



The Critical Role Portable XRF Played in the Discovery to Delivery of the Rarest Economic Mineral Deposit on Earth - Pollucite at Sinclair, Western Australia.

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David J Crook³

Talk: F-13
August

08

Thursday

2019

Chicago IL

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³ Pioneer Resources Limited



Pollucite in the Sinclair Mine

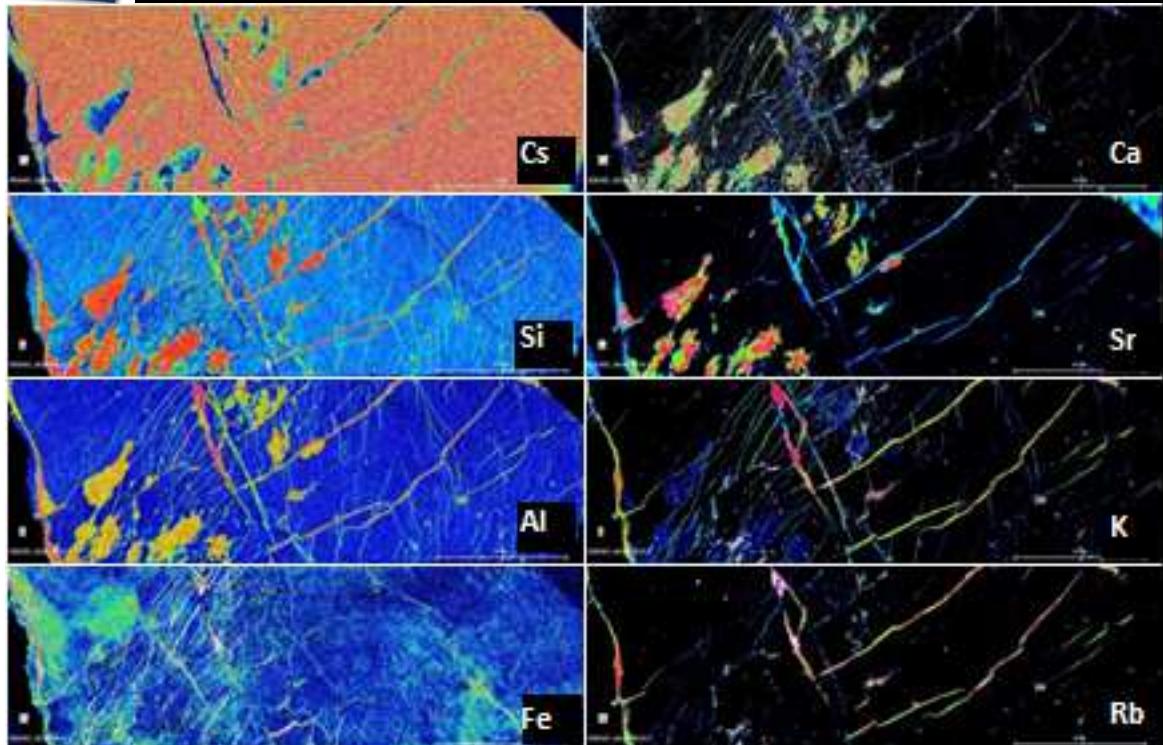




What is Pollucite?



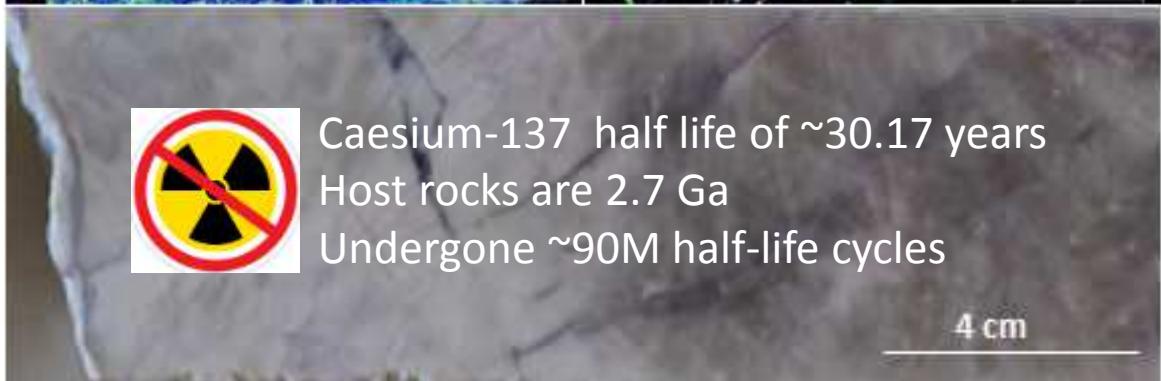
μ XRF mapping of pollucite from PDD167 (49.40 to 49.71m)
Bruker M4 TORNADO



- A high value mineral due to its high caesium content (~29.66% Cs_2O)
 - Only forms in extremely fractionated lithium-caesium-tantalum (LCT) pegmatite systems.

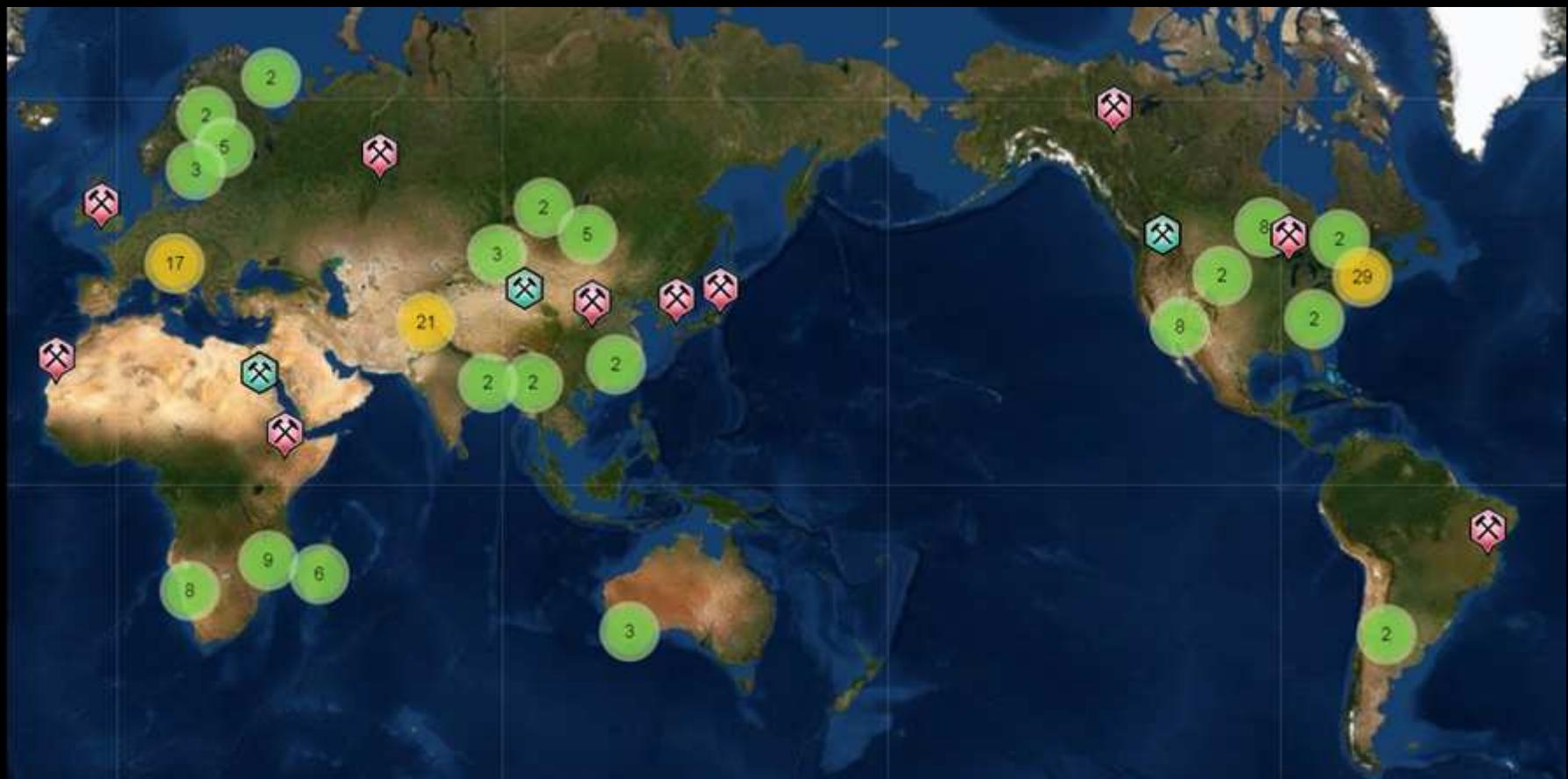


Caesium-137 half life of ~30.17 years
Host rocks are 2.7 Ga
Undergone ~90M half-life cycles



Where do you find Pollucite?

Only 160 occurrences of pollucite known globally
Typically pollucite occurs as grain-size to fist size samples



Source:  Mindat.org

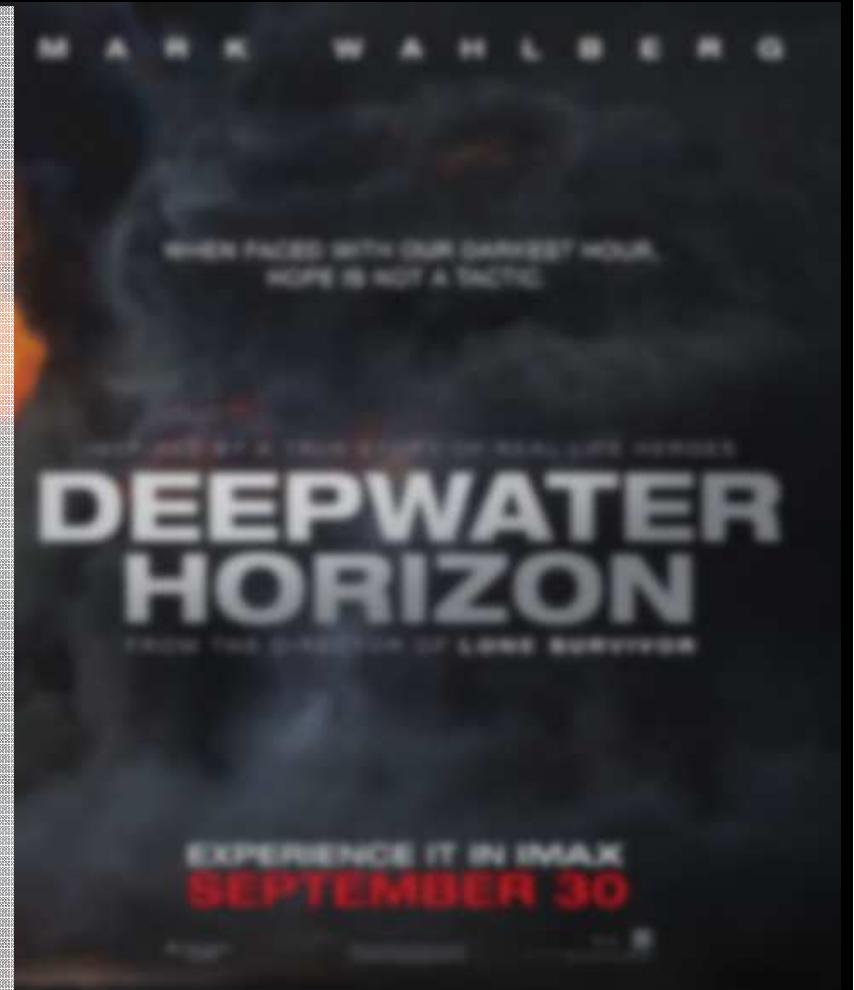
Location of Economic Pollucite Deposits?

Only 3 occurrences of economic pollucite known globally
Economic pollucite occurrences range in size 10kT - 100kT



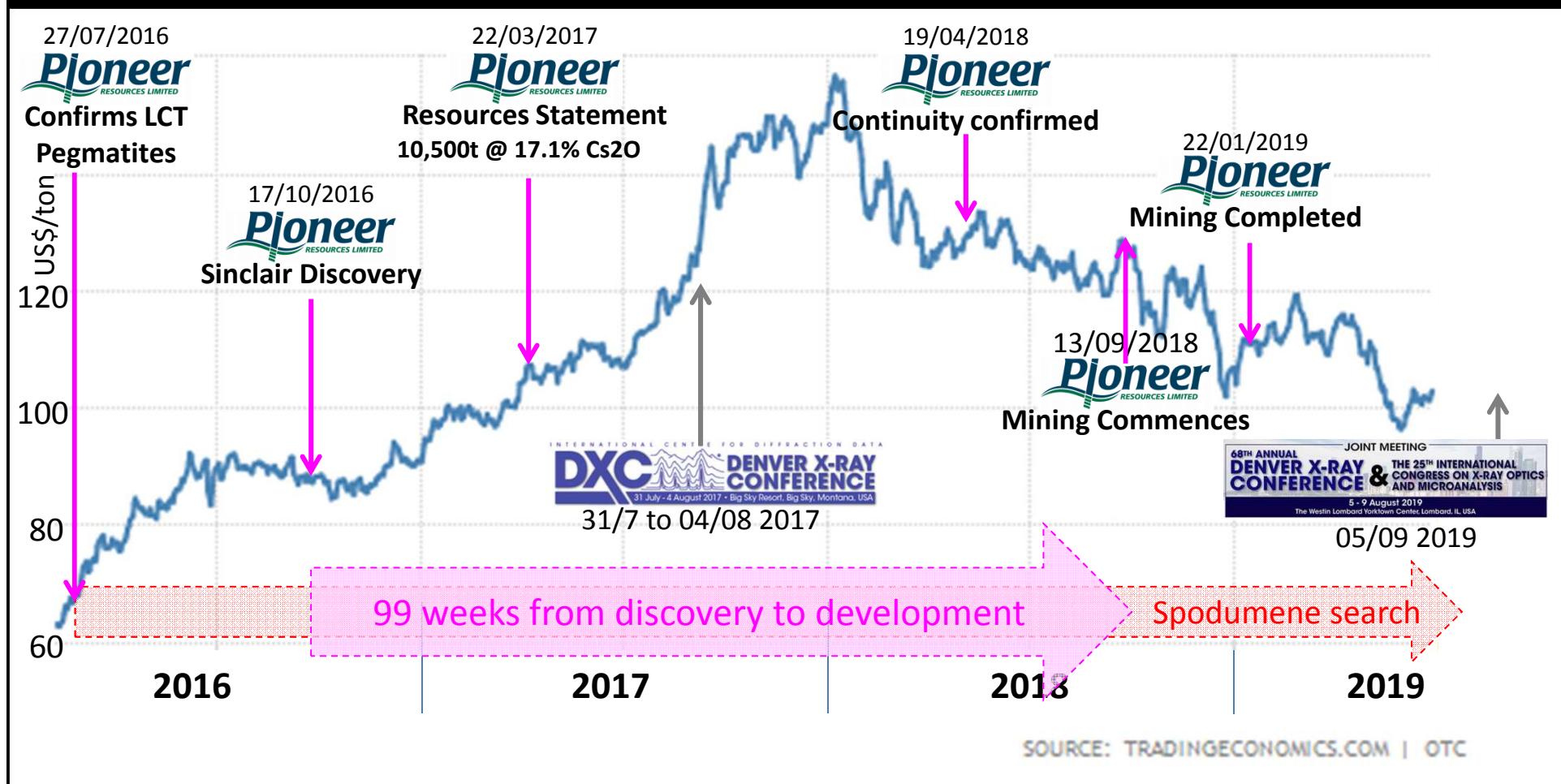
Use of Pollucite

- Pollucite main used is in **Cs-formate** manufacturing.
- Cs-formate is a **drilling fluid** used in **high temperature / high pressure** oil and gas drilling to prevent blowout.
- Cs-formate is **LEASED** to oil companies during the transition from exploration to production.



Pollucite pricing is not transparent

Discovery, Delineation, Development of Sinclair and the future...



Detecting

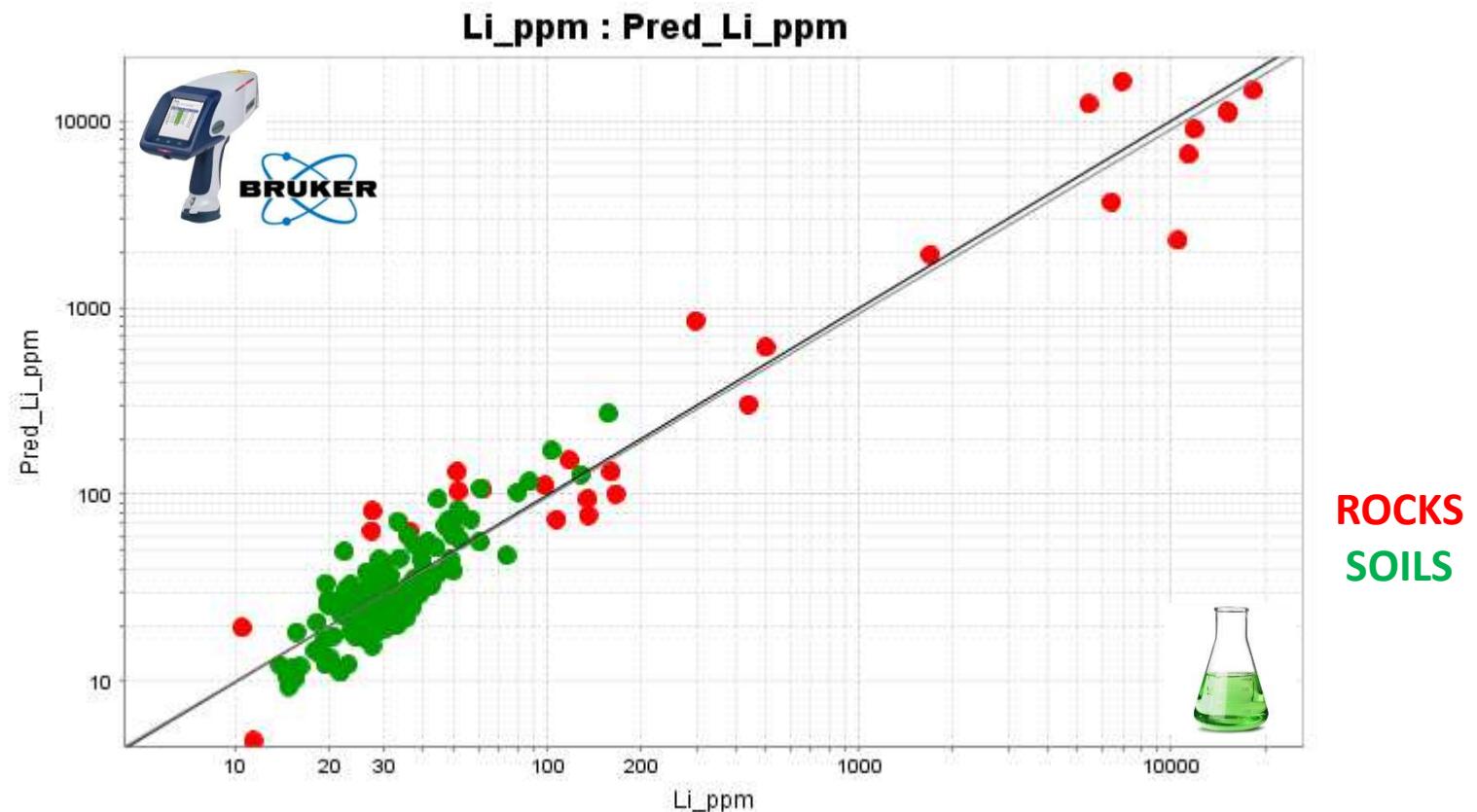
Lithium by pXRF

- Portable XRF (pXRF) can detect down to Na (Z11).
- pXRF cannot detect lithium (Z3) directly
- pXRF can detect elements associated with **LCT Pegmatites** (Ga, Rb, Nb, Sn, Cs, Ta & Tl)
- an algorithm based on associated LCT elements is used to estimate the Li content (**Lithium Index**)
- Using *EasyCal* on Bruker S1 Titan a fundamental parameter “**Lithium Index**” calibration can be uploaded on pXRF

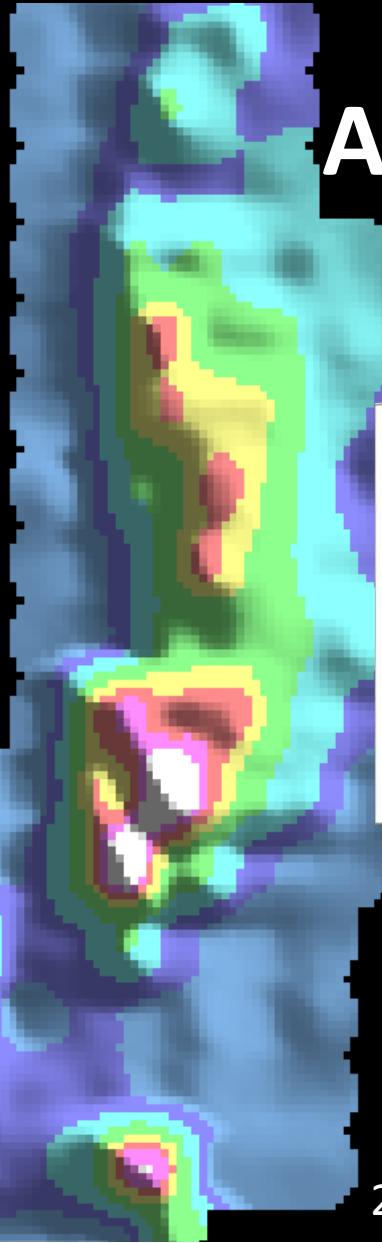




Lithium (calculated)



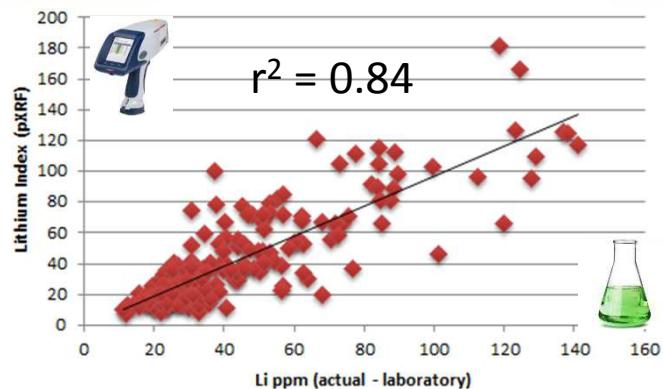
Both images are derived from the SAME samples
Laboratory Li, predicted Li from pXRF instrument



A Li by pXRF

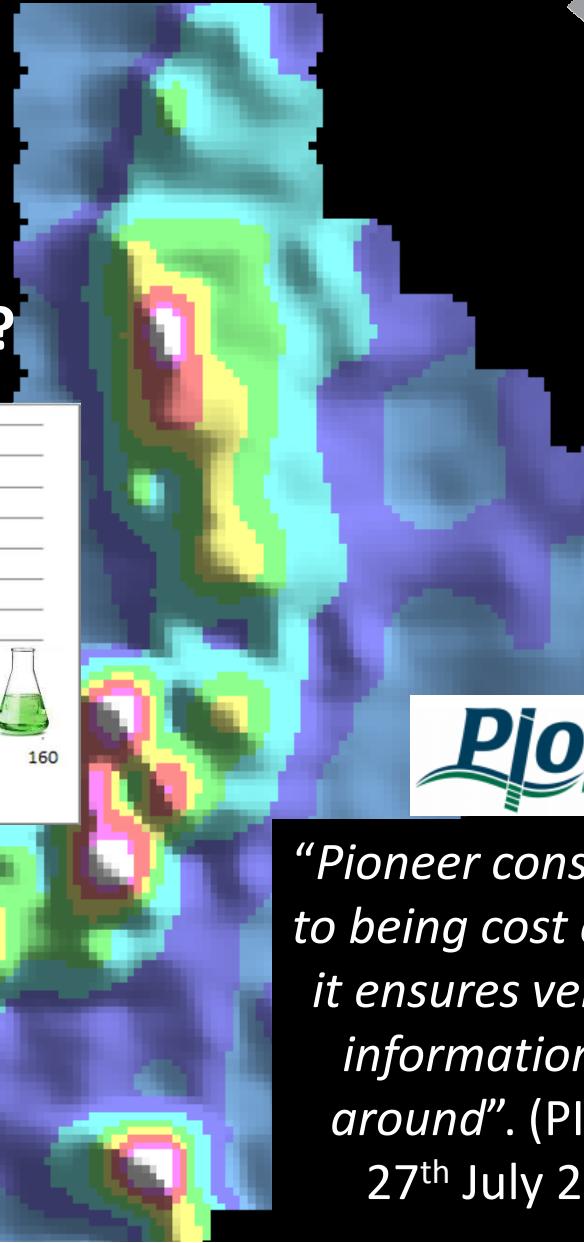


Which is Li by pXRF?



