Utah Core and Research Center (UCRC), a department of the Utah Geological Survey (UGS).

Figure 1: Core from the Lisbon D-616 well (8,619' depth) showing exceptional dolomitic vuggy porosity. Note core plug sample (circular hole). Semi-inset: Thin section at 8,619' showing a 100% dolomite reservoir, with secondary porosity enhanced by hydrothermal dolomitization (pore spaces in blue)

Direct analysis of core, through core plug analysis (see Figure 1), is the gold standard in the determination of crucial reservoir characteristics such as porosity and permeability. It provides critical, robust data for the formulation of a JORC-compliant Mineral Resource Estimate (MRE), often allowing for the increase in confidence and quantity of a given MRE.

Figure 2: UCRC core storage facility

Within the Utah Lithium Project area, 5 core plug analyses (porosity and permeability) are available from the Leadville Formation along with 2 core plug analyses from clastics within the overlying Paradox Formation. This data has been made available to Mandrake and will be fed into the resource modelling workflow. Further, with core available from 16 legacy wells, Mandrake can conduct further core plug analyses for porosity and permeability across particular formations or zones of interest.

Of particular value in having access to the core data is the ability to now be able to calibrate the Company's vast petrophysical database (core logs from previous wells) with actual real-world core data values for porosity and permeability, increasing the accuracy and application of the petrophysics as well as generating a far more robust reservoir model (see Figure 3).

The presence of dolomitization within the Leadville Formation is a key indicator of enhanced reservoir quality. In wells without a Photoelectric (PE) wireline curve, it is prudent to look at the rock core to distinguish the dolomite and limestone facies within the Leadville. Dolomites are easily differentiated from limestones in the cores using an acid test.

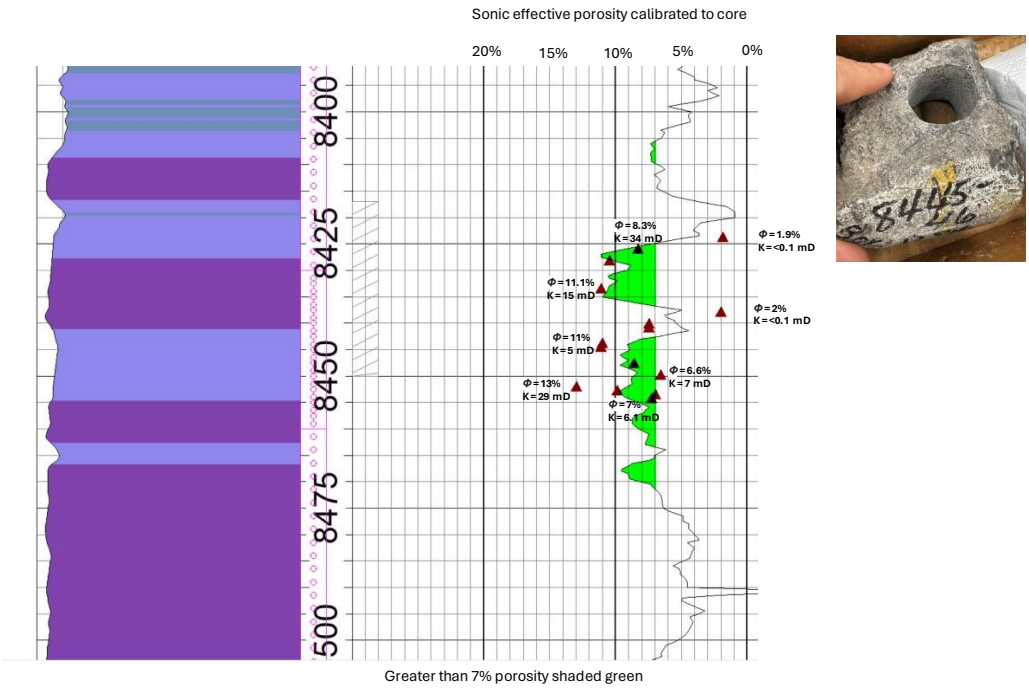

Figure 3: Calibration of petrophysics using core data – Lisbon D-816 located within the Utah Lithium Project

All the observed cores from Mandrake's Utah Project area show substantial dolomitization within the Leadville Formation. Of note is the widespread presence of early dolomitization observed in thin section analysis in the Leadville Formation. This first stage of matrix dolomitization occurred near the time of deposition and is observed on a regional scale.