Li by lab B

200 x 50m grid (n = 207)



*"Pioneer considers.....
to being cost efficient,
it ensures very rapid
information turn-
around". (PIO: ASX
27th July 2016).*

Discovery





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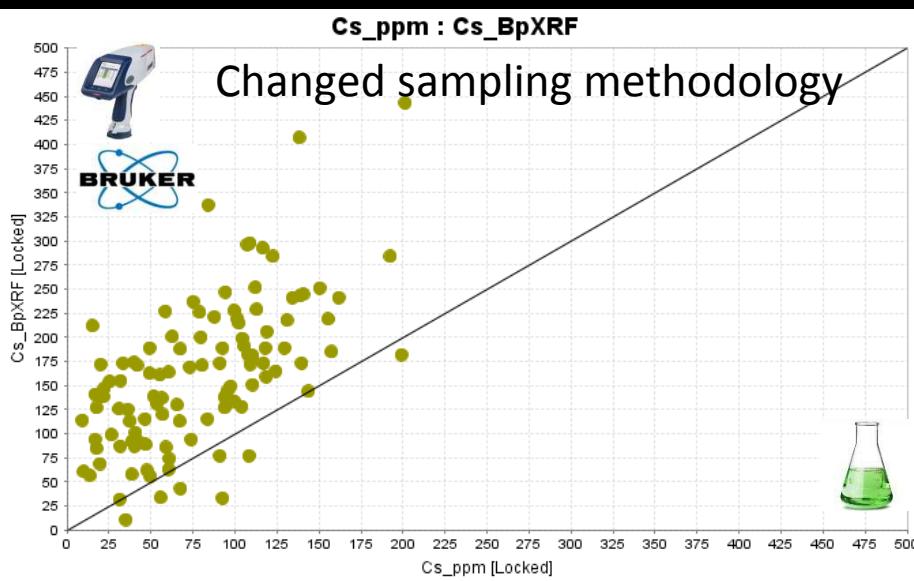
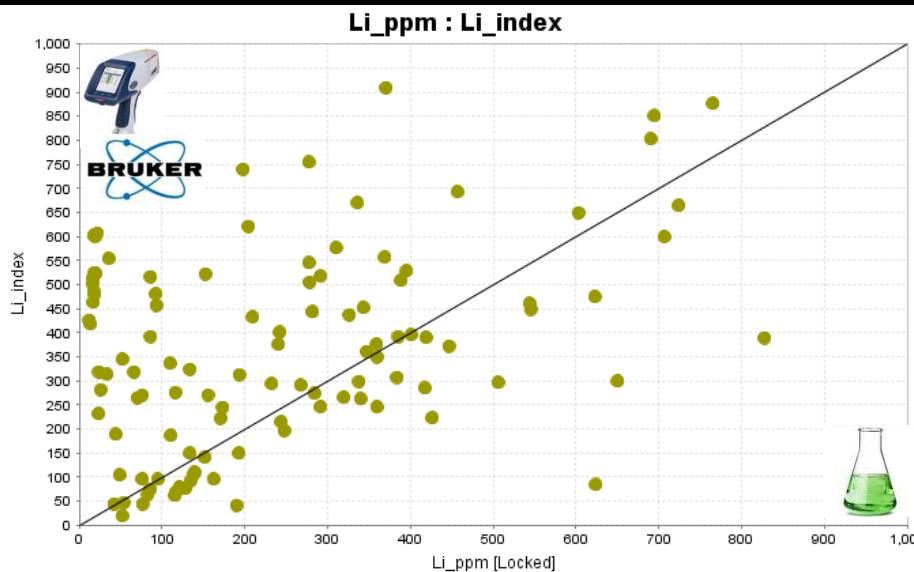
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DRILLING TO COMMENCE AT PIONEER DOME LITHIUM PROJECT

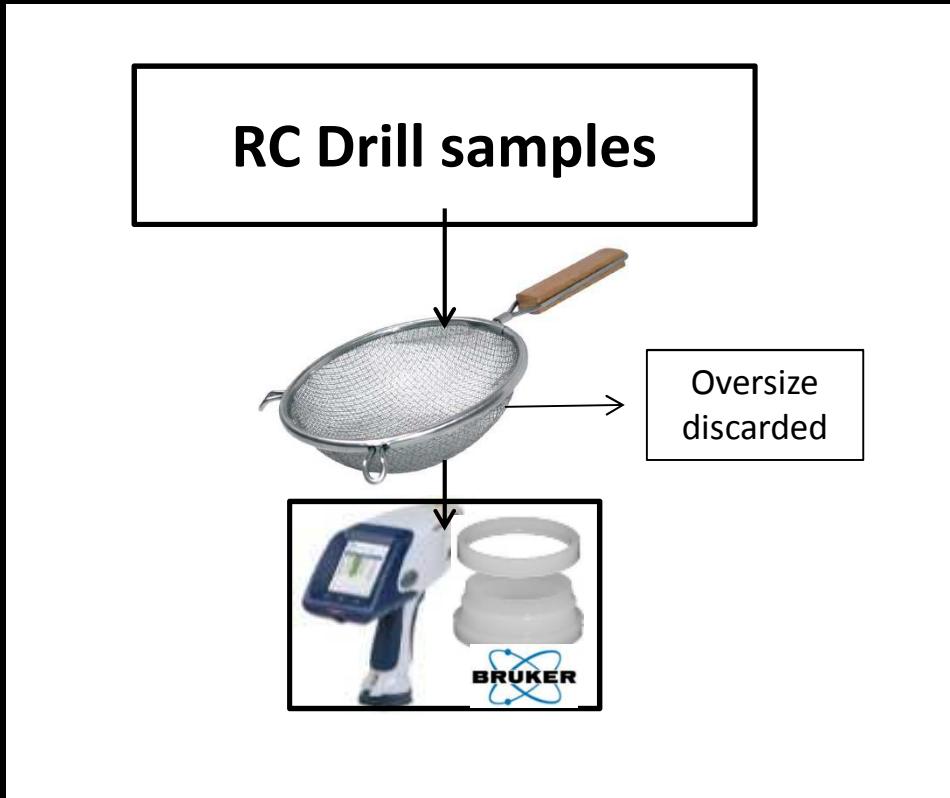
Perth Western Australia, **23 August 2016**: Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to provide the following exploration update.

The Company advises that drilling is booked to commence on Tuesday 30 August. All regulatory requirements for drilling have been completed, including a Programme of Work approval and a Heritage Protection Survey.

LCT Pegmatite (drilling)



LCT Pegmatite (drilling)

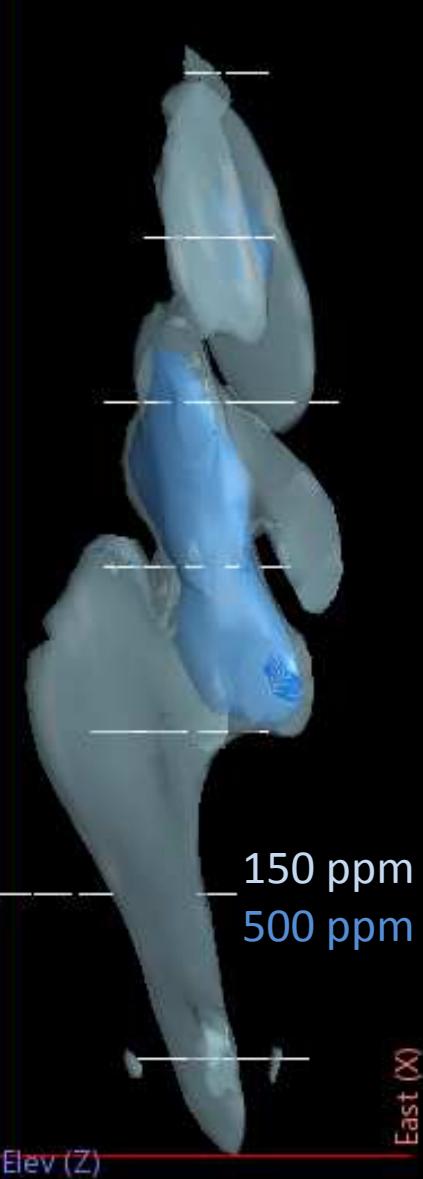


LCT Pegmatite (drilling)

Lithium Index (pXRF)



Caesium (pXRF)

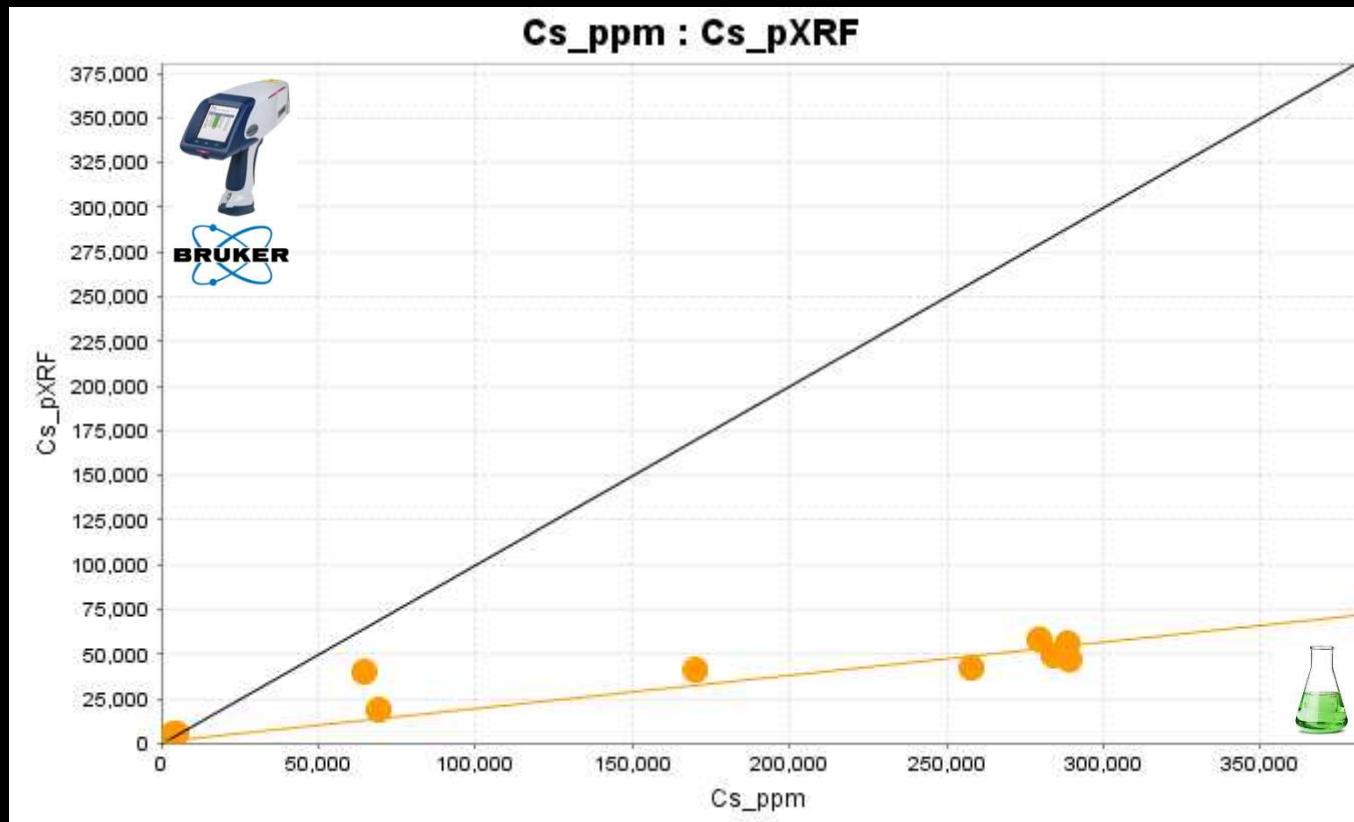


Caesium Discoveredbut who knew?

DateTime	Depth	HoleID	Application	Nb	Nb Err	Sn	Sn Err	Cs	Cs Err	Ta	Ta Err	Li_IDX
9/04/2016 19:13	44	PDRC015	Li Index	0.000	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
9/04/2016 19:13	45	PDRC015	Li Index	0.000	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00
9/04/2016 19:14	46	PDRC015	Li Index	0.001	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00
9/04/2016 19:15	47	PDRC015	Li Index	0.001	0.00	0.02	0.01	3.96	0.05	0.00	0.00	0.05
9/04/2016 19:15	48	PDRC015	Li Index	0.000	0.00	0.12	0.03	5.63	0.05	0.02	0.02	0.00
9/04/2016 19:16	49	PDRC015	Li Index	0.003	0.00	0.10	0.03	4.21	0.05	0.06	0.02	0.23
9/04/2016 19:17	50	PDRC015	Li Index	0.000	0.01	0.12	0.03	5.80	0.06	0.02	0.02	0.00
9/04/2016 19:17	51	PDRC015	Li Index	0.005	0.00	0.10	0.03	4.69	0.05	0.01	0.02	0.30
9/04/2016 19:18	52	PDRC015	Li Index	0.002	0.00	0.09	0.02	4.95	0.05	0.00	0.02	0.28
9/04/2016 19:19	53	PDRC015	Li Index	0.005	0.00	0.07	0.02	4.08	0.05	0.00	0.01	0.37
9/04/2016 19:19	54	PDRC015	Li Index	0.008	0.00	0.04	0.01	1.84	0.03	0.00	0.01	0.33
9/04/2016 19:20	55	PDRC015	Li Index	0.006	0.00	0.04	0.01	0.52	0.02	0.00	0.01	0.26
9/04/2016 19:21	56	PDRC015	Li Index	0.005	0.00	0.04	0.01	0.35	0.02	0.00	0.01	0.16
9/04/2016 19:22	57	PDRC015	Li Index	0.008	0.00	0.03	0.01	0.43	0.02	0.01	0.01	0.23



Issue with Calibration?

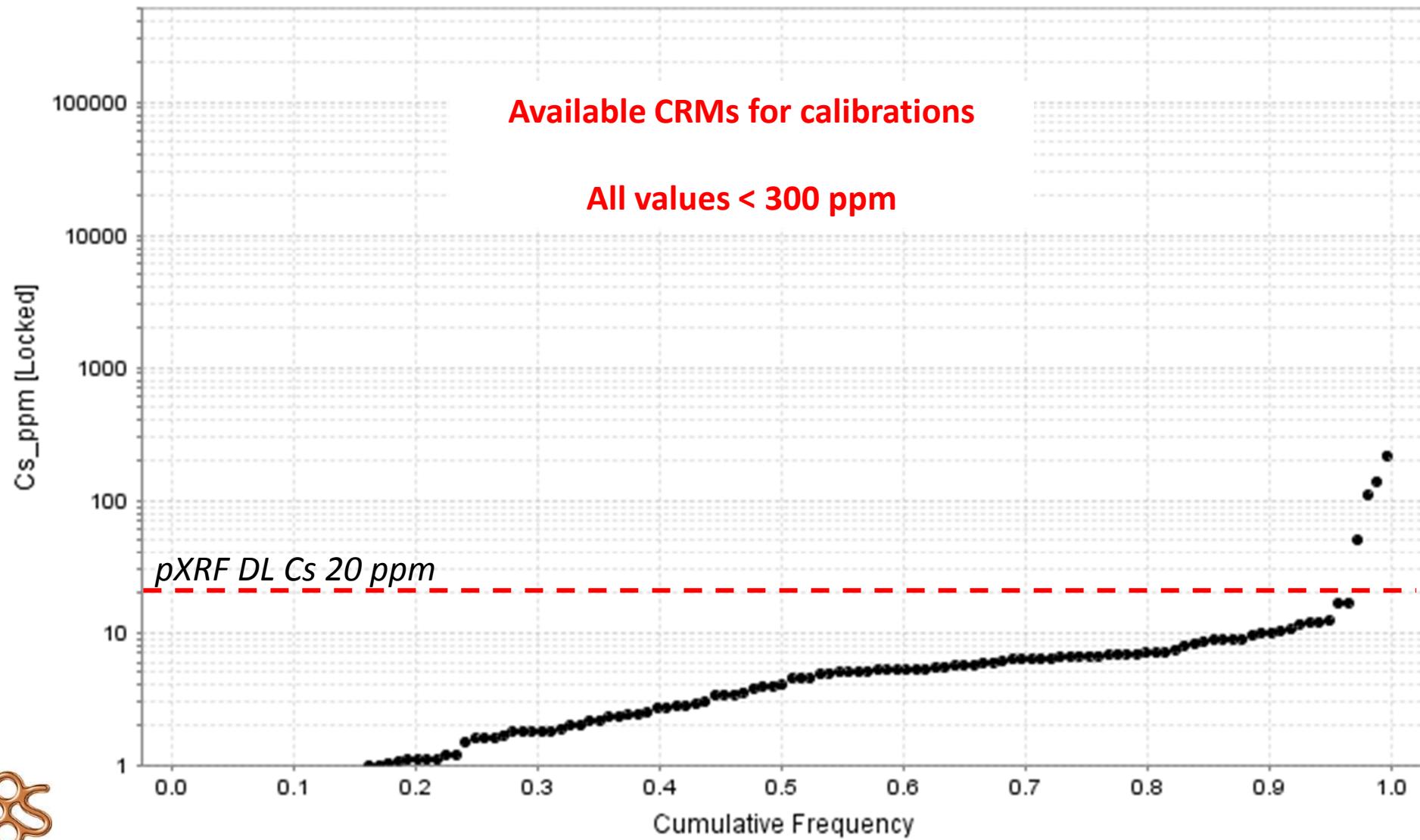


No commercially available high Cs grade certified reference material

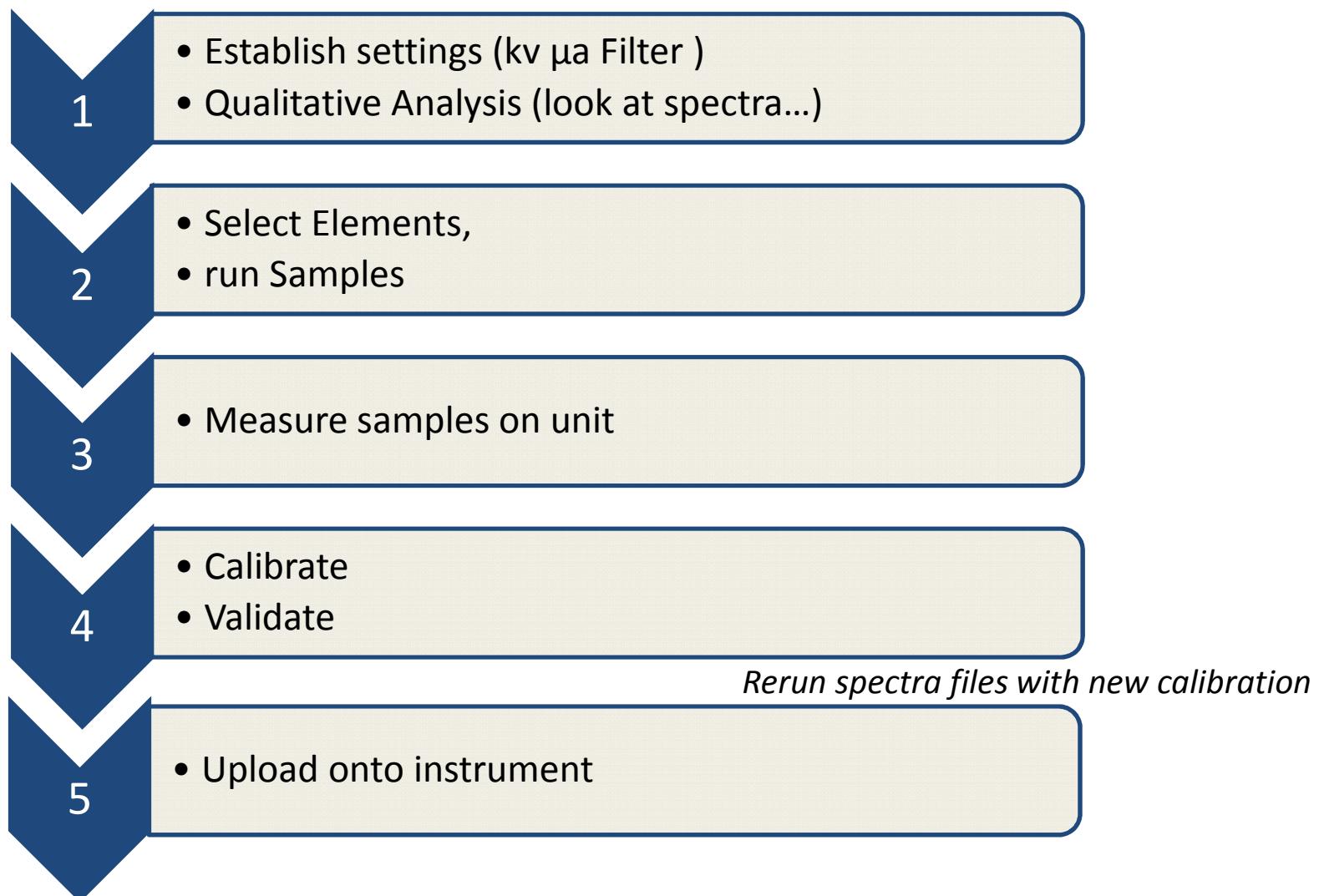


Cs - Z:55

Cs_ppm

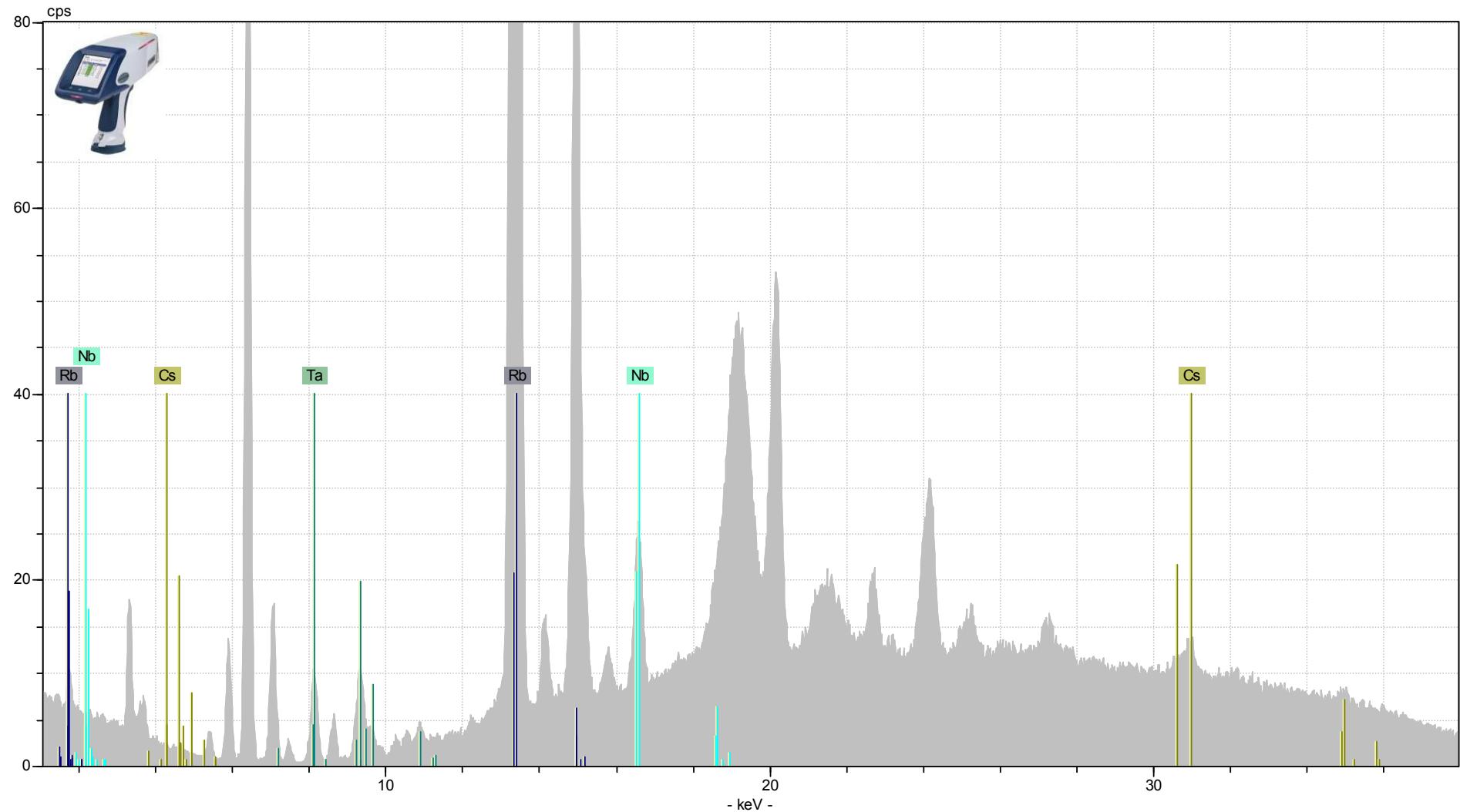


Custom calibration process



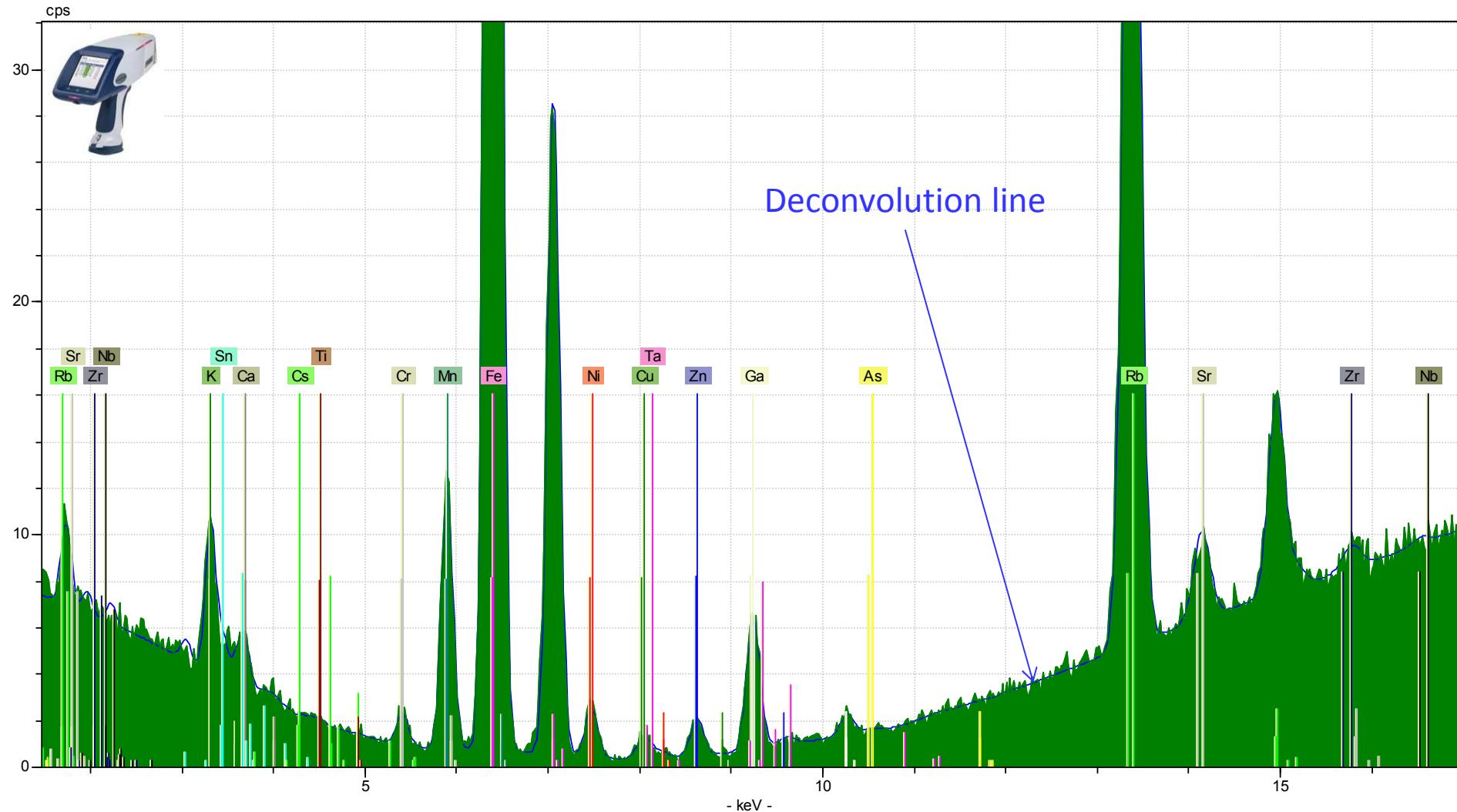


key elements

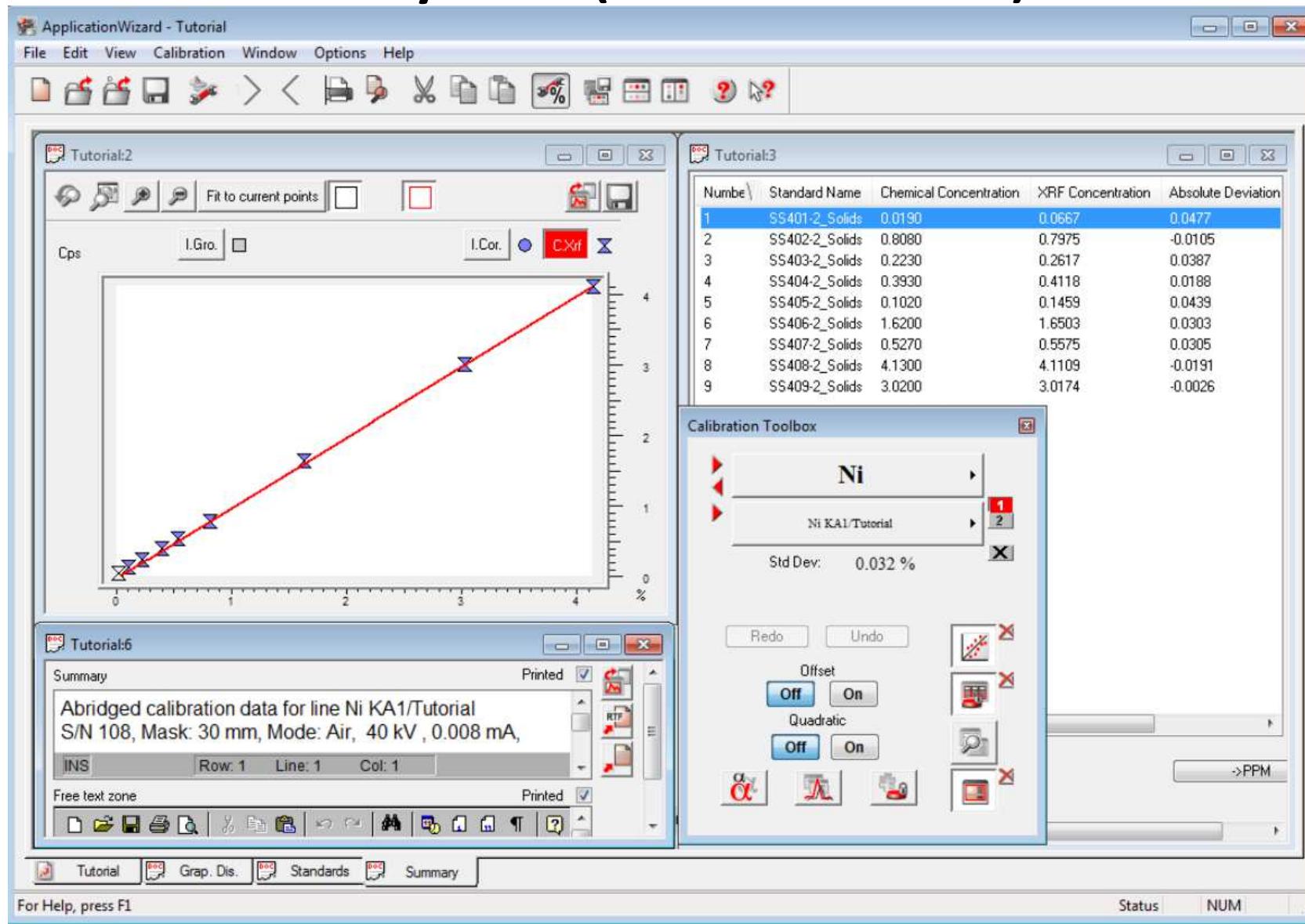




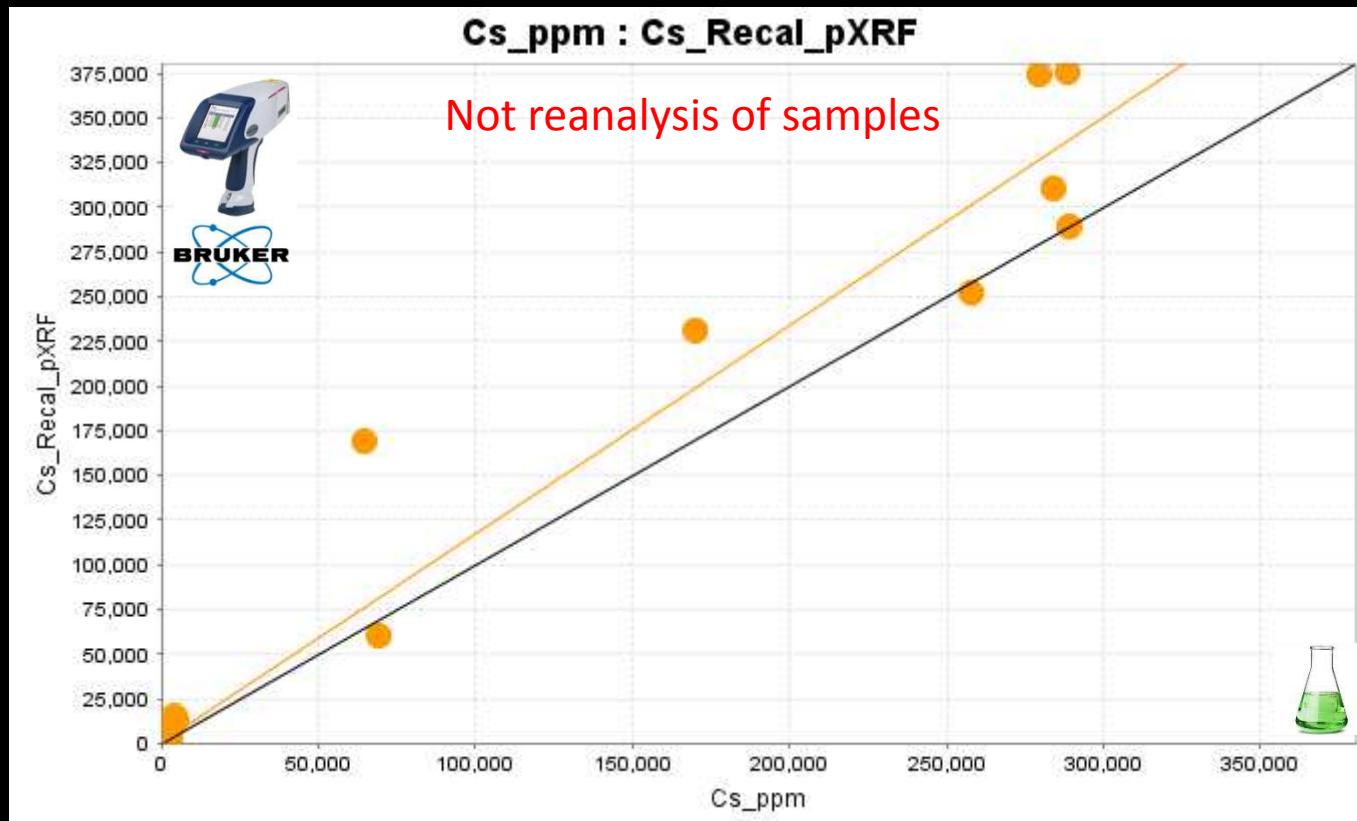
Account for ALL elements Deconvolution



EasyCal (calibration)



Updated custom calibration using Project Samples (4 acid digest)

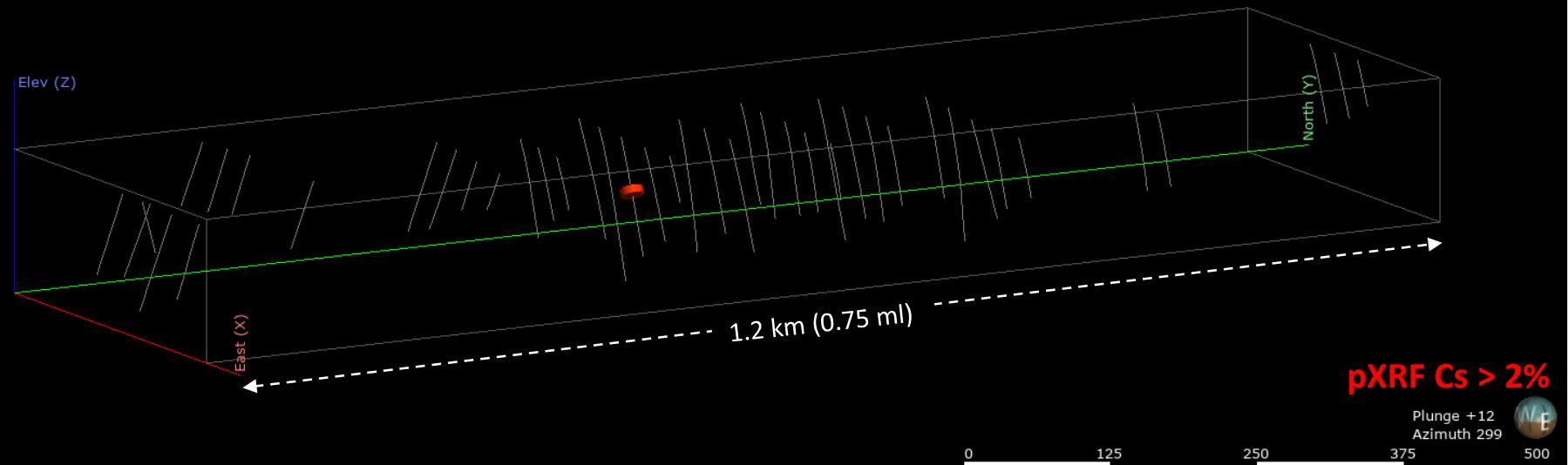


NOTE:

Only commercially available assay method = four acid with upper detection limit of 500 ppm (lab-1) and 2000 ppm (lab-2); over range through dilution.

No total fusion XRF Cs commercially available (at this stage)

Drilling: Phase 1 (Aug-Sept 2016) Lithium-Caesium Discovery (pXRF data)



04/10/2016



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LITHIUM-CAESIUM DISCOVERY AT PIONEER DOME
(Lithium) 7m at 1.52% Li₂O and (High Grade Caesium) 6m at 27.7% Cs₂O

Perth Western Australia, 4 October 2016: Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to provide the following update regarding its 100%-held Pioneer Dome Lithium Project.

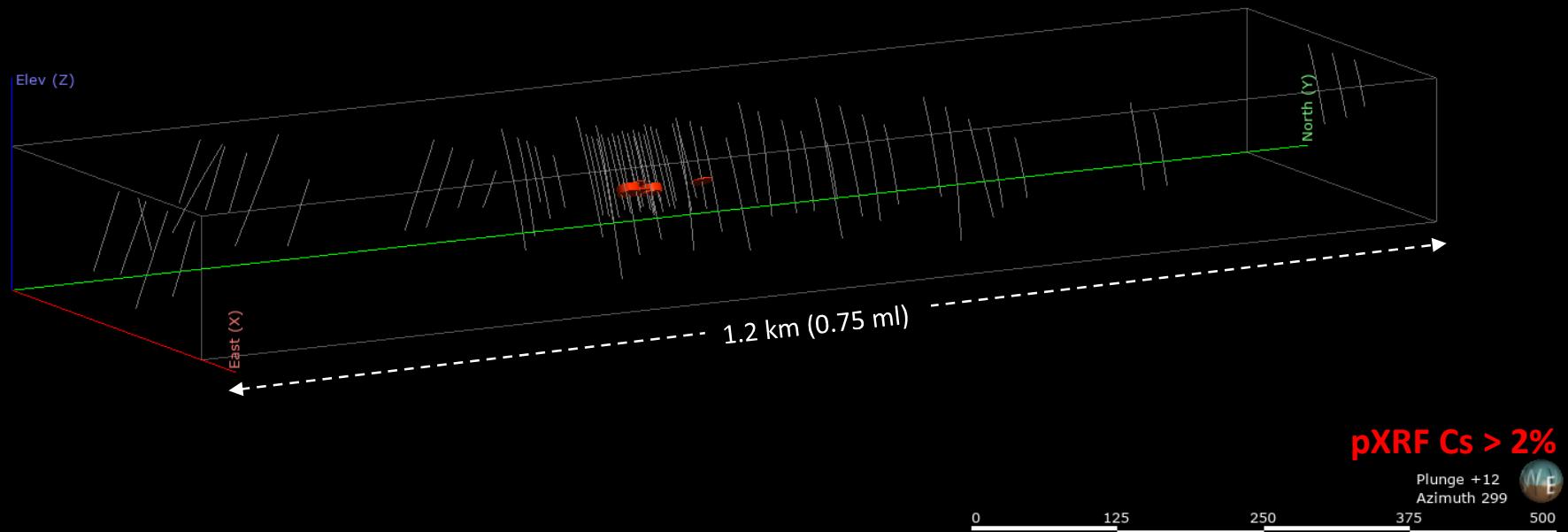


Delineation



Drilling: Phase 2 (Nov-Dec 2016)

Further High Grade Pollucite



13/12/2016



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DRILLING INTERSECTS FURTHER HIGH GRADE POLLUCITE AT PIONEER DOME

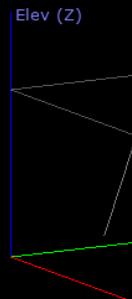
Pollucite is a High Value Caesium Mineral

Perth Western Australia, 13 December 2016: Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to provide a drilling update for its 100%-held Pioneer Dome LCT Pegmatite Project in the Eastern Goldfields of Western Australia, and notifies of a delay to the drilling programme at Mavis Lake, Canada.



Drilling: Phase 3 (January 2017)

Drilling continues to define Sinclair



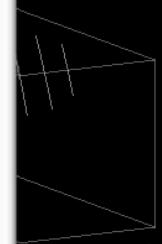
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MINERAL RESOURCE ESTIMATE FOR THE SINCLAIR CAESIUM PROJECT

Australia's First Caesium Resource: 10,500t grading 17.1% Cs₂O

- Metallurgy Underway - Preliminary Indications for Caesium Formate Production
- Mine Planning Underway – Mining Lease Applied For and Design Work Commences
- January Drill Results Include 3m at 11.5% Cs₂O from 49m in PDRC094

Perth, Western Australia: **22 March, 2017:** Pioneer Resources Limited (the "Company" or "Pioneer") (ASX: PIO) is pleased to announce a Mineral Resource Estimate for the Sinclair Caesium Zone, which is within the Company's 100%-owned Pioneer Dome Lithium-Caesium-Tantalum ("LCT") Project.



pXRF Cs > 2%
Plunge +12
Azimuth 299
375 500

24/01/2017



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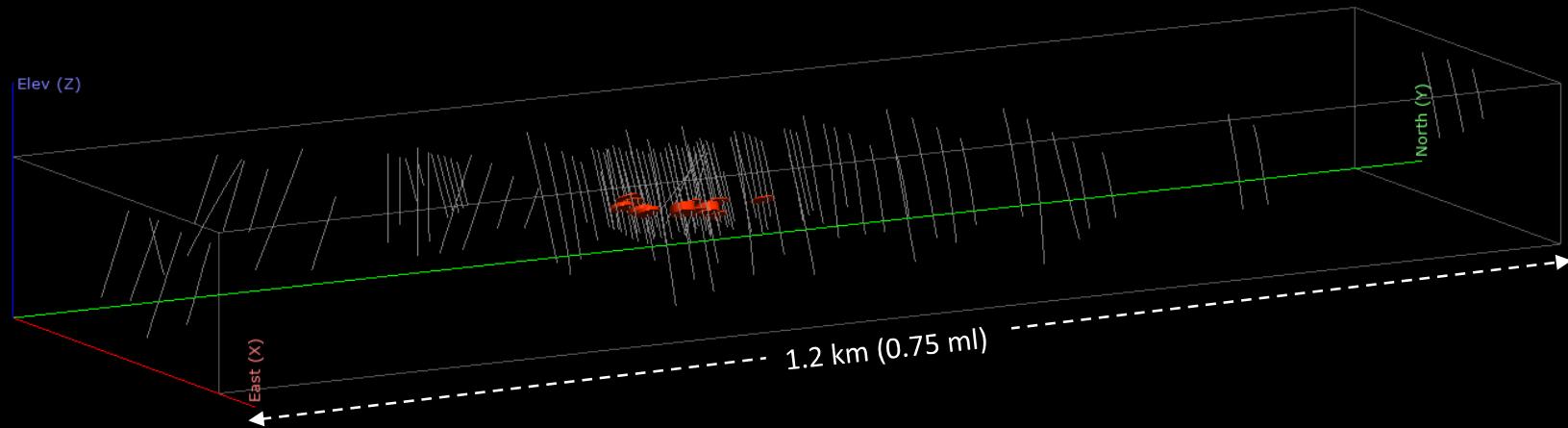
DRILLING CONTINUES TO DEFINE SHALLOW HIGH-GRADE CAESIUM AT THE SINCLAIR DISCOVERY WITHIN THE PIONEER DOME PEGMATITE.

Perth Western Australia, **24 January 2017:** Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to provide a drilling update for its 100%-held Pioneer Dome Lithium-Caesium-Tantalum ("LCT") Pegmatite Project in the Eastern Goldfields of Western Australia.



Drilling: Phase 4 (May 2017)

High grade Lithium



20/06/2017

pXRF Cs > 2%

Plunge +12
Azimuth 299



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0 125 250 375 500

DRILLING INTERSECTS HIGH GRADE LITHIUM AT PIONEER DOME INCLUDING:

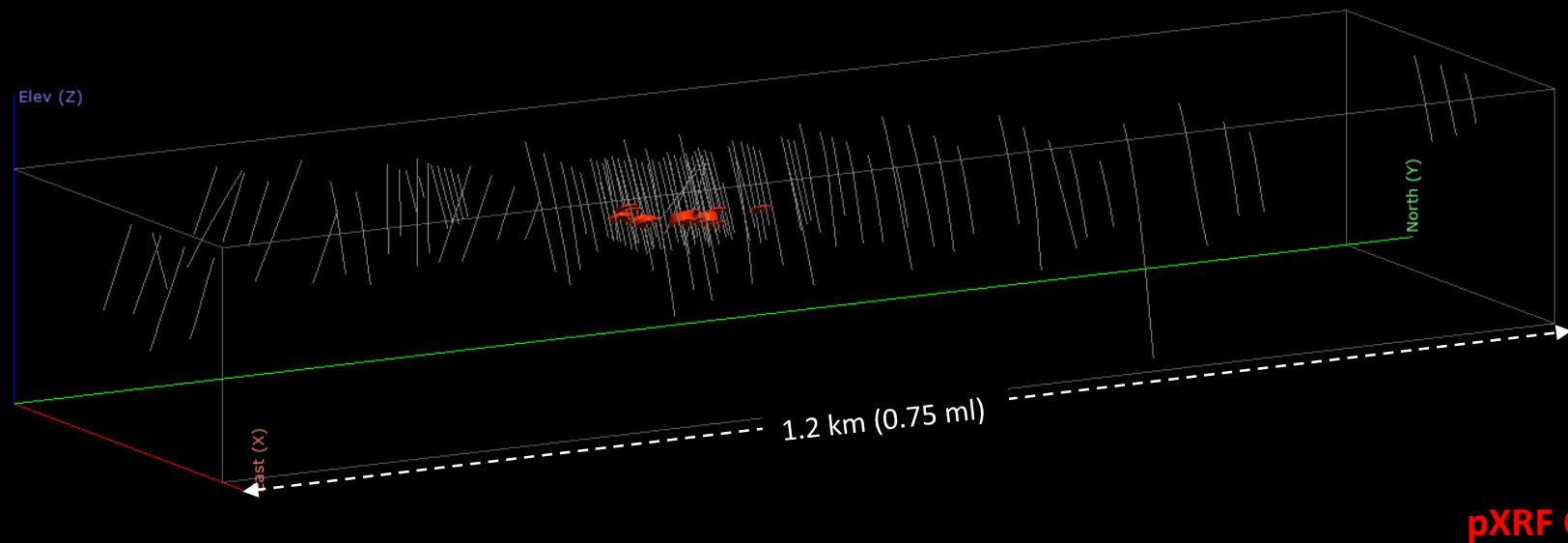
- PDRC114: 19m at 1.77% Li₂O from 39m
- PDRC115: 17m at 1.48% Li₂O from 35m
- PDRC116: 20m at 2.48% Li₂O from 36m
- PDRC112: 31m at 2.54% Li₂O from 47m

Perth Western Australia, 20 June 2017: Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to announce assay results received from the most recent drilling programme at its 100%-held Pioneer Dome Lithium-Caesium-Tantalum ("LCT") Pegmatite Project, near Norseman in WA.

BRUKER



Drilling: Phase 5 (November 2017) Project Update



17/01/2018



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0 125 250 375 500
Plunge +12
Azimuth 299
WE

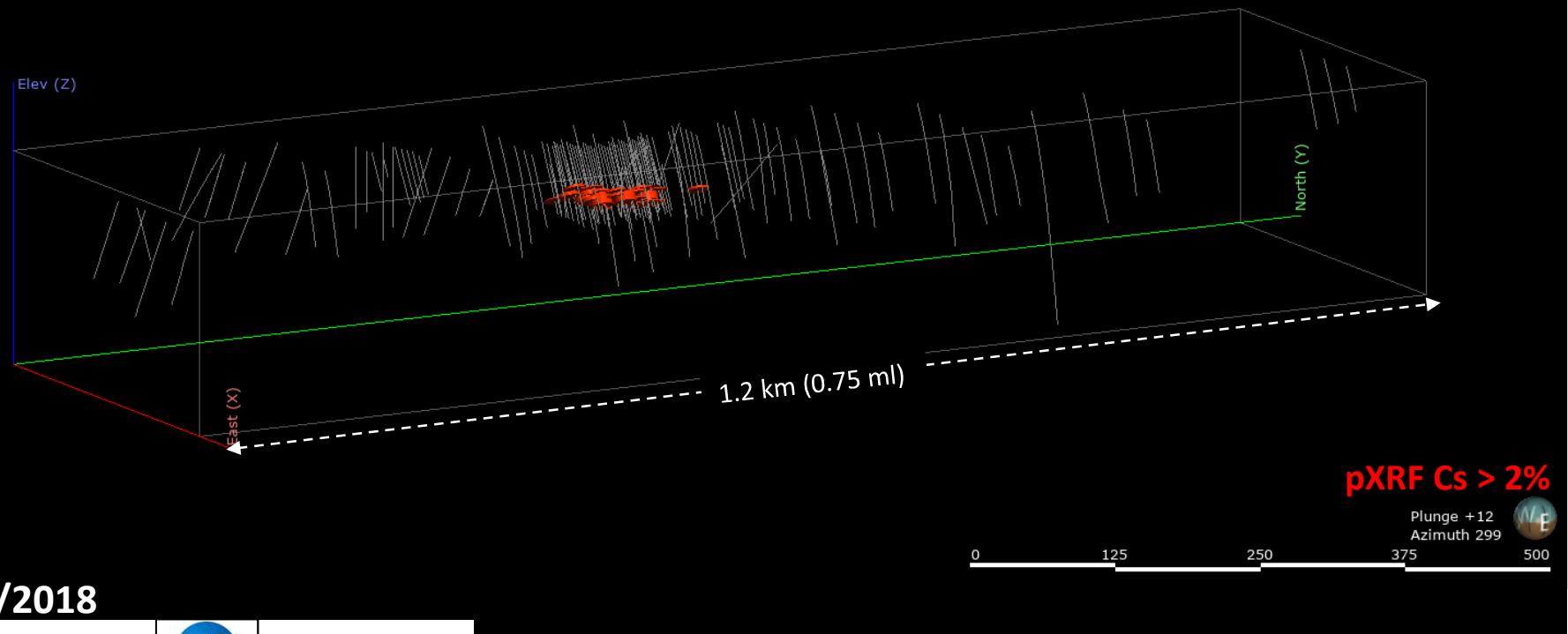
SINCLAIR ZONE CAESIUM DEPOSIT – PROJECT UPDATE

Perth, Western Australia, 17 January 2018: Pioneer Resources Limited ("Pioneer" or the "Company" (ASX: PIO)) is pleased to provide the following update on the Sinclair Zone Project.