Enhanced secondary dolomitic porosity is also observed in all Leadville cores with available thin section analysis. Secondary porosity is created by later diagenetic events, including leaching, followed by replacement dolomitization. Saddle dolomites and hydrothermal dolomitization increase the pore space within the rock and greatly enhances fluid flow pathways. Secondary diagenetic porosity was observed in the Lisbon D-816, Lisbon D-616, Lisbon B-816, and Lisbon B-610 (see Figure 4).

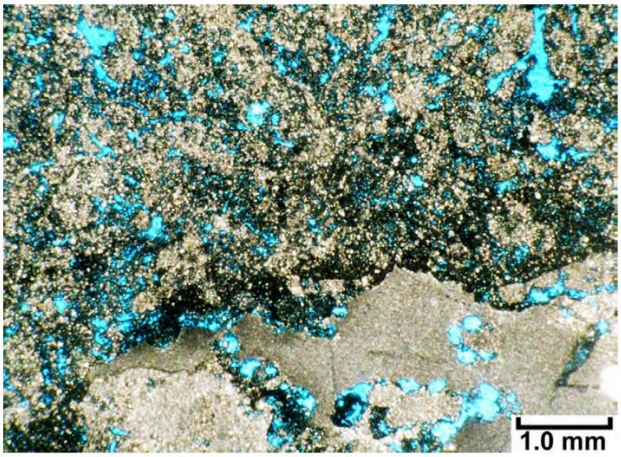

Figure 4: Thin section from a 1" diameter core plug taken at 7886' depth in the Lisbon B-610. The Leadville shows early matrix dolomitization, leaching, then secondary replacement saddle dolomites creating excellent porosity and permeability. The measured effective porosity and permeability from this depth was 13.8% and 114 mD (pore spaces in blue).

The dolomitic facies are known to have increased porosity and permeability, thus greatly improving reservoir deliverability, indicating the ability of the reservoir to yield brine at significant rates. The potentially significant yield of the reservoir bodes well for forthcoming Direct Lithium Extraction (DLE) pilot testing as well as any future production.

Moreover, the access to core-derived permeability and porosity data will generate a more robust Mineral Resource Estimate, with the ability to calibrate petrophysical data with effective porosity core values further reinforcing the accuracy of reservoir models.