Drilling: Phase 6 (Jan-Feb 2018)

Potassium Feldspar deposit discovered



21/02/2018



ABN: 44 103 423 981



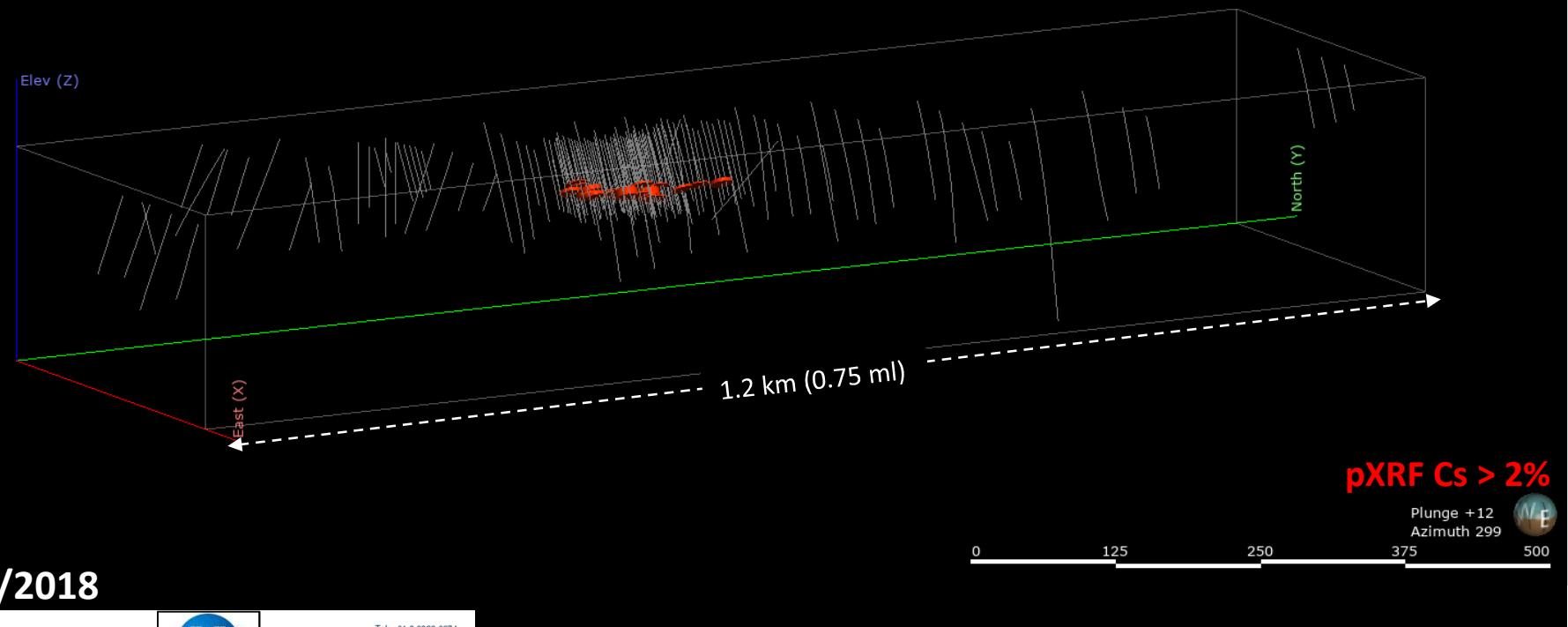
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POTASSIUM FELDSPAR DEPOSIT DISCOVERED AT THE
SINCLAIR ZONE CAESIUM DEPOSIT

Perth, Western Australia: 21 February 2018: Pioneer Resources Limited (the "Company" or "Pioneer") (ASX: PIO), is pleased to provide the results from 2 diamond core holes drilled within the Company's 100%-owned Sinclair Zone Caesium Deposit, located within the Pioneer Dome Project approximately 140km south of Kalgoorlie, Western Australia.



Drilling: Phase 7 (Mar-Apr 2018) Infill drilling of Sinclair



19/04/2018



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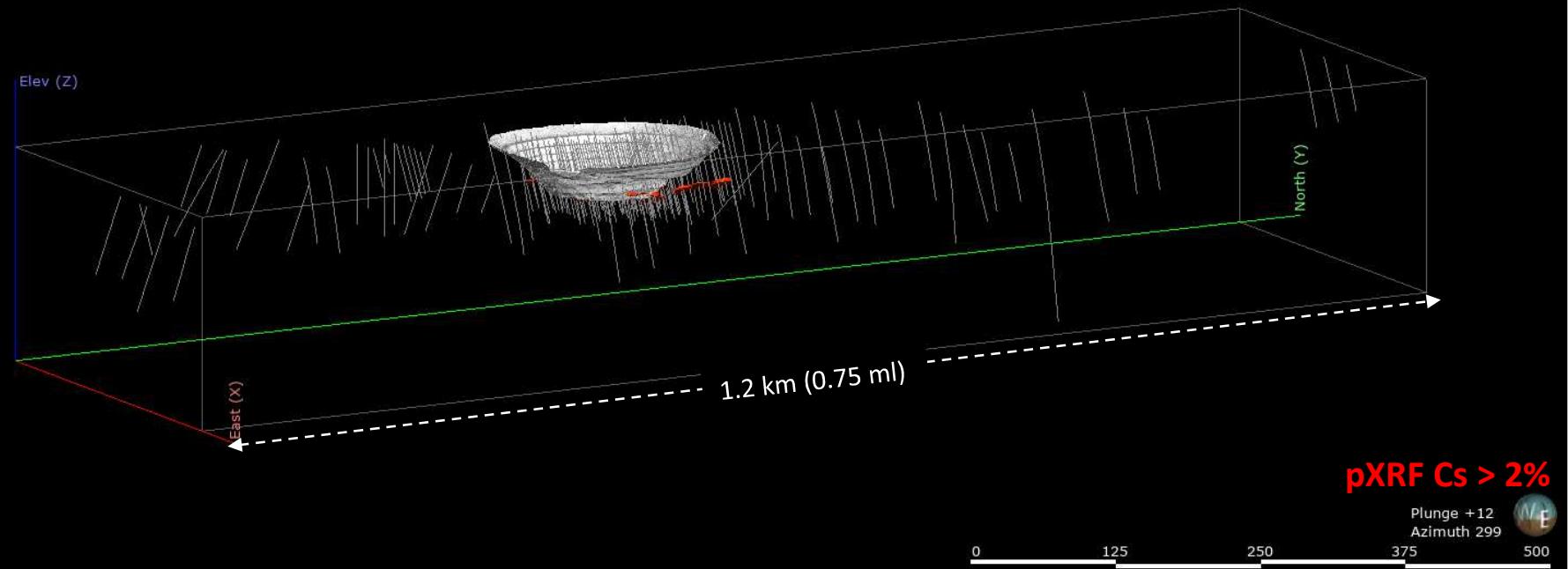
INFILL DRILLING CONFIRMS CONTINUITY OF HIGH-GRADES AT THE
SINCLAIR ZONE CAESIUM DEPOSIT
PREPARATIONS FOR MINING ADVANCE

Perth Western Australia, 19 April 2018: Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to provide a drilling update for its 100%-held Pioneer Dome Project in the Eastern Goldfields of Western Australia, which includes the Sinclair Zone Caesium Deposit.



Drilling: Phase 8 (June-July 2018)

Mining Proposal approved



25/07/2018



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SINCLAIR CAESIUM MINE UPDATE

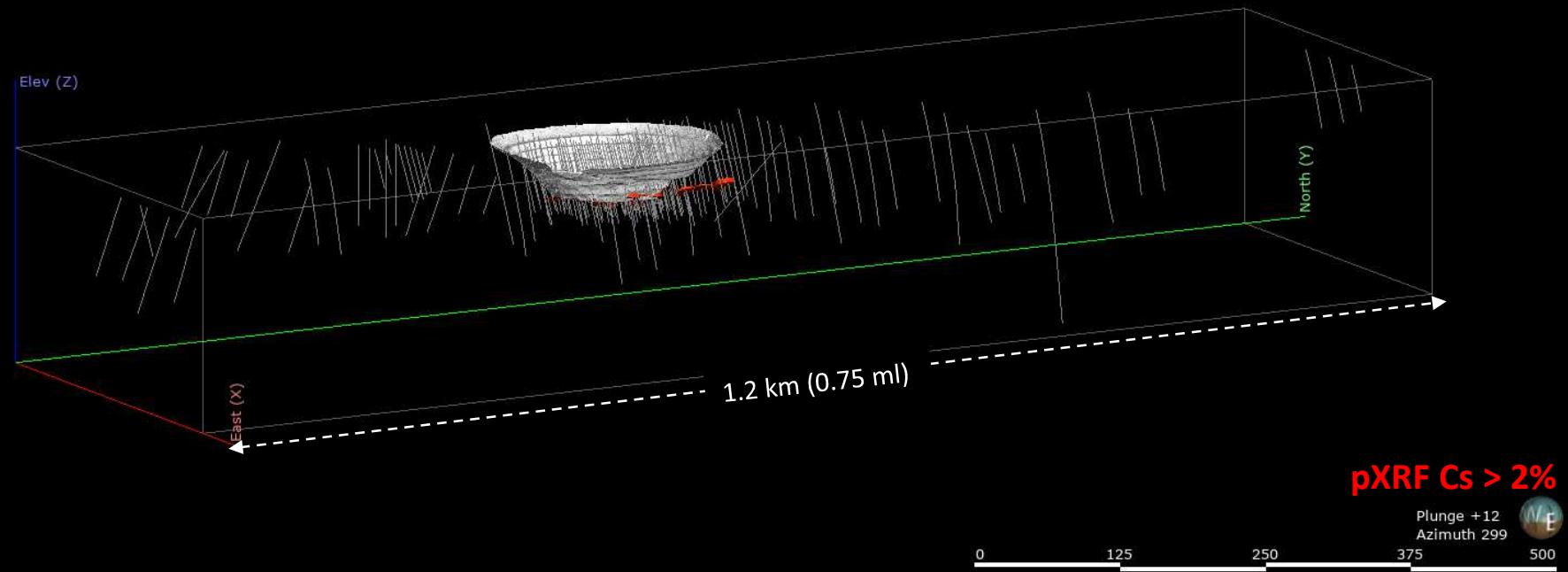
MINING PROPOSAL APPROVED

Perth Western Australia, 25 July 2018: Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to provide the following update for its 100%-held Pioneer Dome Project in the Eastern Goldfields of Western Australia, which includes the Sinclair Zone Caesium Deposit.



Drilling: Phase 8 (June-July 2018)

Mining Proposal approved



25/07/2018



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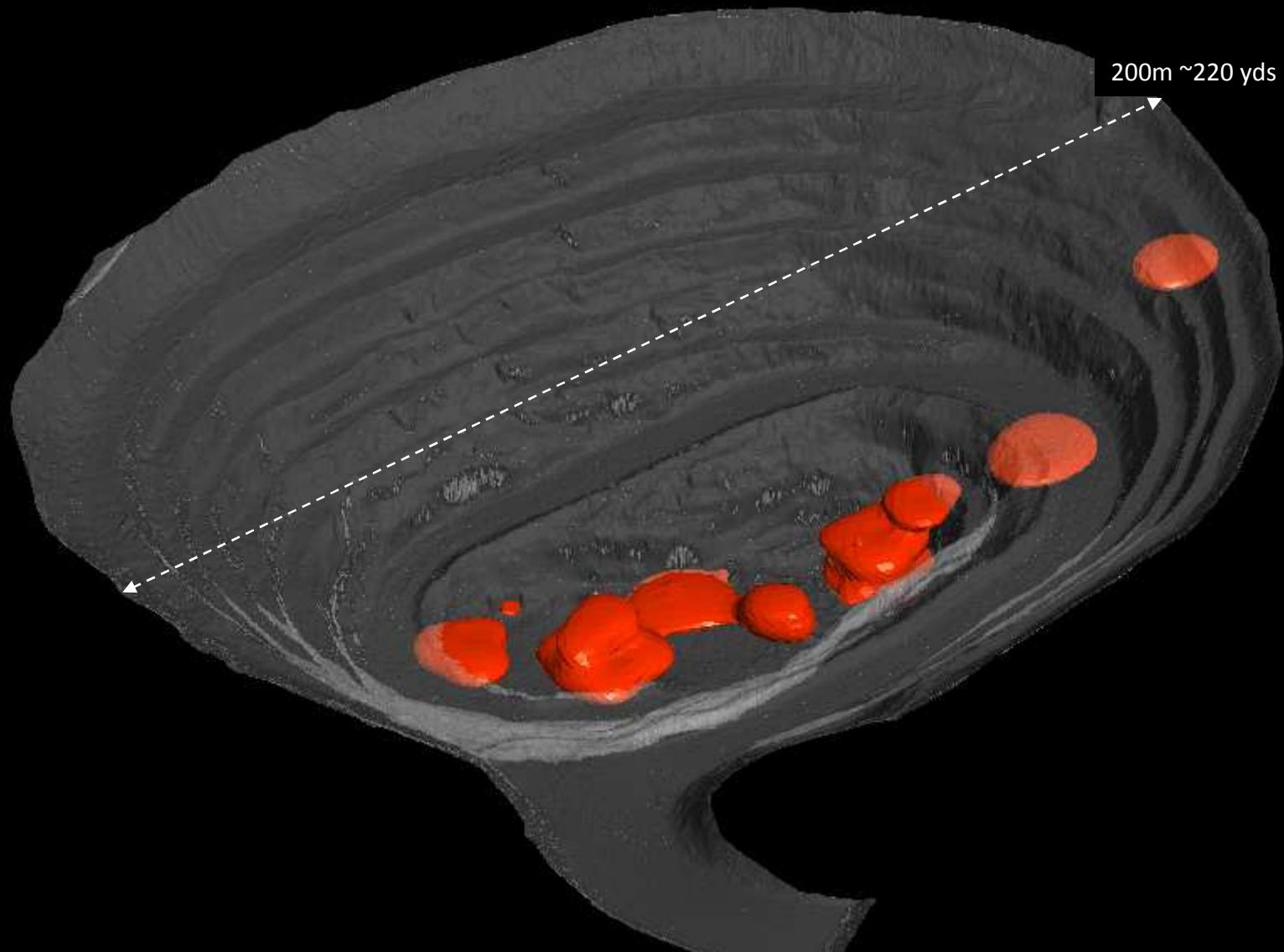
SINCLAIR CAESIUM MINE UPDATE

MINING PROPOSAL APPROVED

Perth Western Australia, 25 July 2018: Pioneer Resources Limited ("Company" or "Pioneer", ASX: PIO) is pleased to provide the following update for its 100%-held Pioneer Dome Project in the Eastern Goldfields of Western Australia, which includes the Sinclair Zone Caesium Deposit.



Sinclair Pollucite Ore Shells



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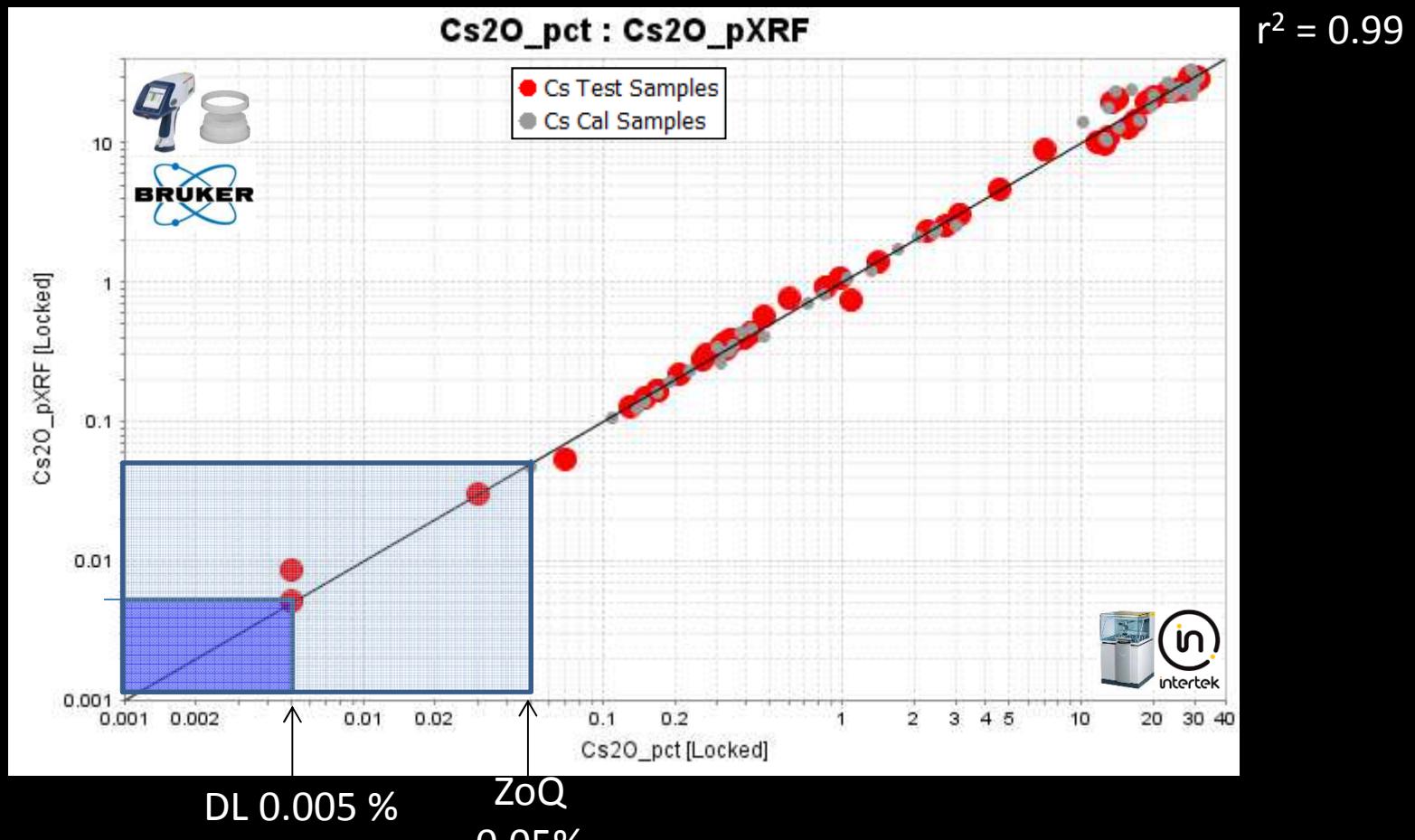
Fine tuning the matrix matched custom calibration

Fusion XRF vs pXRF (technique comparison)

Fusion XRF vs Fusion XRF (laboratory comparison)

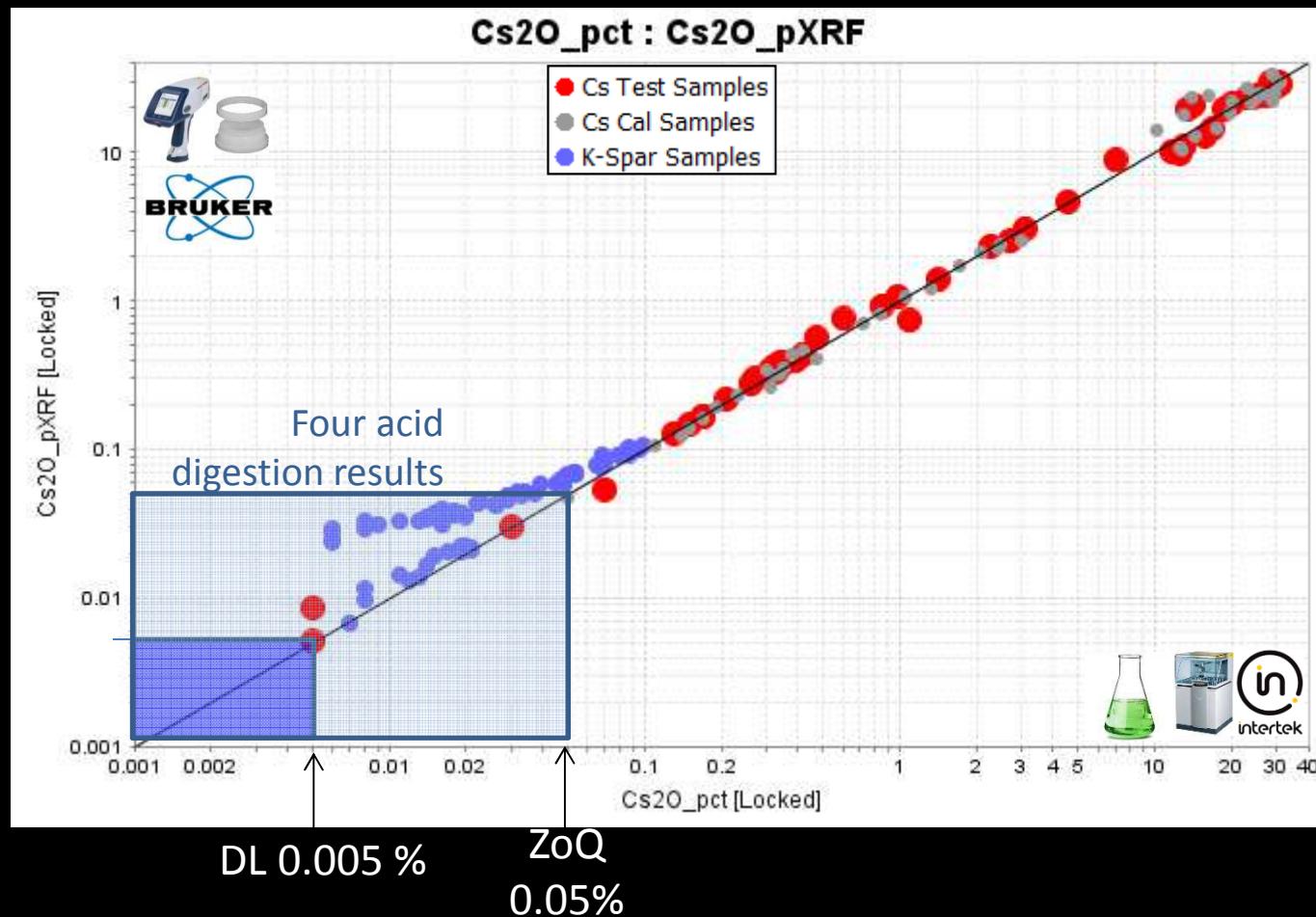
Fusion X vs four acid (method comparison)

Caesium: Fusion XRF vs pXRF



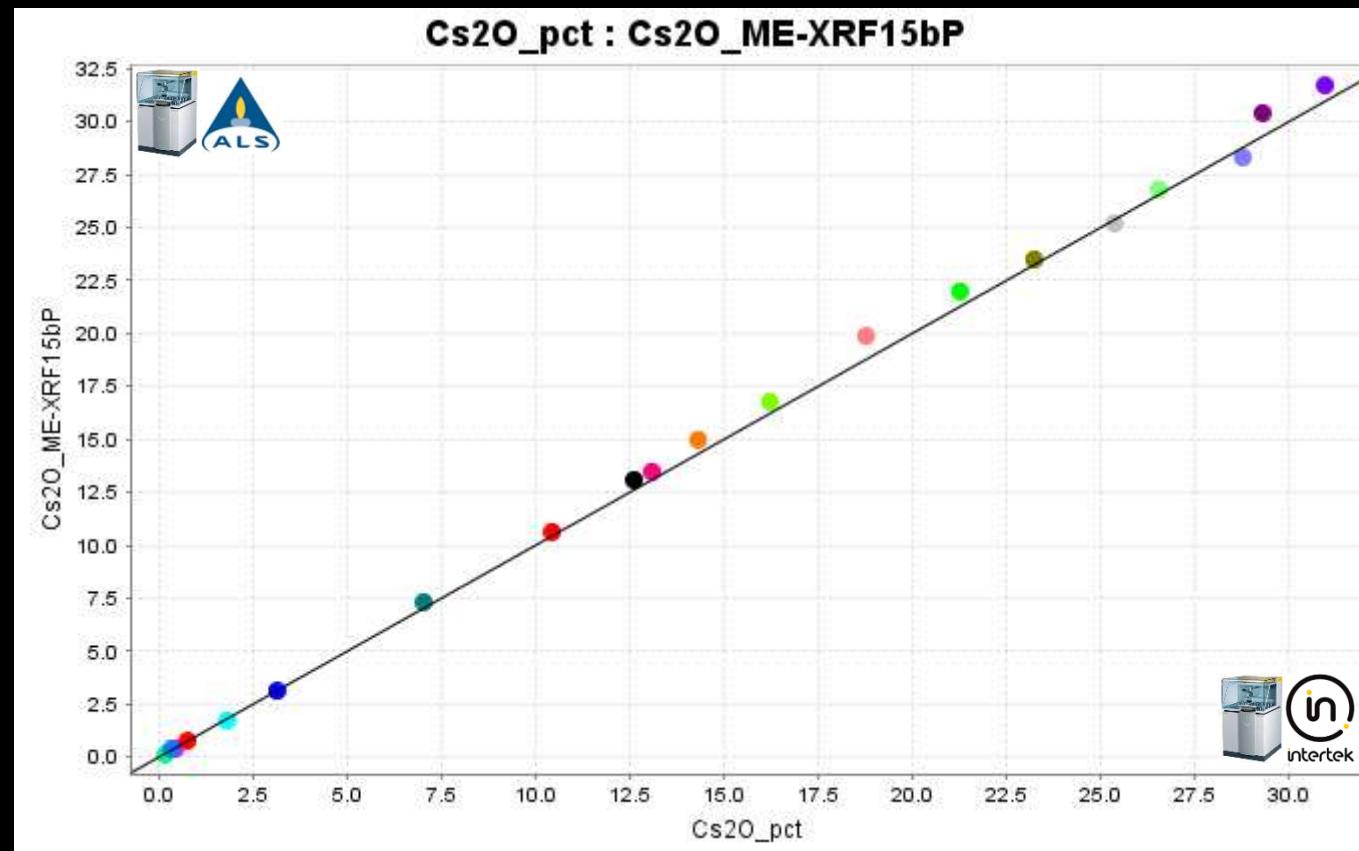
$$\text{Cs}_2\text{O_PXRF} = (0.979 * \text{Cs}_2\text{O_PCT})$$

Caesium: Fusion XRF vs pXRF



Umpire validation: Cs₂O analysis

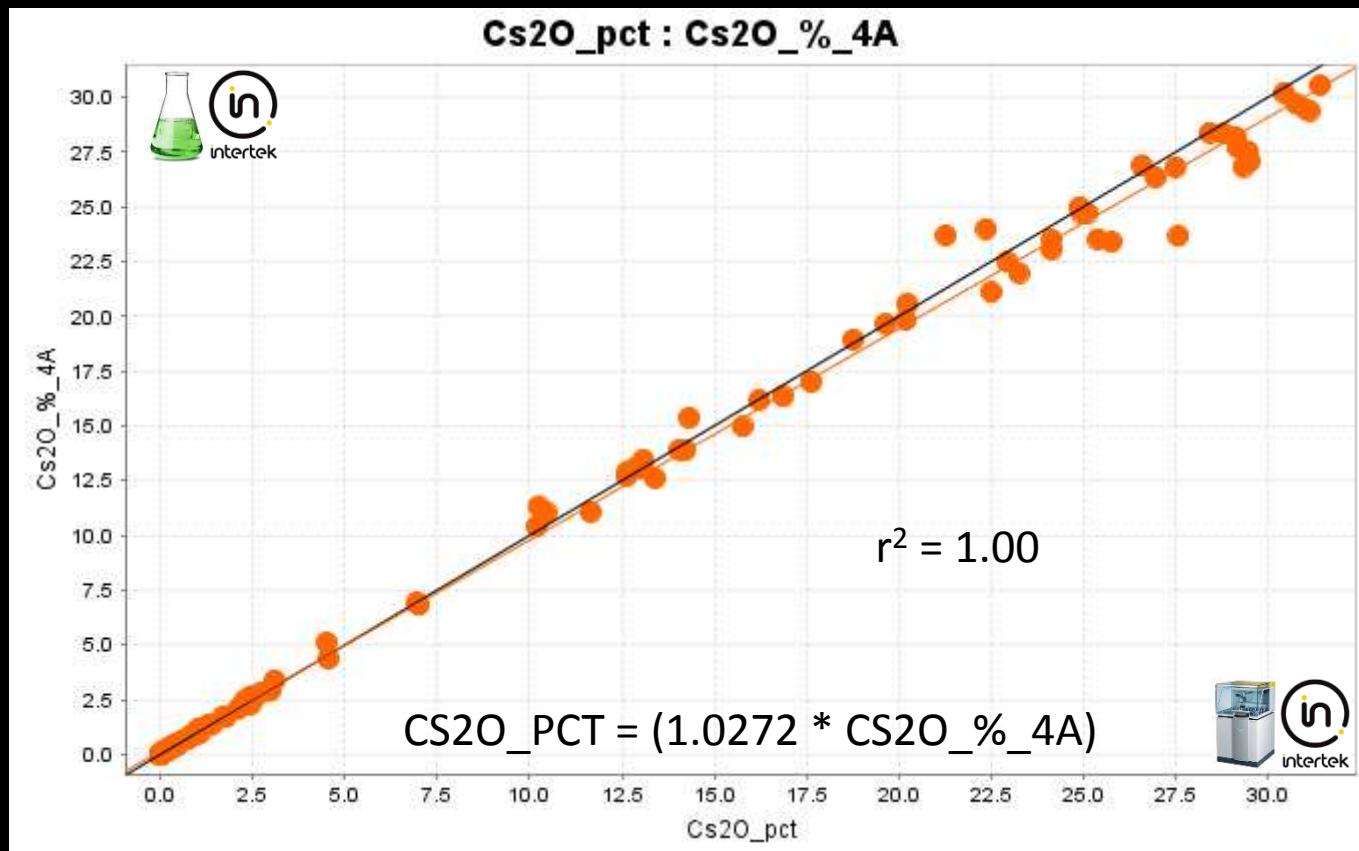
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ARC106412
ARC106414
ARC106513
ARC106514
ARC106547
ARC106548
ARC106549
ARC106551
ARC106616
ARC106617
ARC106618
ARC106982
ARC106985
ARC107037
ARC107041
ARC107043
ARC107044
ARC107291
ARC107293
ARC107345



$$\text{CS}_2\text{O_ME-XRF15BP} = (1.019 * \text{CS}_2\text{O_PCT})$$

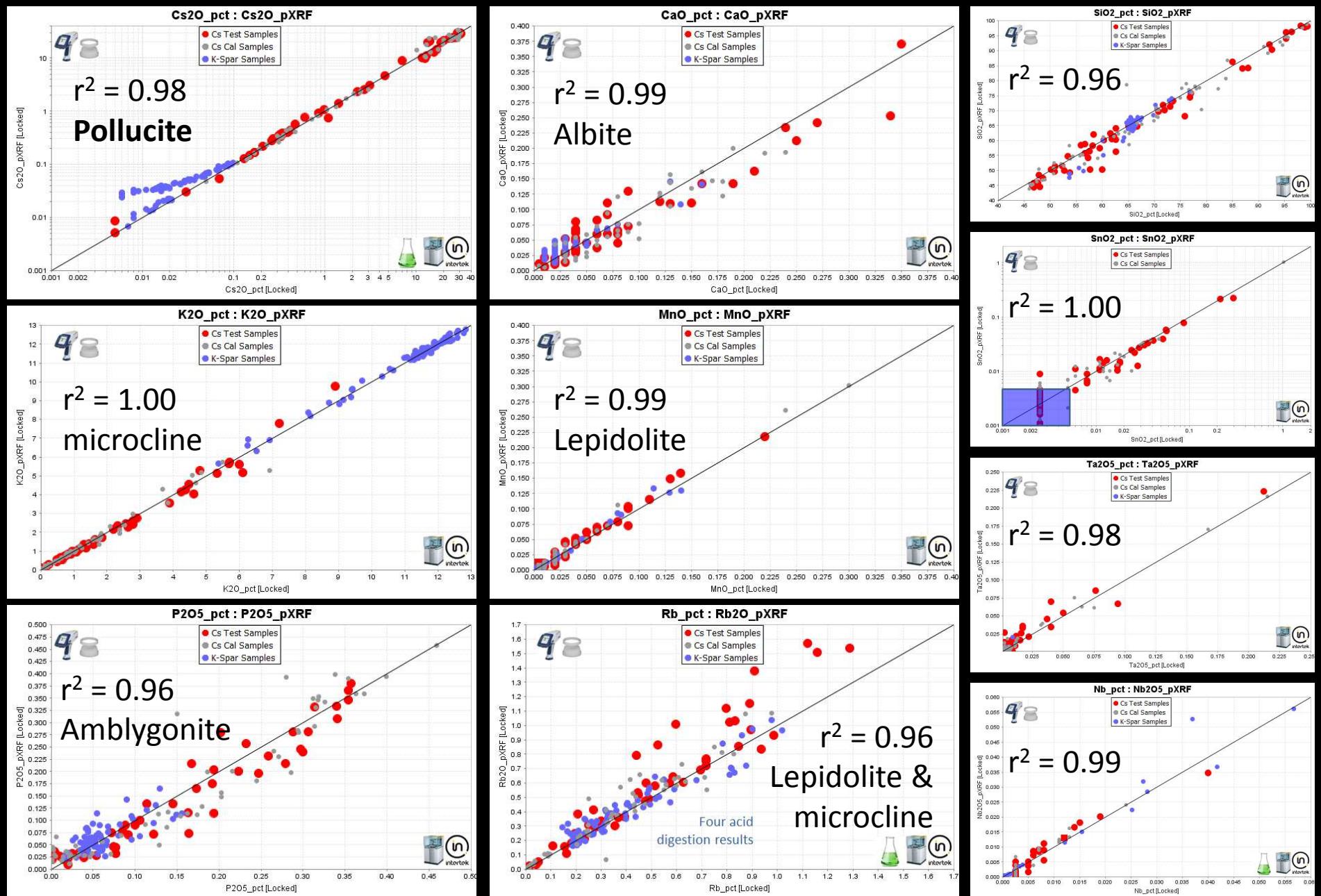
Within expected analytical error

Cs₂O Fusion vs 4A – method check

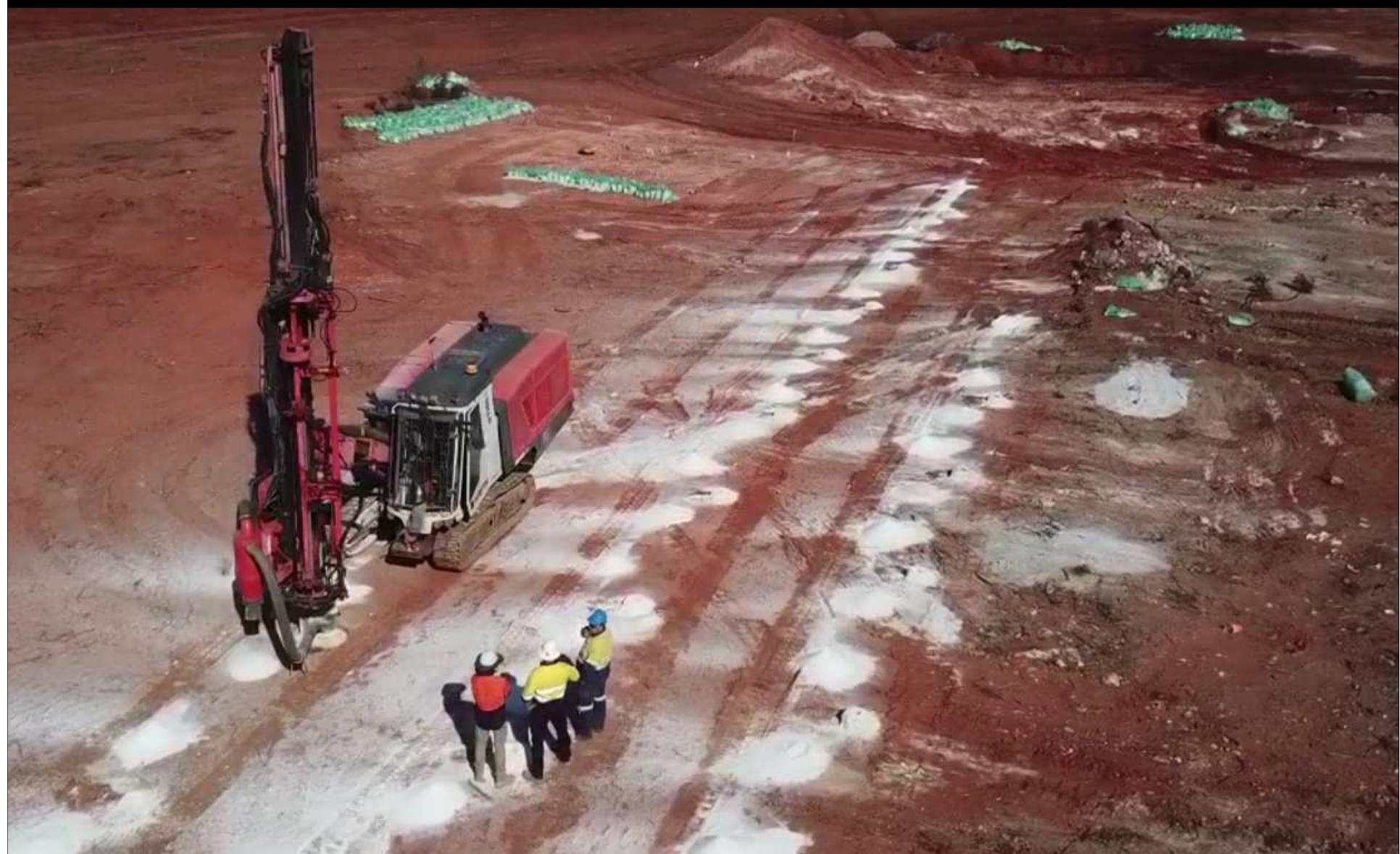


Precision between the two methods is excellent
There is an overall positive bias to fusion XRF by ~3% (relative)

Sinclair: pXRF vs fusion XRF



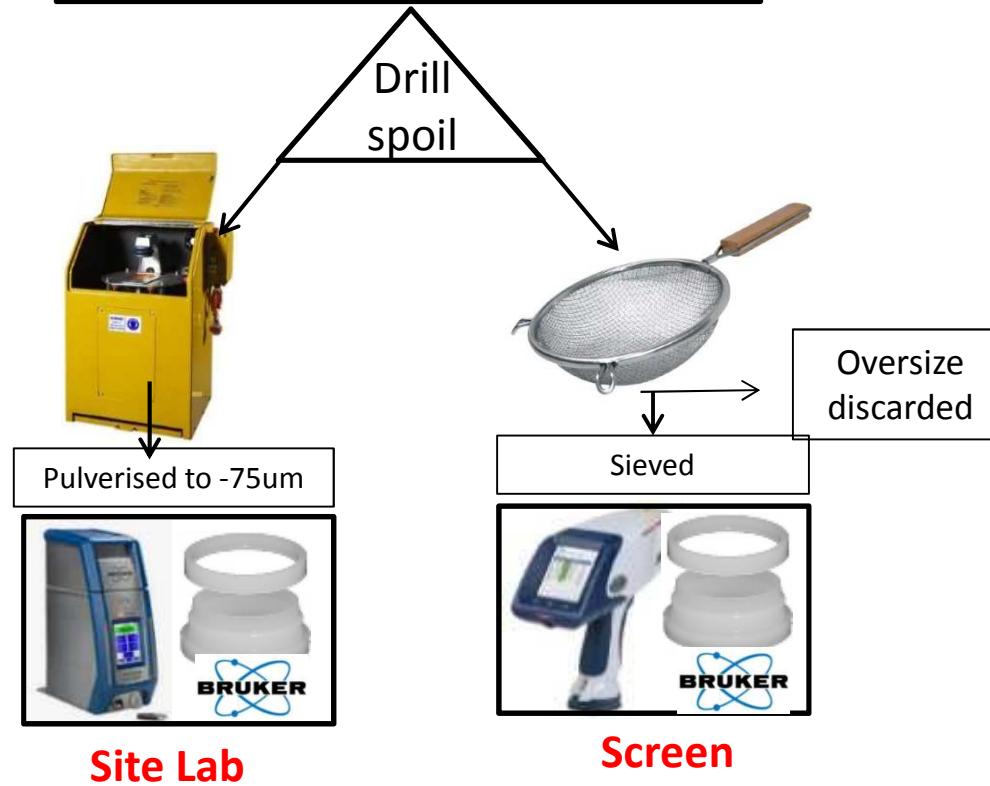
Development of Sinclair



Grade Control (blast hole) Drilling



Grade Control samples

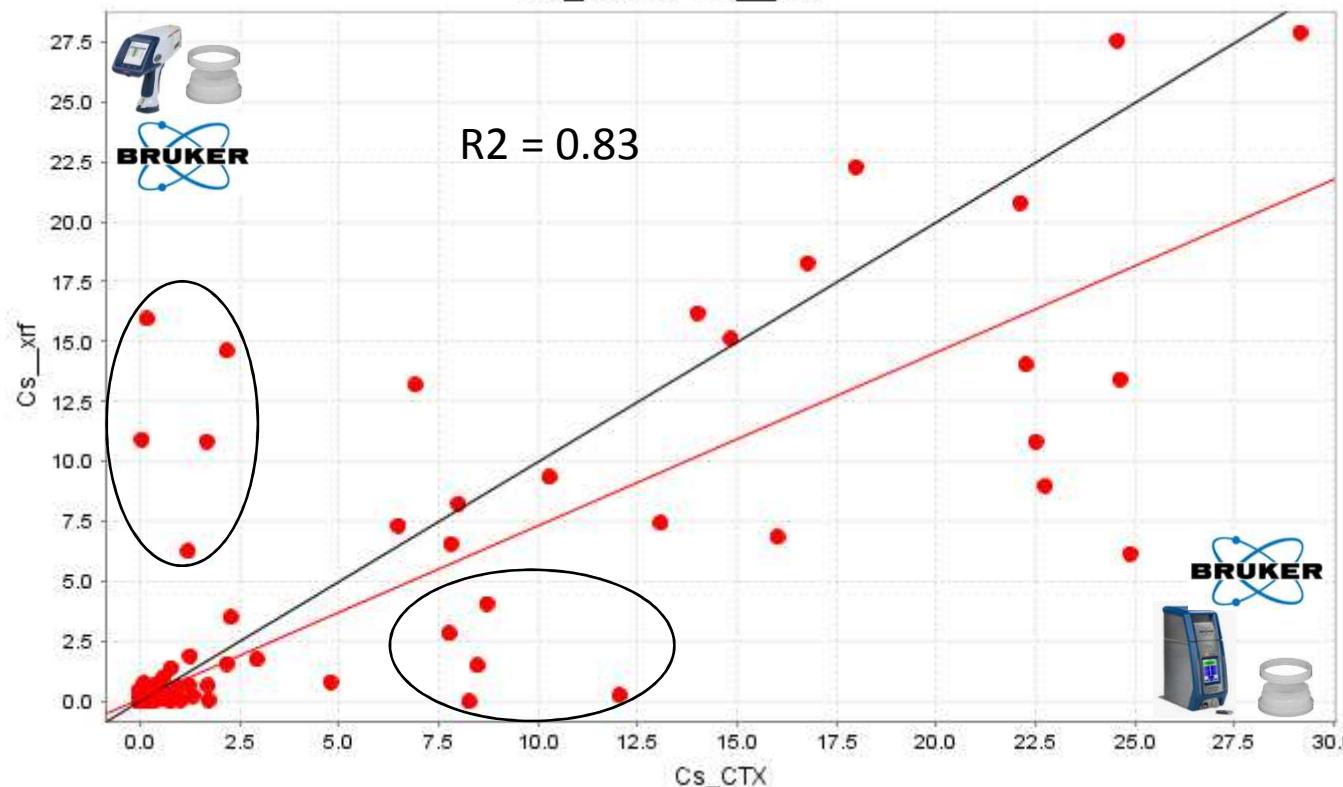


Comparison between prepped samples using CTX and sieved (unprepared) samples using Titan S1 pXRF

CS

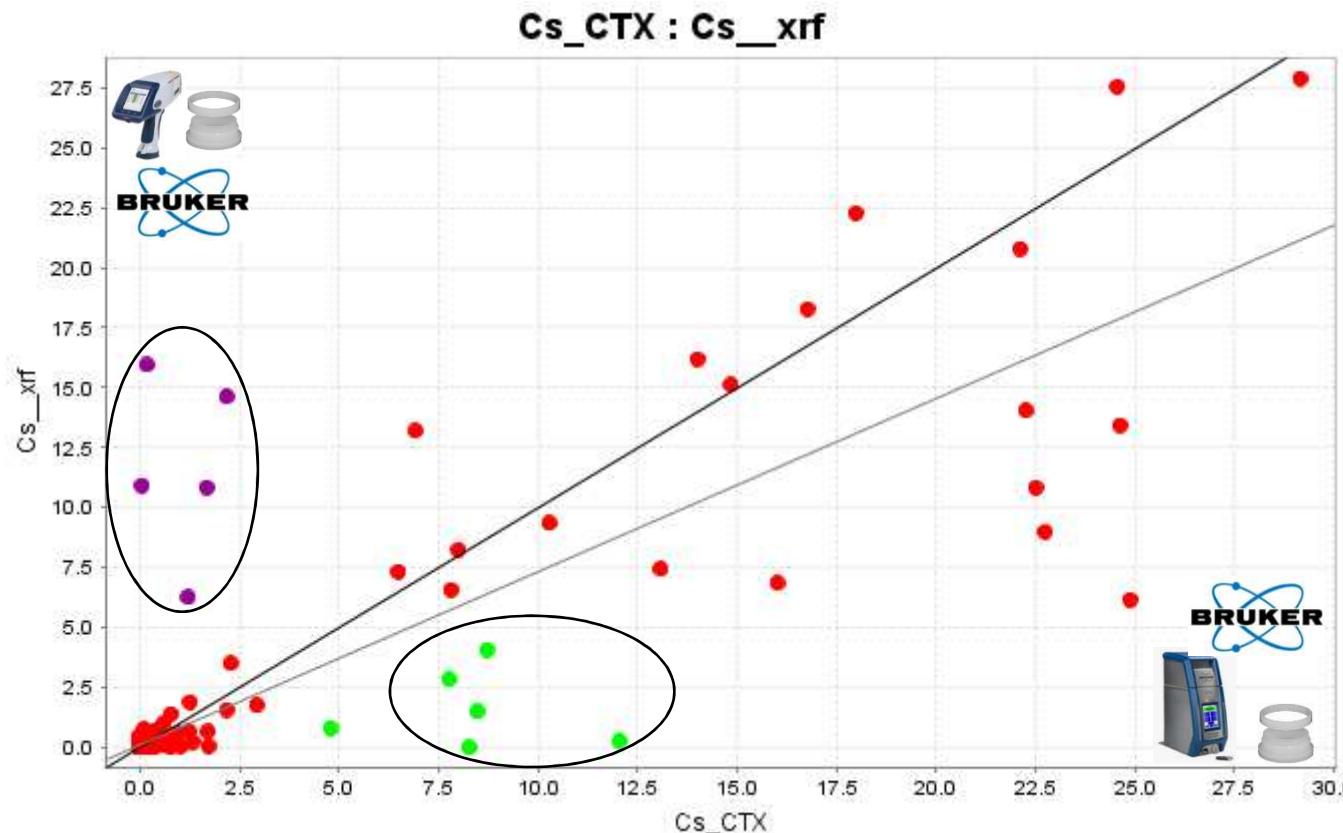
$$CS_CTX = (0.9692 * CS_XRF)$$

CS_{CTX} : CS_{XRF}



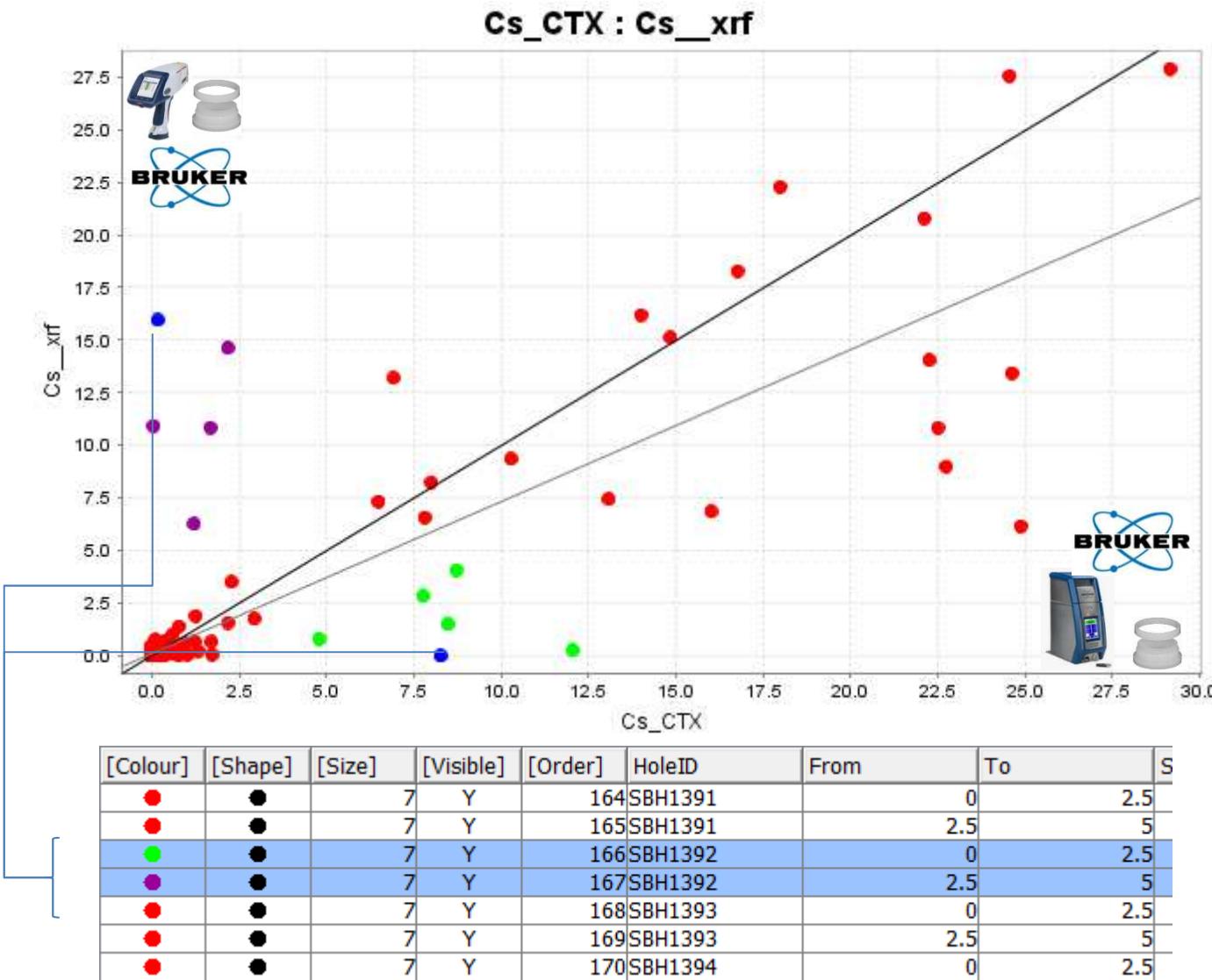
	CS_CTX	CS_XRF
Count Numeric	427	384
Minimum	0.0010	0.0001
Maximum	29.14	27.89
Mean	1.13	0.97
Standard Deviation	4.09	3.57