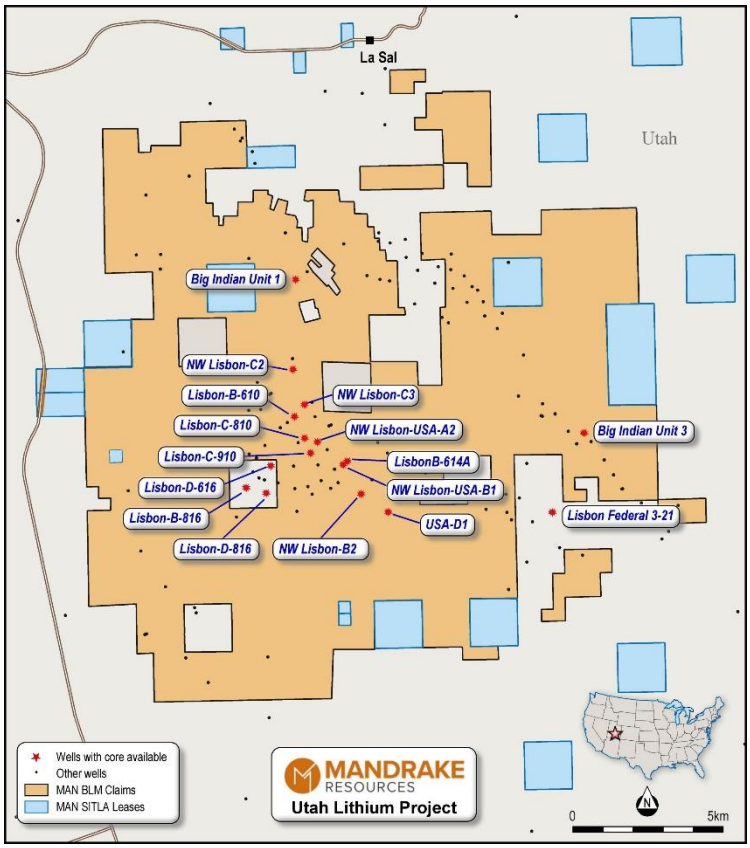

Figure 5: Location of wells with core stored at UCRC

About Mandrake

Mandrake is an ASX listed explorer, focused on advancing its large-scale lithium project in the prolific 'lithium four corners' Paradox Basin in south-eastern Utah, USA. The Company's 100%-owned tenure position exceeds 93,000 acres (~379km^2).

Mandrake has produced a significant Exploration Target (JORC 2012) for Lithium mineralisation which ranges from 1.7 to 5.6 million tonnes (Mt) of contained Lithium Carbonate Equivalent (LCE) and is currently establishing a maiden Mineral Resource.

The Exploration Target has been prepared and reported in accordance with the 2012 edition of the JORC Code. The potential quantity and grade of the Exploration Target is conceptual in nature. There has been insufficient exploration to estimate a Mineral Resource. It is uncertain if further exploration will result in the estimation of a Mineral Resource.

Positioned within Utah's pro-mining jurisdiction, the project benefits from a favourable regulatory environment that supports mining activities. The project has access to Tier 1 infrastructure, including power and water resources.

Furthermore, the project aligns with the proactive efforts of the US government and industry to promote domestic exploration and production of strategic and critical materials.

This announcement has been authorised for release by the Board of Mandrake Resources.

Competent Persons Statement

The information related in this announcement has been compiled and assessed under the supervision of Mr James Allchurch, Managing Director of Mandrake Resources. Mr Allchurch is a Member of the Australian Institute of Geoscientists. He has sufficient experience that is relevant to the information under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the JORC Code. Mr Allchurch consents to the inclusion in this announcement of the matters based on his information in the form and context in which it appears.

JORC Code, 2012 Edition – Table 1 report template

Section 1 Sampling Techniques and Data

(Criteria in this section apply to all succeeding sections.)

Criteria	JORC Code explanation	Commentary
Sampling techniques	• Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling. • Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. • Aspects of the determination of mineralisation that are Material to the Public Report. • In cases where 'industry standard' work has been done this would be relatively simple (eg 'reverse circulation drilling was used to obtain 1m samples from which 3kg was pulverised to produce a 30g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.	• Mandrake has not yet drilled any wells, instead utilising historical petroleum company wells. • A number of the historical petroleum wells were cored though various zones of interest to test reservoir characteristics. • Select drill core was then subjected to core plug sub-sampling to determine a host of reservoir characteristics. • Core plugs are stored at the Utah Core Research Center in Salt Lake City, Utah.
Drilling techniques	• Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).	• Mandrake has yet to conduct any drilling at the Utah Lithium Project. • The historical oil and gas company owned wells were drilled using conventional oil and gas drill rigs that drill vertical well bores.
Drill sample recovery	• Method of recording and assessing core and chip sample recoveries and results assessed.	• Mandrake has not yet drilled any wells, instead utilising historical petroleum company wells.