Cs: Probable Sample Switched

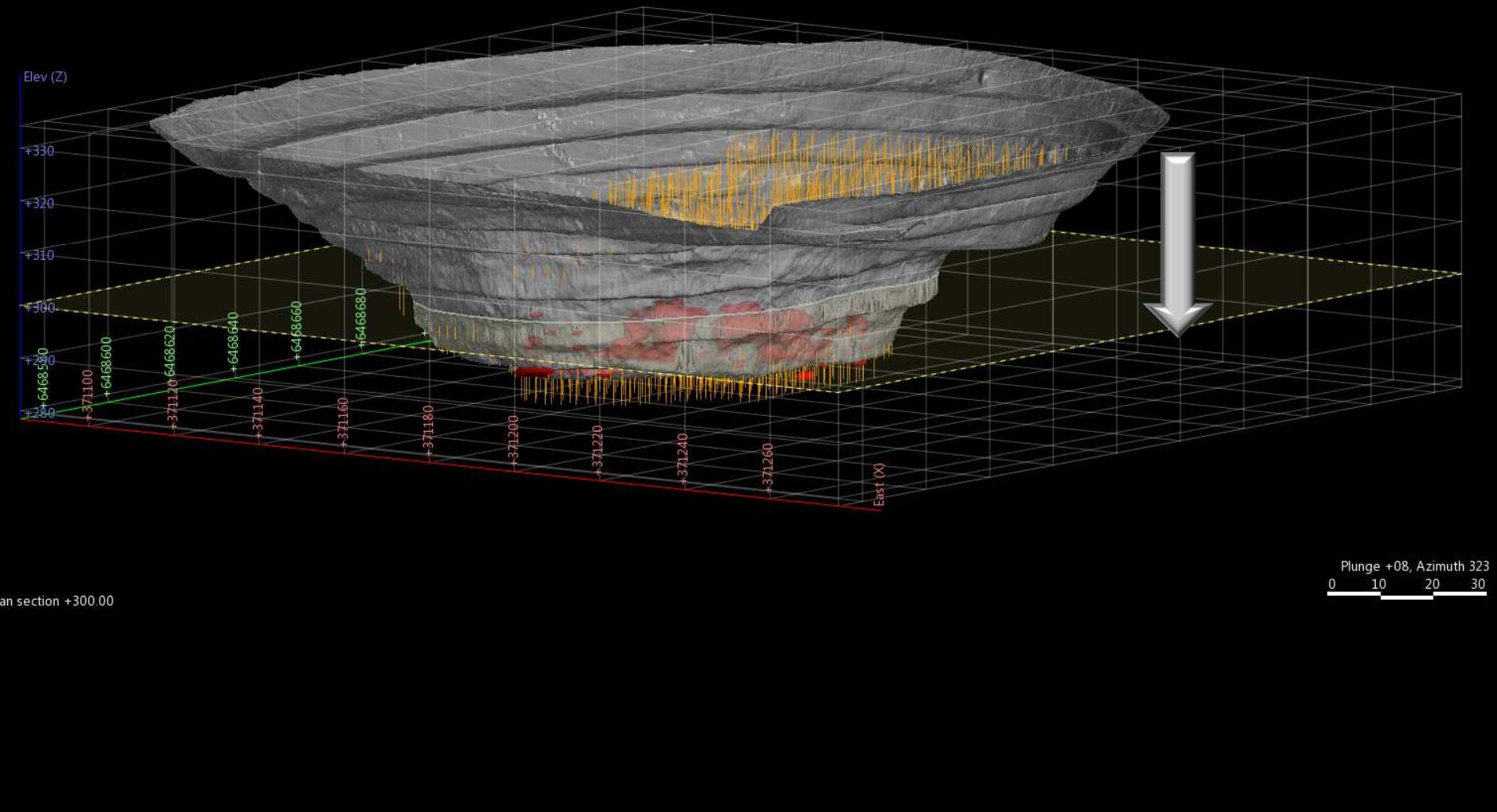


[Colour]	[Shape]	[Size]	[Visible]	[Order]	HoleID	From	To	S
●	●	7	Y	164	SBH1391	0	2.5	
●	●	7	Y	165	SBH1391	2.5	5	
●	●	7	Y	166	SBH1392	0	2.5	
●	●	7	Y	167	SBH1392	2.5	5	
●	●	7	Y	168	SBH1393	0	2.5	
●	●	7	Y	169	SBH1393	2.5	5	
●	●	7	Y	170	SBH1394	0	2.5	

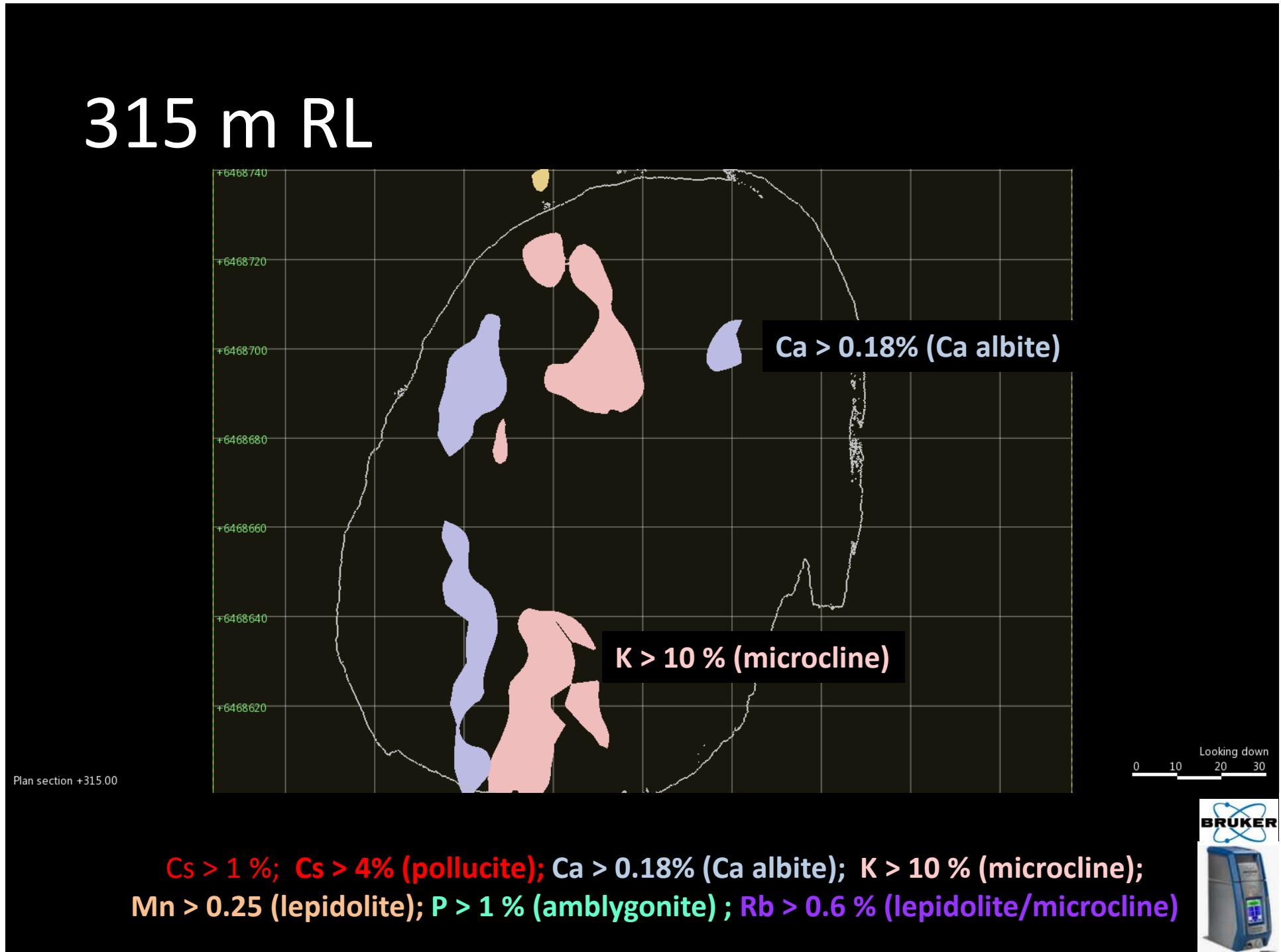
Cs: Probable Sample Switched



Grade Control



315 m RL



Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)

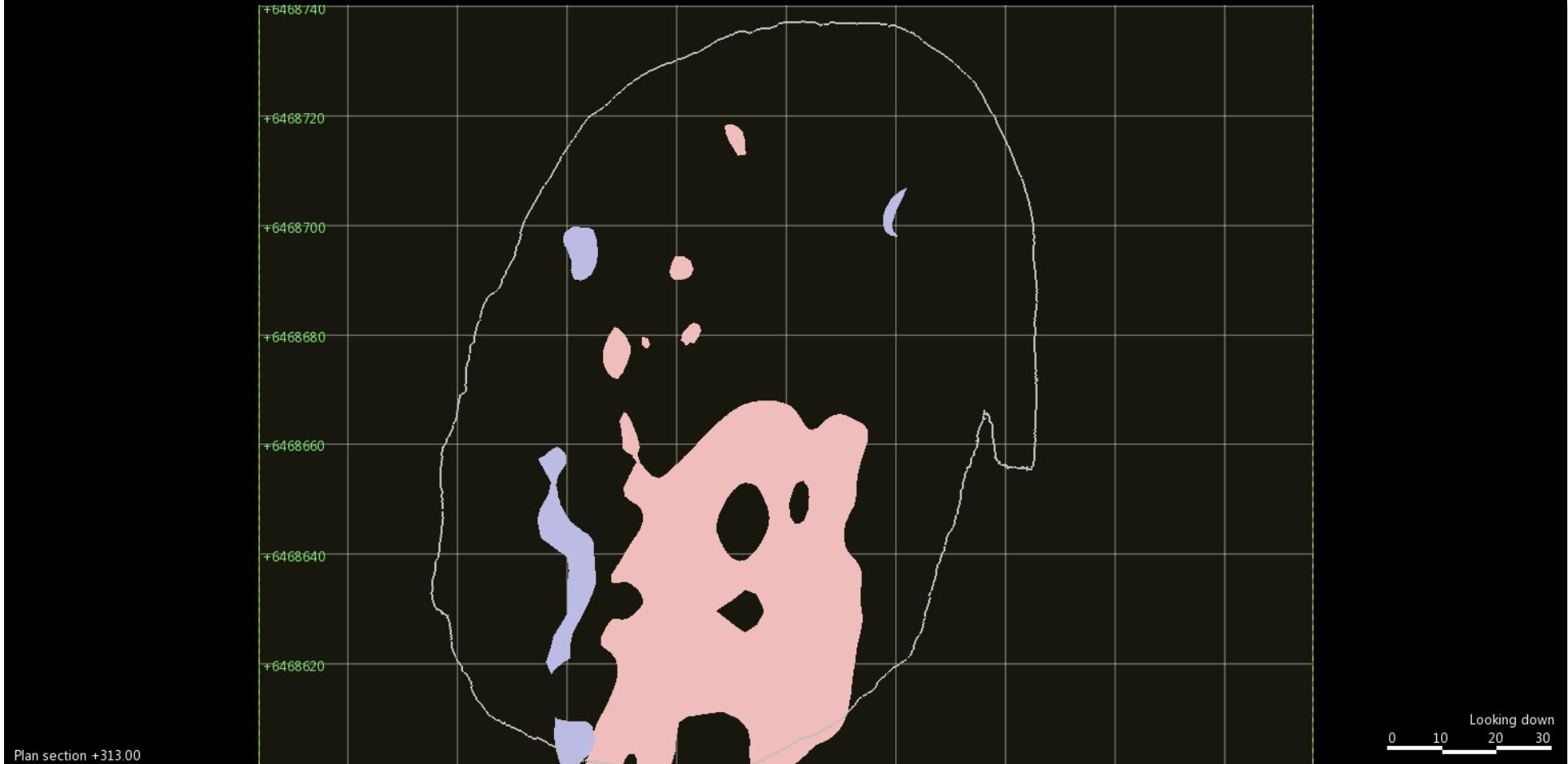
314 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



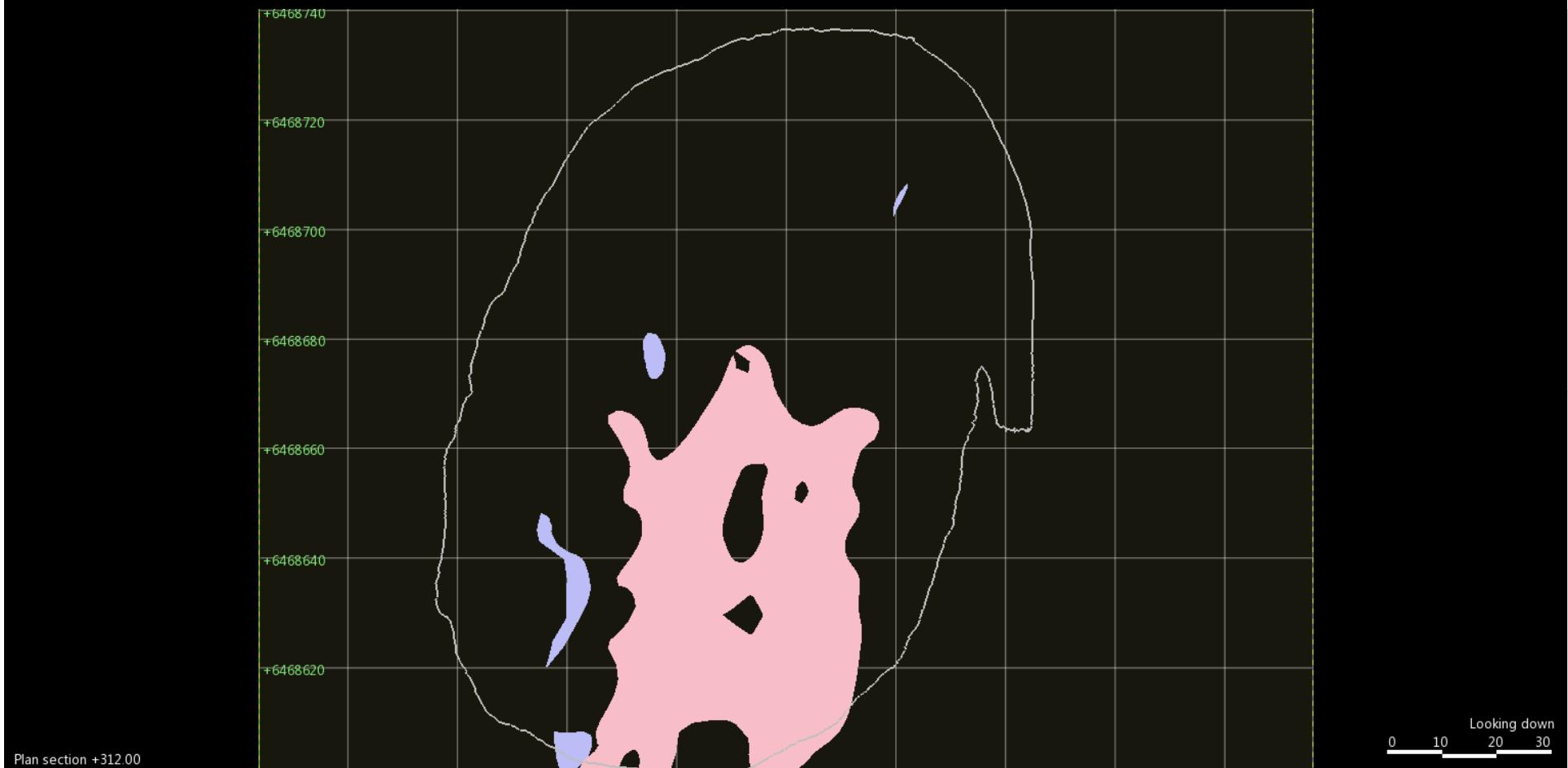
313 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



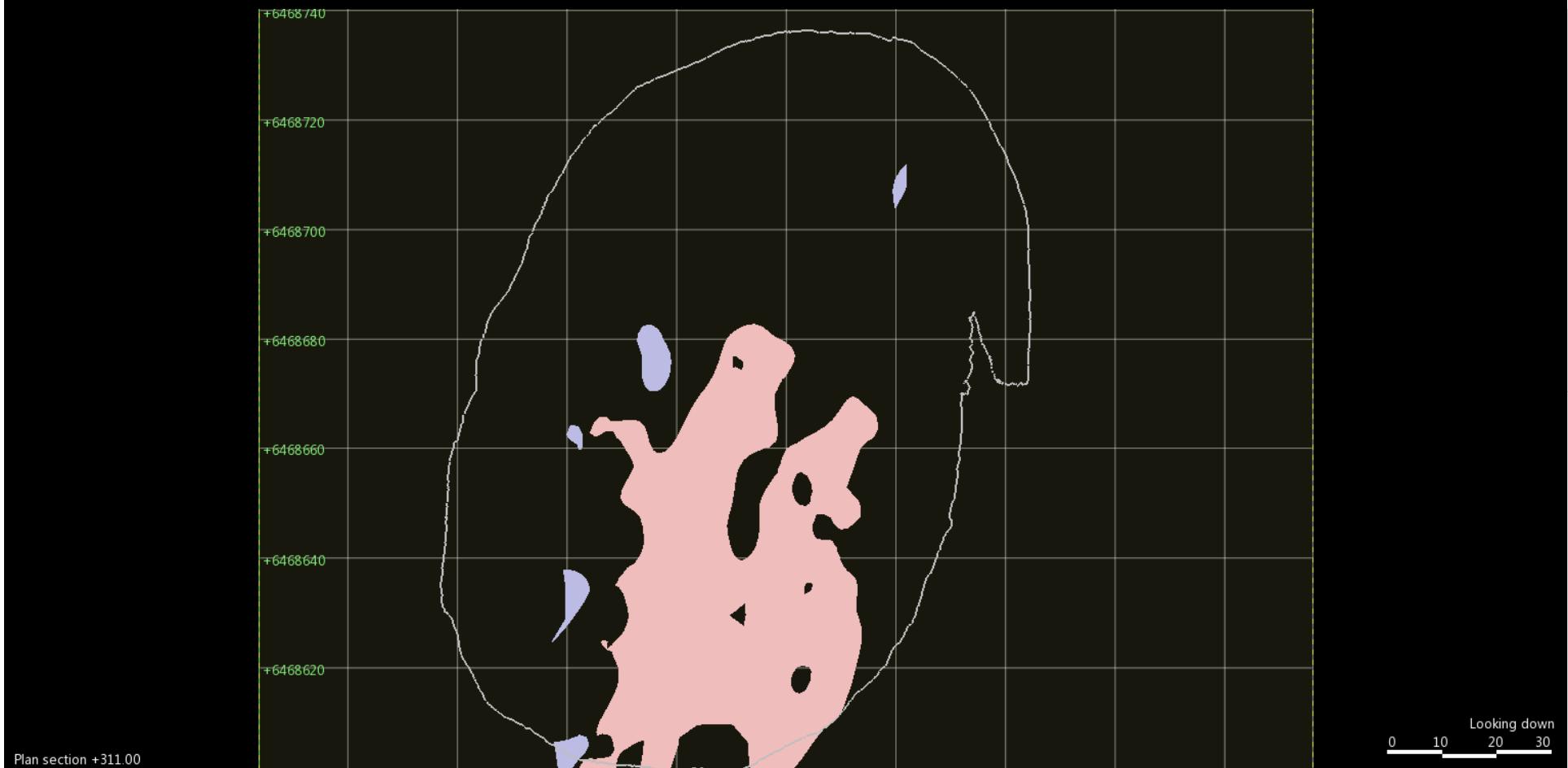
312 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



311 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



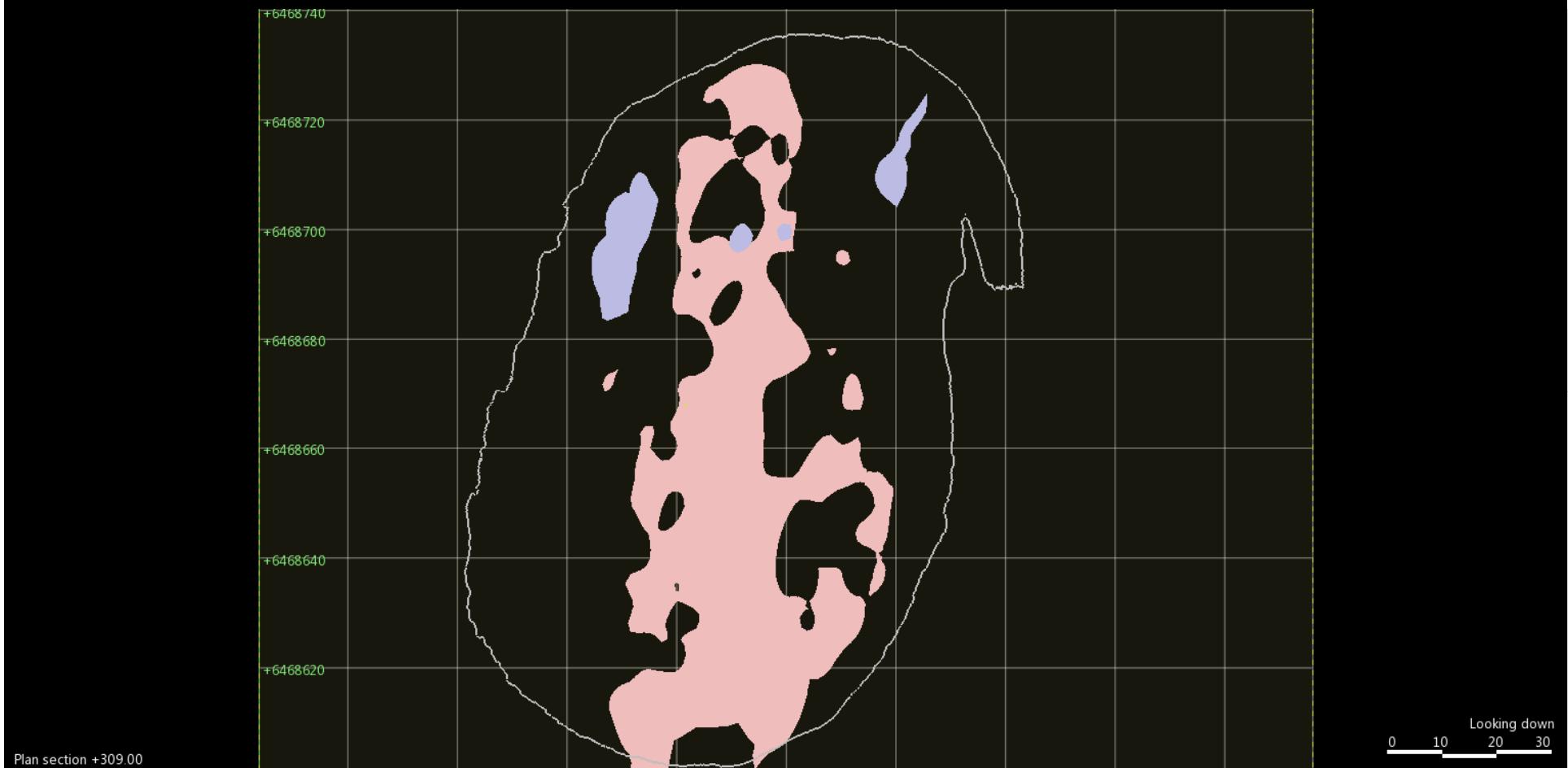
310 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



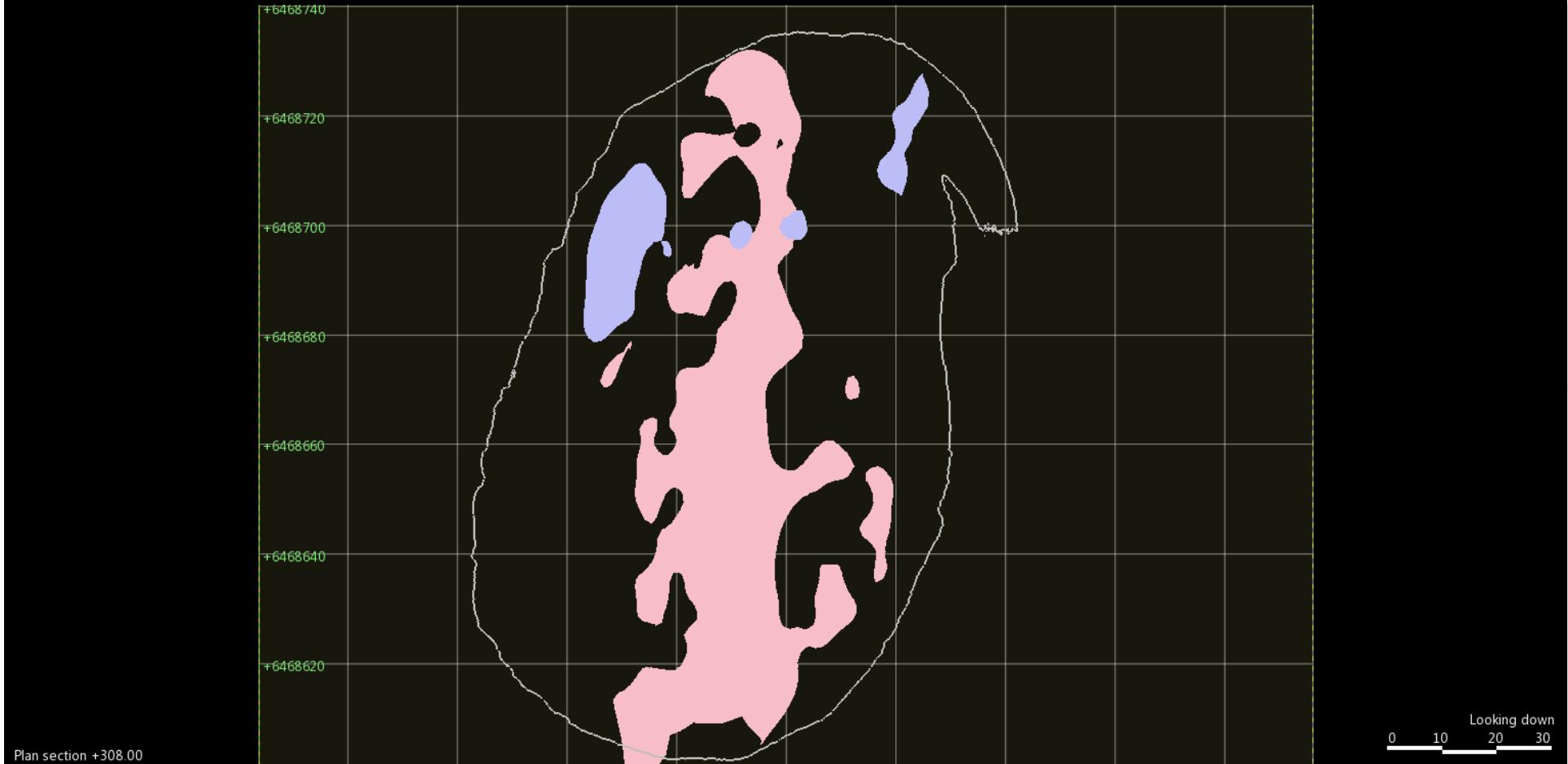
309 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



308 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



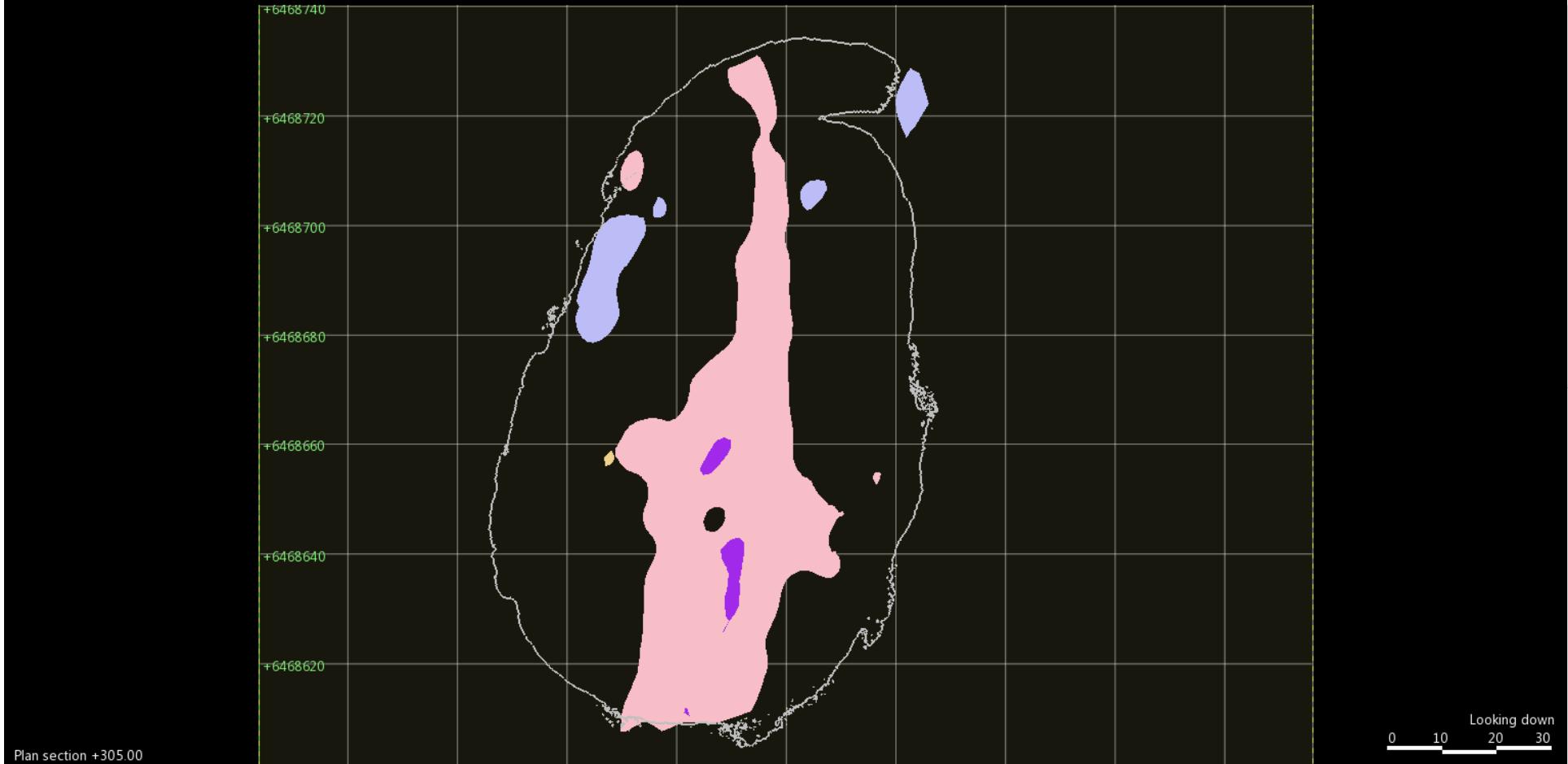
307 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



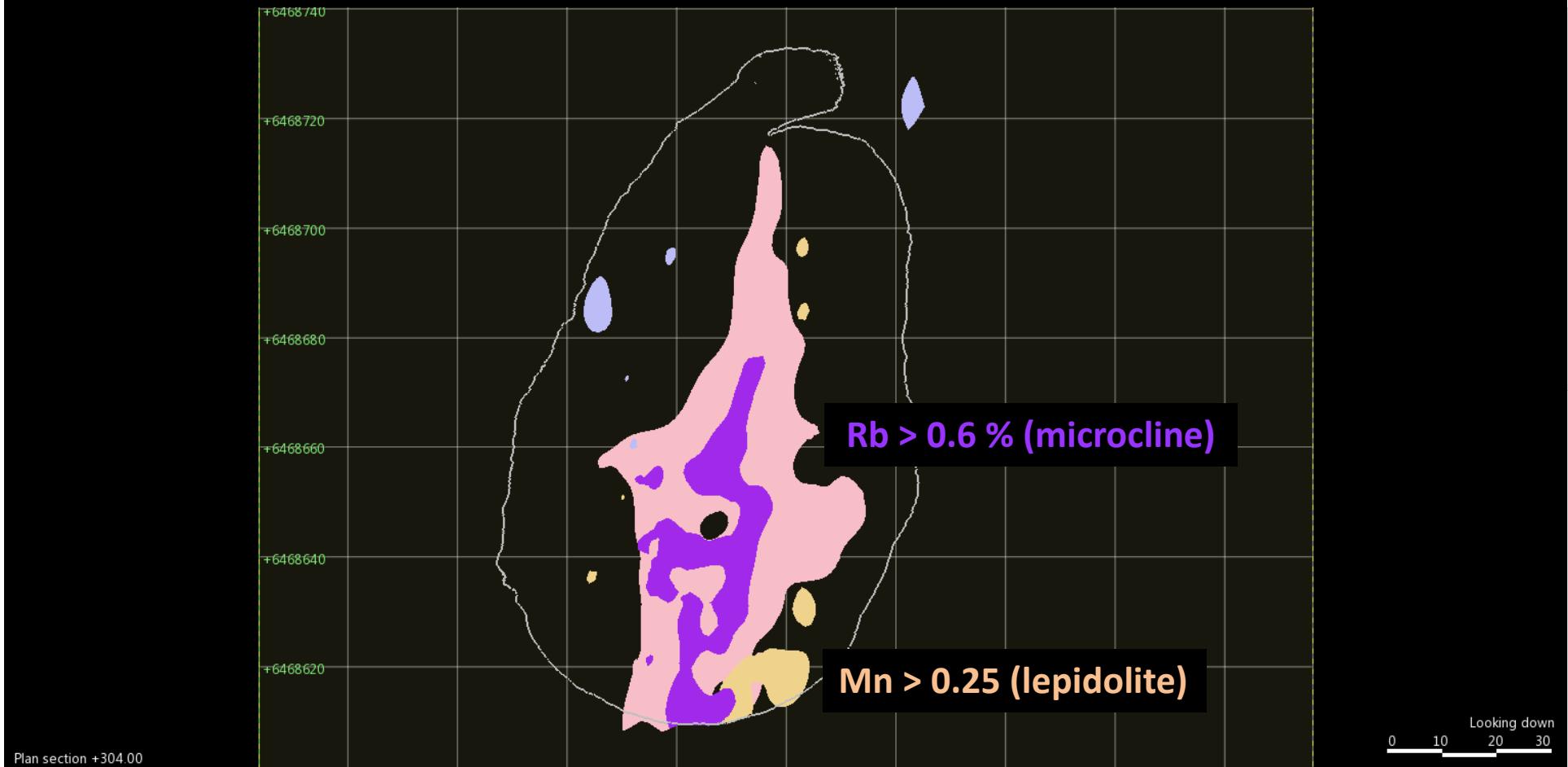
306 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



304 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



303 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



302 m RL



Plan section +302.00

**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



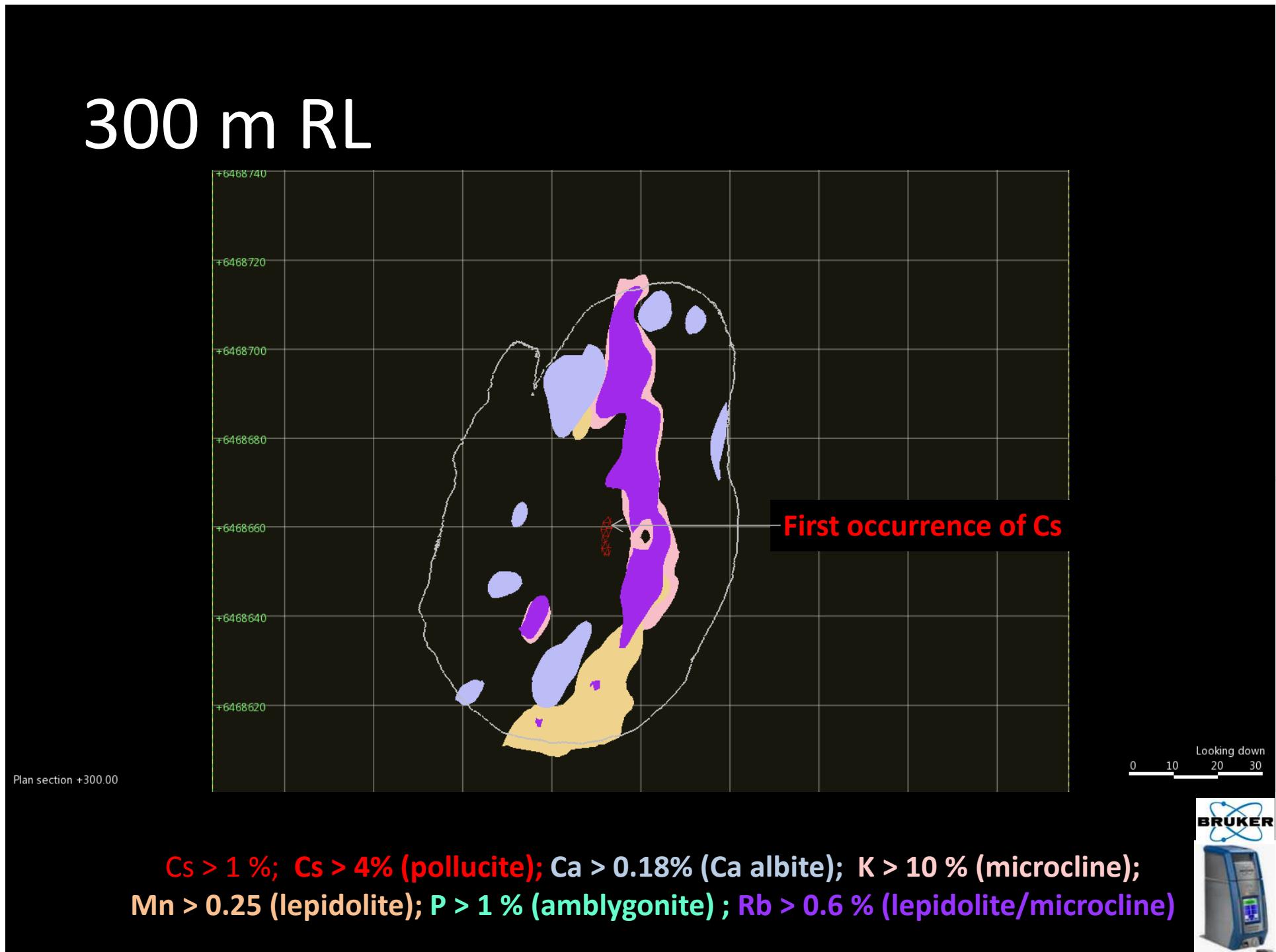
301 m RL



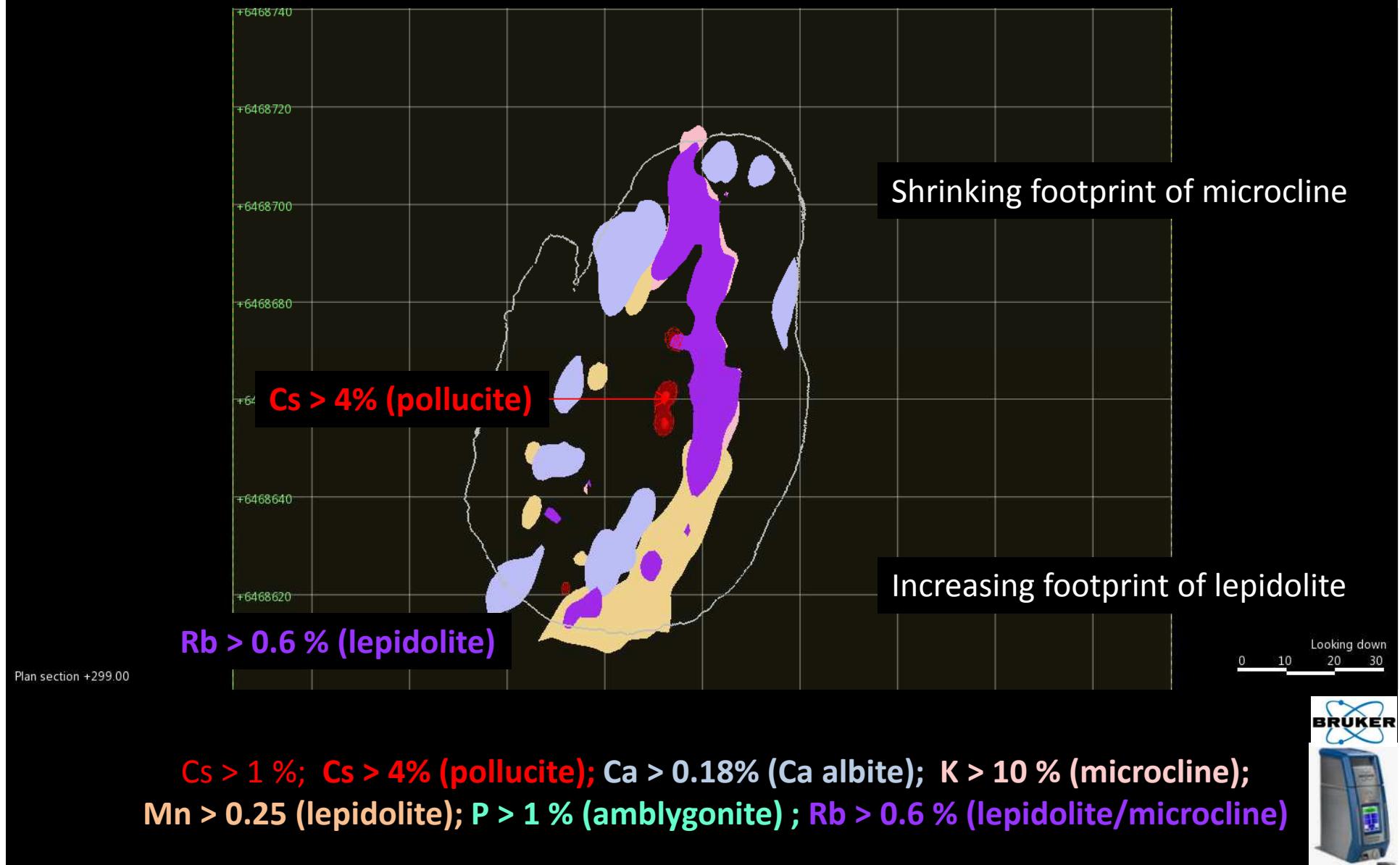
**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



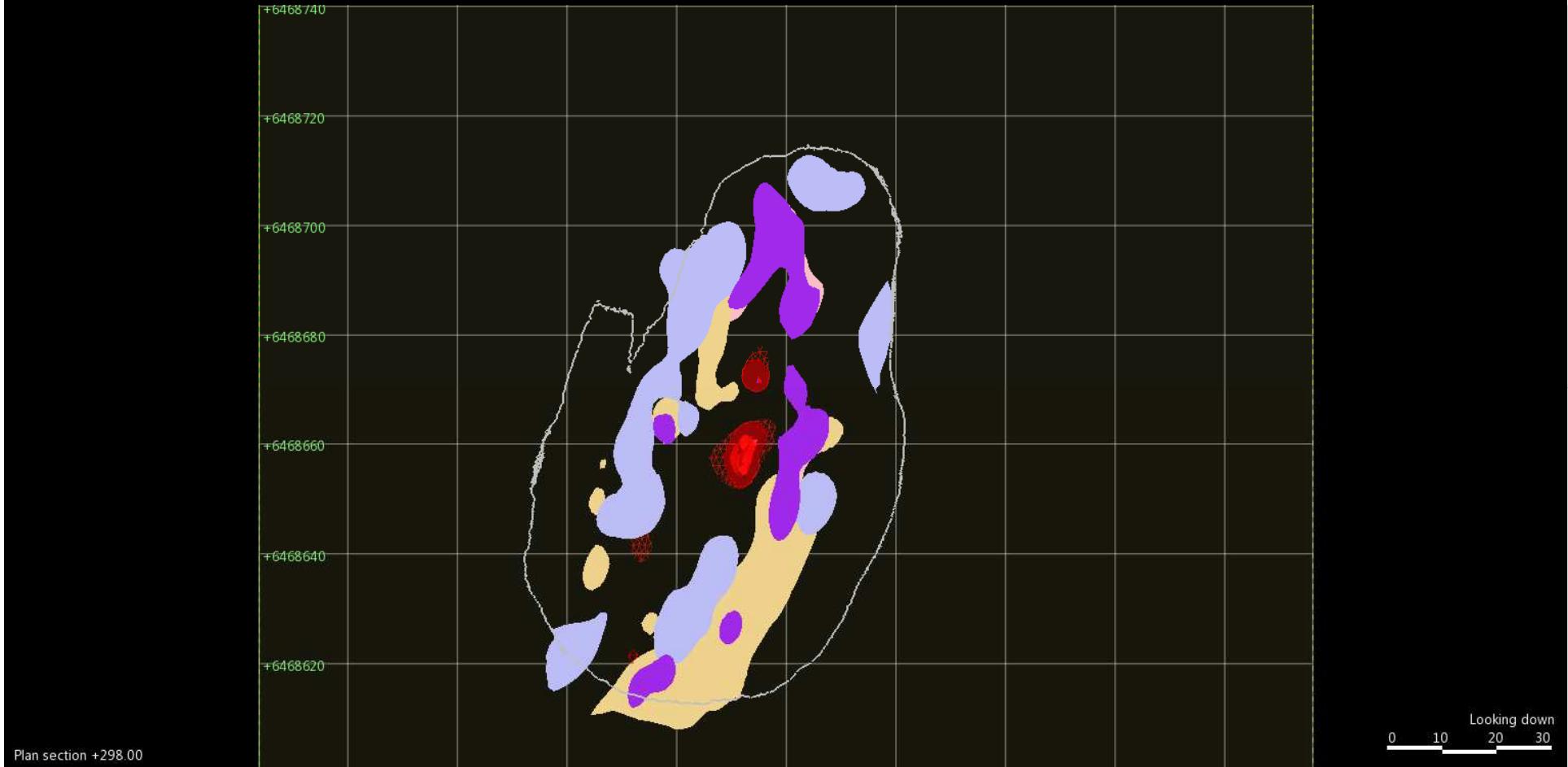
300 m RL



299 m RL



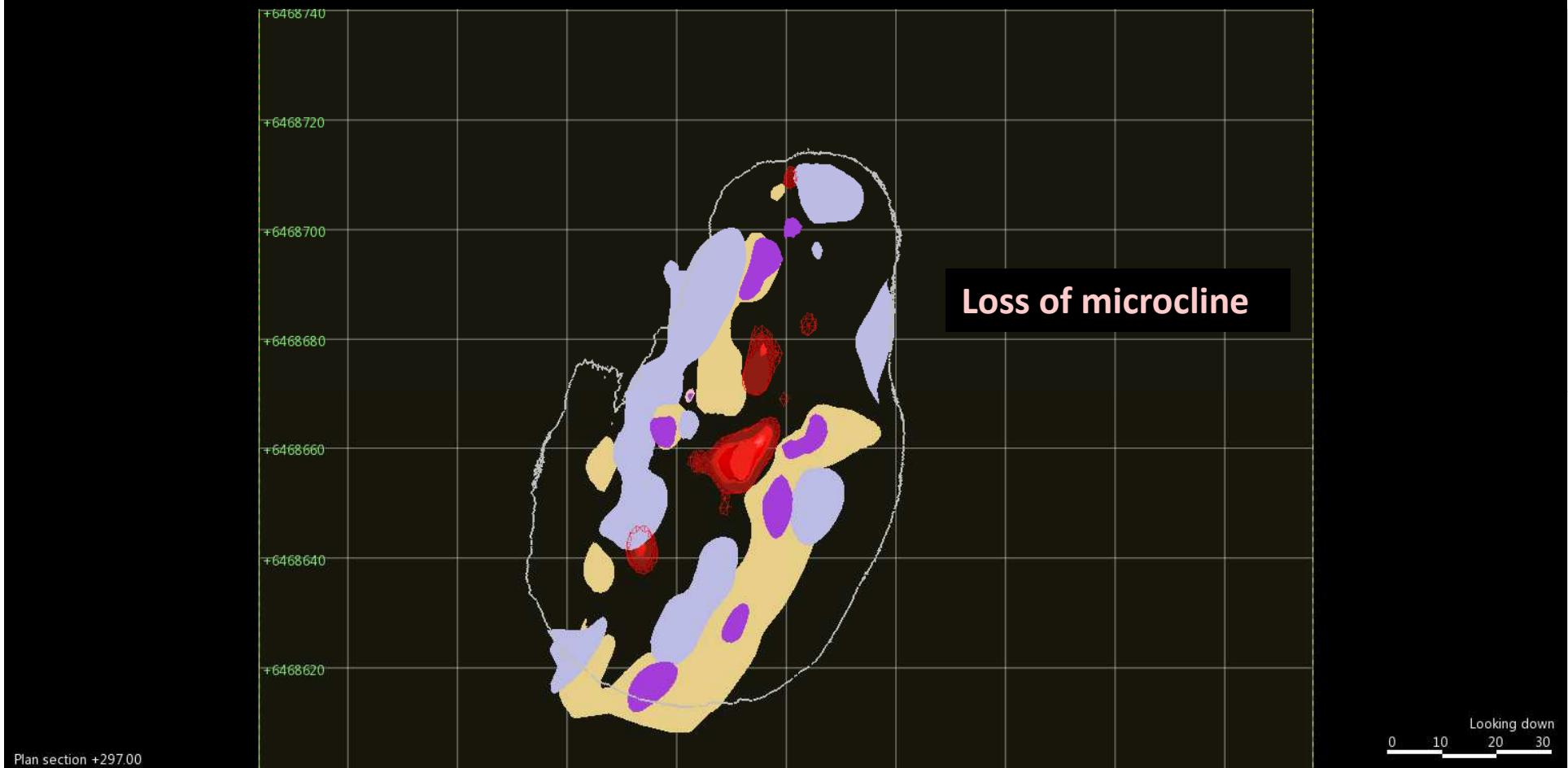
298 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