Criteria	JORC Code explanation	Commentary
	• Measures taken to maximise sample recovery and ensure representative nature of the samples. • Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	• The historical drill sampling recovery from the oil and gas wells is unknown.
Logging	• Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies. • Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. • The total length and percentage of the relevant intersections logged.	• Petrophysical well logs associated with the historical wells include gamma-ray, neutron density, resistivity, sonic, and mud logs. • The petrophysical logs provide information such that geologists can make porosity estimations and stratigraphic formation picks to define the down-well lithology of each well. These interpreted lithological logs are used to prepare cross-sections to map the reservoir and to target future well locations.
Sub-sampling techniques and sample preparation	• If core, whether cut or sawn and whether quarter, half or all core taken. • If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry. • For all sample types, the nature, quality and appropriateness of the sample preparation technique. • Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples. • Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling. • Whether sample sizes are appropriate to the grain size of the material being sampled.	• Sub-sampling included drilling of one inch diameter core plugs from drill core.
Quality of assay data and laboratory tests	• The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total. • For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the	• Mandrake has not yet drilled any wells, instead utilising historical petroleum company wells. • Precise analytical procedures are unknown.

Criteria	JORC Code explanation	Commentary
	analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc. • Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.	
Verification of sampling and assaying	• The verification of significant intersections by either independent or alternative company personnel. • The use of twinned holes. • Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. • Discuss any adjustment to assay data.	• No verification of sampling has been applied.
Location of data points	• Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation. • Specification of the grid system used. • Quality and adequacy of topographic control.	• Well locations are identifiable in the field. • The longitude and latitude locations of the oil and gas wells provided by the oil and gas companies are recorded in government databases.
Data spacing and distribution	• Data spacing for reporting of Exploration Results. • Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. • Whether sample compositing has been applied.	• Data spacing and distribution is insufficient to establish the degree of geological and grade continuity appropriate for a potential future Mineral Resource or Ore Reserve.
Orientation of data in relation to geological structure	• Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. • If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	• The effect of structures in the concentration of different elements in the brines is not fully understood. • Seismic interpretation has been undertaken by Mandrake to evaluate geological structures but further work is still required.
Sample security	• The measures taken to ensure sample security.	• Sample security procedures (if any) as conducted by the historical oil and gas companies are unknown.

Criteria	JORC Code explanation	Commentary
Audits or reviews	• The results of any audits or reviews of sampling techniques and data.	• No audits/reviews of the data have been undertaken at this stage.

Section 2 Reporting of Exploration Results

(Criteria listed in the preceding section also apply to this section.)

Criteria	JORC Code explanation	Commentary

Mineral tenement and land tenure status	• *Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.*
	• *The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.*
		• The Utah Lithium Project is located approx. 60km SSE of the City of Moab, in the State of Utah in the United States.
		• The total land position is 93,755 acres and includes:
		  o 34,670 acres within an Other Business Agreement (OBA) with the Utah State Government's School and Institutional Trust Lands Administration (SITLA).
		  o The remaining land position of approximately 59,085 acres is comprised of over 2,950 staked Bureau of Land Management (BLM) placer claims.
		• Mandrake has lithium rights over 100% of both SITLA and BLM tenure.
		• Mandrake has potash rights over SITLA tenure only.
		• All the leases / BLM claims are 100% owned by Mandrake's US subsidiary, Mandrake Lithium USA Inc.

Exploration done by other parties	• *Acknowledgment and appraisal of exploration by other parties.*	• Historical exploration work has been performed by oil and gas companies who have completed hydrocarbon-specific exploration and production activities over the last 80 years across the lease and claim areas. • Individual wells within oilfields continue to produce in the Paradox Basin and within the boundaries of the Utah Lithium Project.
Geology	• *Deposit type, geological setting and style of mineralisation.*	• The Project is in the north-central portion of the Paradox Basin. • Structurally, Mandrake's Project occurs on the southern margin of the "Paradox fold and fault belt", which consists of a series of roughly parallel, northwest-trending faults,

<table>
<tr><th>Criteria</th><th>JORC Code explanation</th><th>Commentary</th></tr>
<tr><td></td><td></td><td>northwest striking diapiric salt-cored anticlines and synclines in the northern part of the Paradox Basin.
• Currently, Mandrake's lithium-brine geological target units are defined by the Devonian McCracken sandstone, the Mississippian Leadville-Ouray Limestone Formation (Leadville Limestone) and the Pennsylvanian Paradox Member of the Hermosa Formation.
• The Leadville Limestone comprises massive to thinly laminated, gray, buff, and yellow limestone that were deposited in intertidal to subtidal environments.
• The Paradox Basin can be defined by the maximum extent of halite and potash salts in the Middle Pennsylvanian Paradox Formation and is composed of halite interbedded with gypsum, shale, sandstone, and dolomite deposited intermittently in a closed marine depositional environment.</td></tr>
<tr><td>Drill hole Information</td><td>• A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes:
o easting and northing of the drill hole collar
o elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar
o dip and azimuth of the hole
o down hole length and interception depth
o hole length.
• If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.</td><td>• Mandrake has yet to conduct drilling at the Utah Lithium Project.
• The historical oil and gas wells that were cored, include:
<table><tr><th>Well</th><th>Latitude</th><th>Longitude</th></tr><tr><td>NW Lisbon-C2</td><td>38.21229</td><td>-109.277</td></tr><tr><td>Lisbon D 616</td><td>38.18326</td><td>-109.286</td></tr><tr><td>LISBON FEDERAL3-21</td><td>38.167594</td><td>-109.179</td></tr><tr><td>LISBONB-614A</td><td>38.184211</td><td>-109.257</td></tr><tr><td>LISBONC-810</td><td>38.191271</td><td>-109.273</td></tr><tr><td>LISBONC-910</td><td>38.186866</td><td>-109.271</td></tr></table></td></tr>
</table>

Criteria	JORC Code explanation	Commentary
		BIG INDIAN UNIT 1 | 38.239428 | -109.275 BIG INDIAN UNIT3 | 38.191401 | -109.166 Lisbon B 816 | 38.17676 | -109.296 NW LISBON-B2 | 38.174249 | -109.252 Lisbon D-816 | 38.175036 | -109.288 NW LISBON-USA-B1 | 38.18321 | -109.258 Lisbon B-610 | 38.198009 | -109.277 NORTHWEST LISBON-C3 | 38.201609 | -109.273 NW LISBON-USA-A2 | 38.190178 | -109.268 USA-D1 | 38.168601 | -109.241
Data aggregation methods	• *In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated.* • *Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.* • *The assumptions used for any reporting of metal equivalent values should be clearly stated.*	• No weighting or cut-off grades have been applied. • No metal equivalent values have been reported.
Relationship between mineralisation widths and intercept lengths	• *These relationships are particularly important in the reporting of Exploration Results.* • *If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported.*	• Mandrake has yet to conduct drilling at the Utah Lithium Project. • The oil and gas fluids (hydrocarbons and brine) are produced from large, confined aquifer/reservoir deposits; hence, the brine samples – as fluid media – represent samples from a larger pool of fluids. Accordingly, it is

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	• *If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').*	accurate to state that brine data do not have common solid mineral deposit sample intervals or intercepts. Hence downhole lengths and true widths are not applicable to this type of deposit.
Diagrams	• *Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.*	• Relevant historical information is presented within the figures and text contents of this announcement.
Balanced reporting	• *Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.*	• All results are contained in the announcement.
Other substantive exploration data	• *Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.*	• Based on the Mandrake's current knowledge of the project, all meaningful information has been provided.
Further work	• *The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling).* • *Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.*	• Planning of a swabbing campaign to allow for the sampling of more representative native and uncompromised brines further away from the historical oil and gas well bores is currently underway. • Permitting has been received which allows Mandrake to make new perforations in the historical oil and gas wells that target the lithological units most prospective to host lithium rich brines • Direct Lithium Extraction (DLE) test work to verify that lithium can be extracted from deep-seated brine underlying the Utah Lithium Project, is currently being undertaken by two independent DLE providers. • Work is underway to produce a lithium brine Mineral Resource in accordance with JORC (2012).