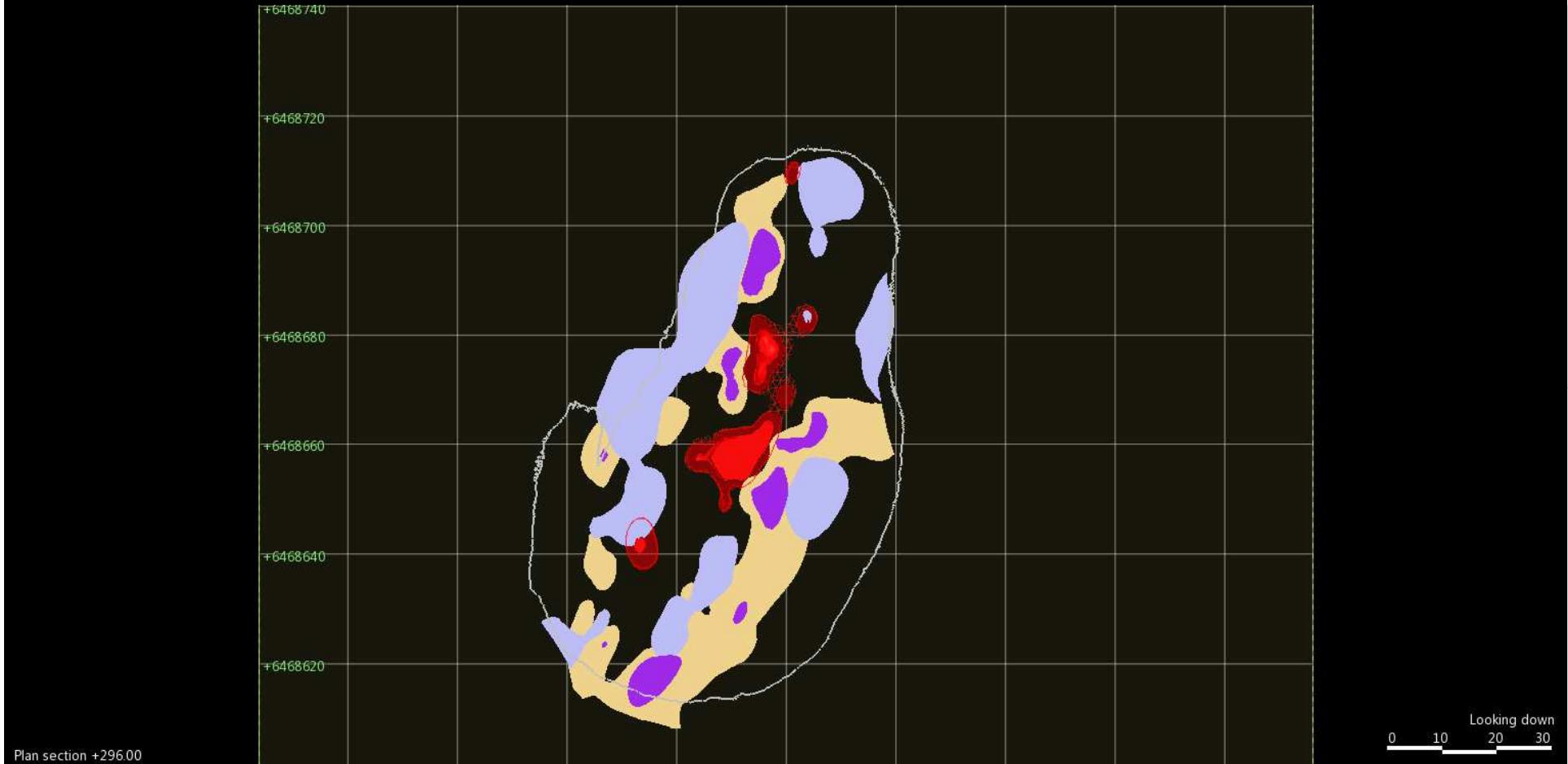
297 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



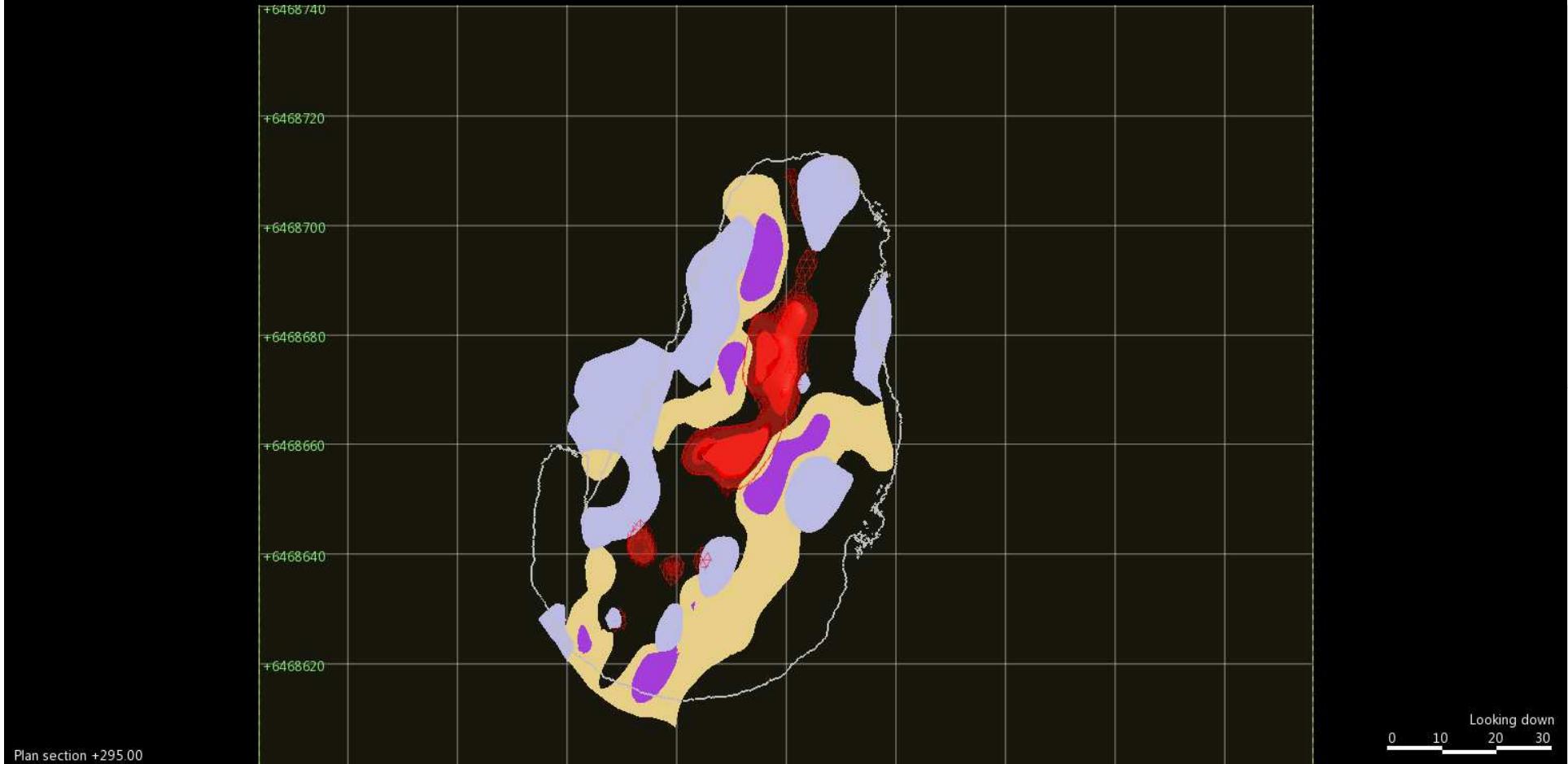
296 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



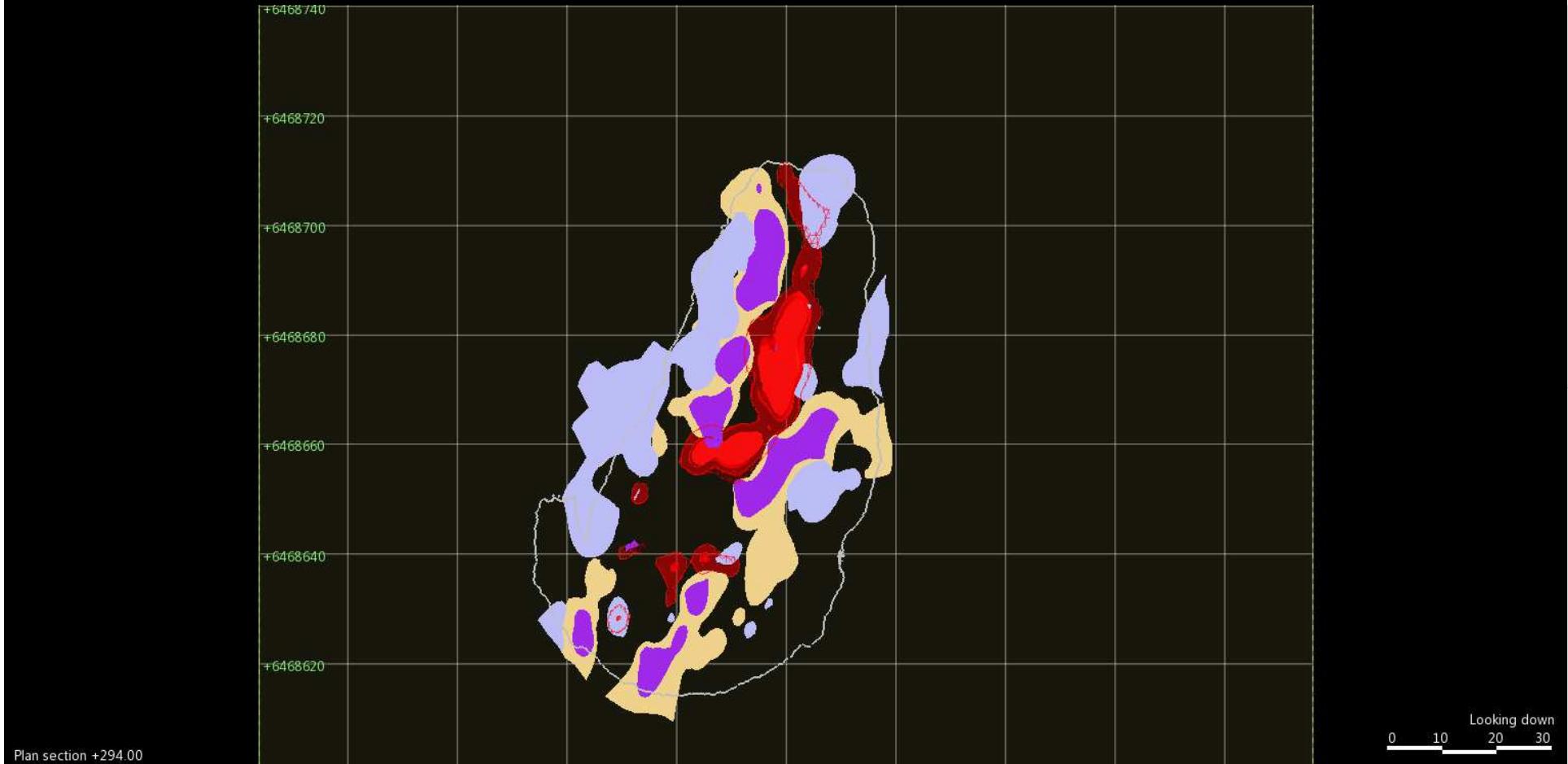
295 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



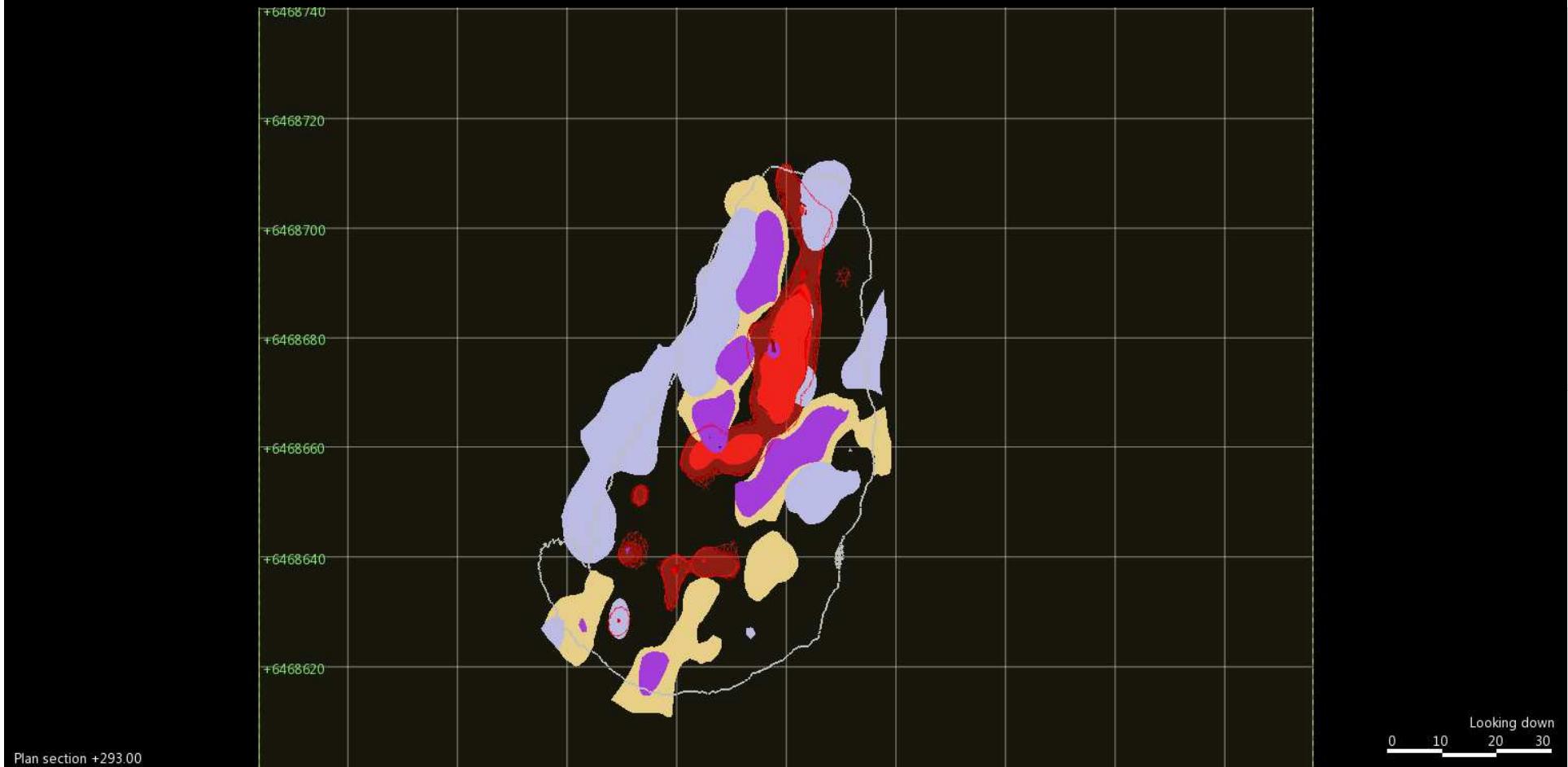
294 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



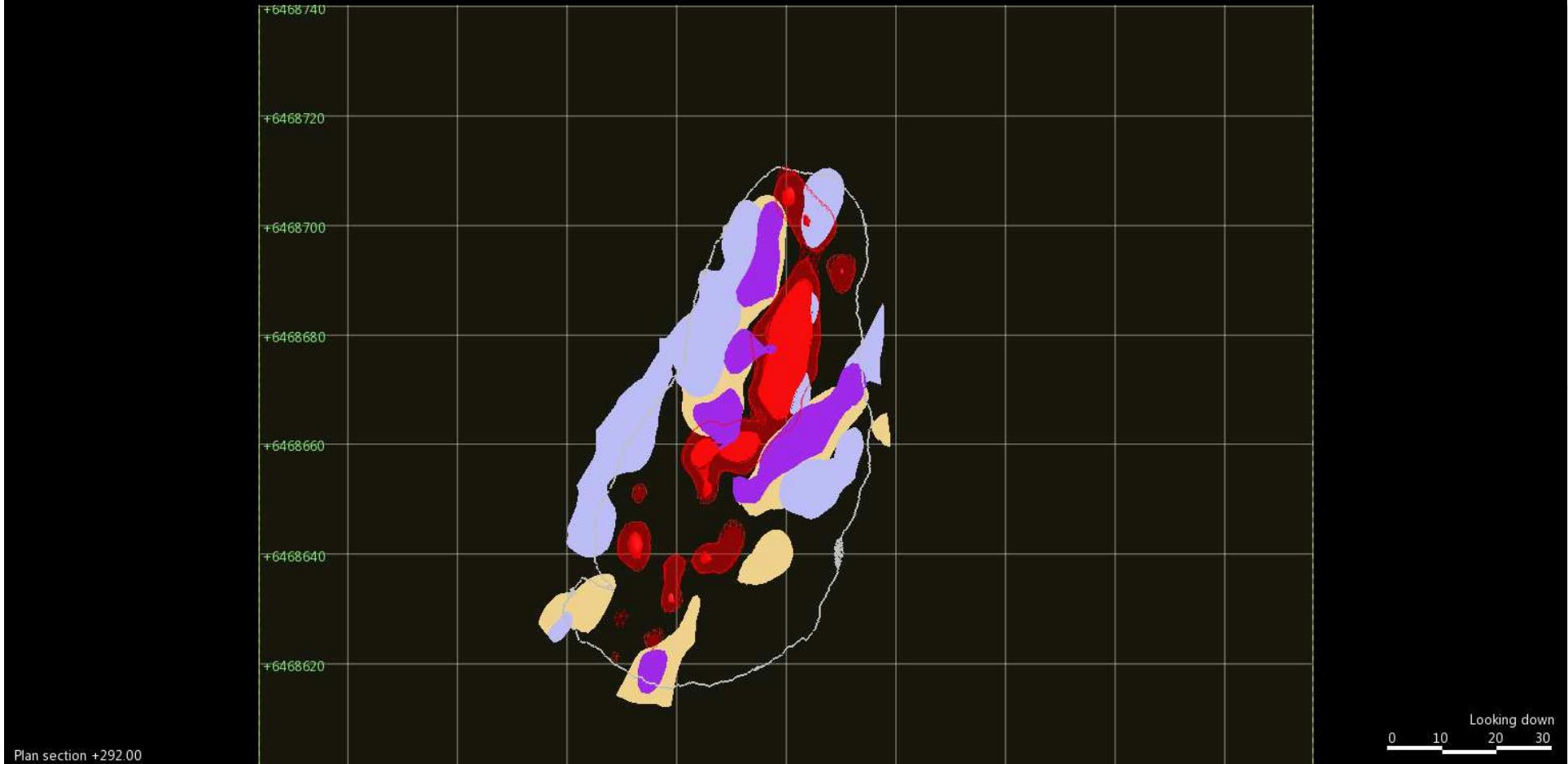
293 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



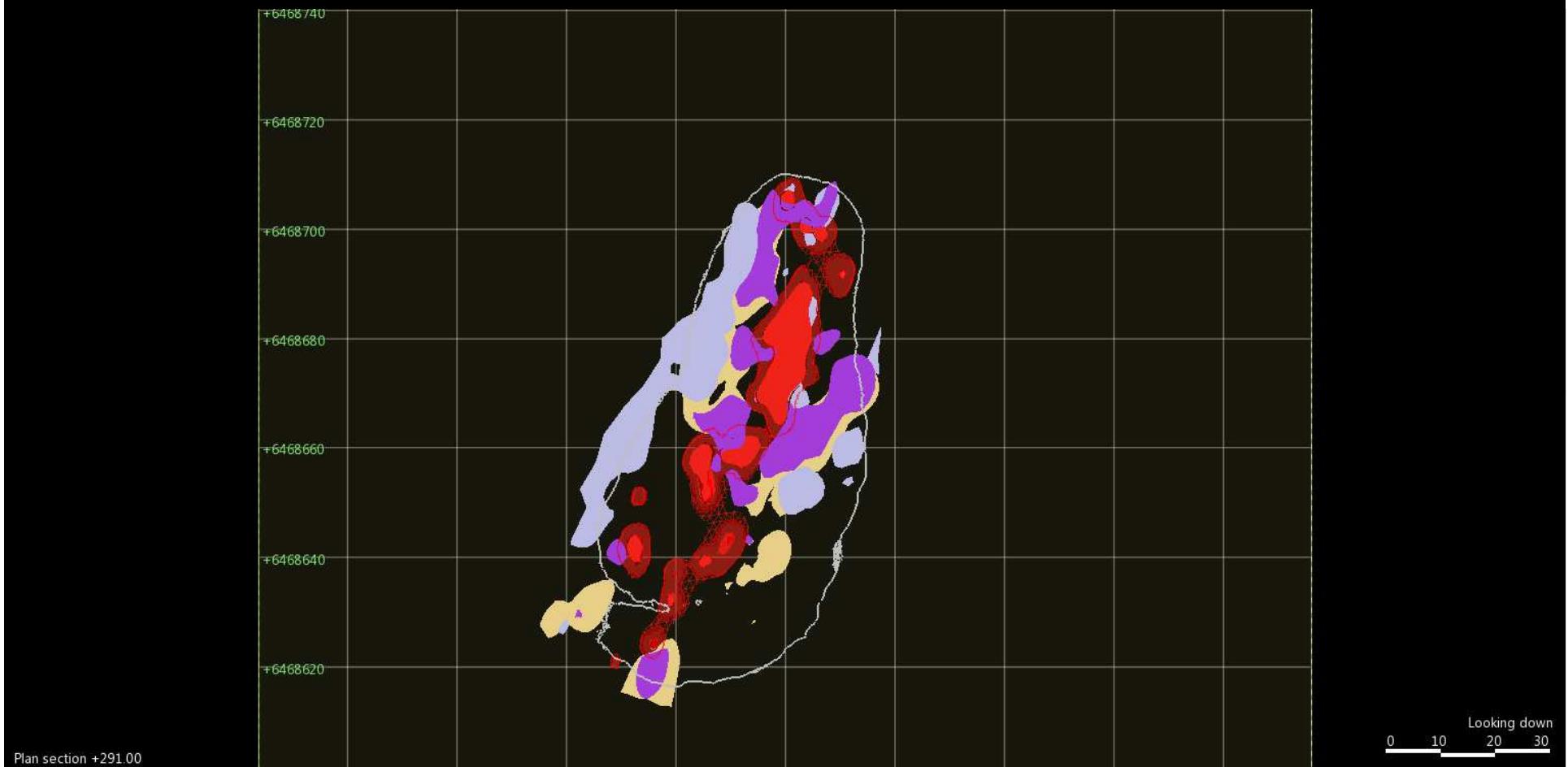
292 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



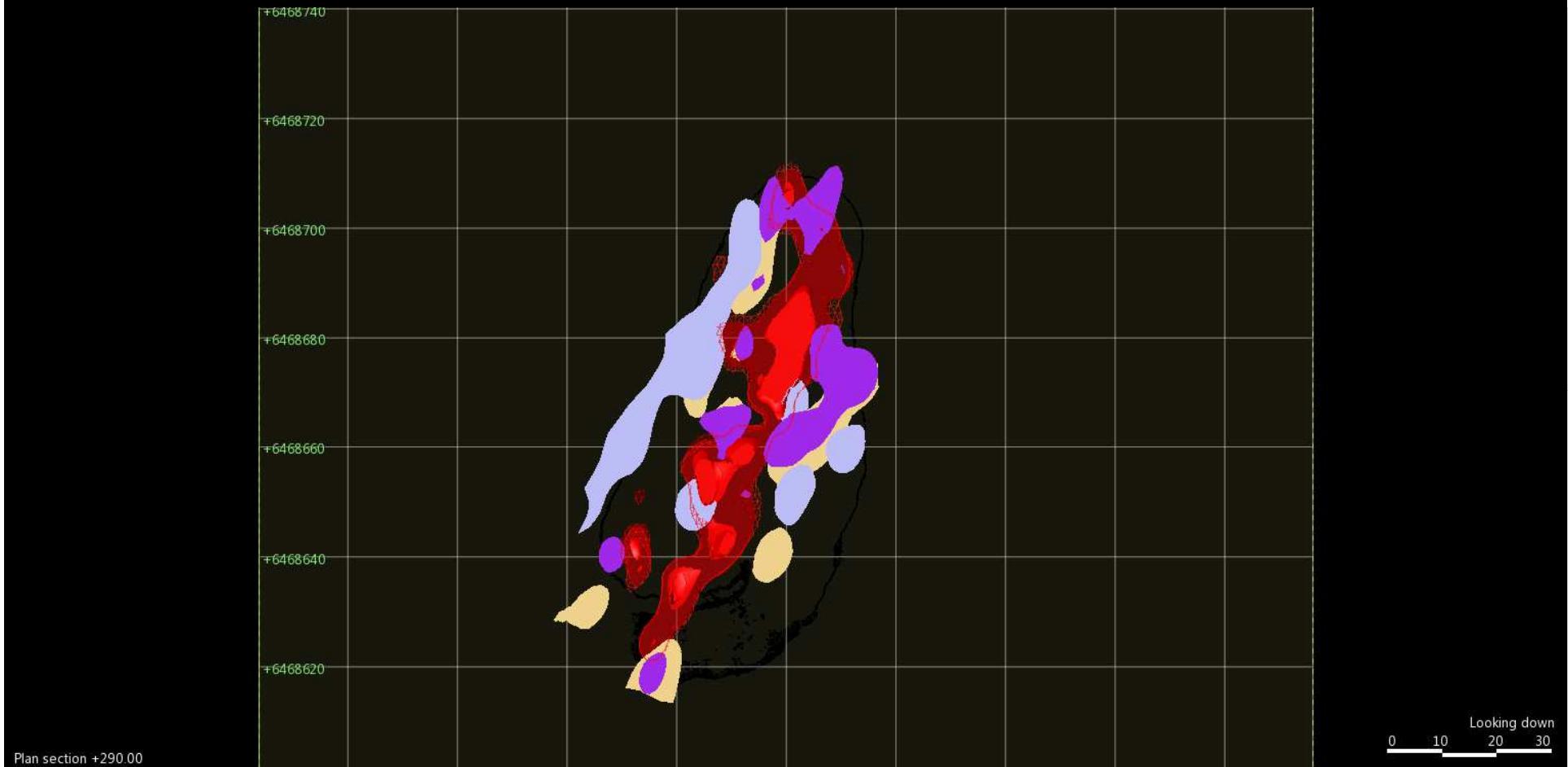
291 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



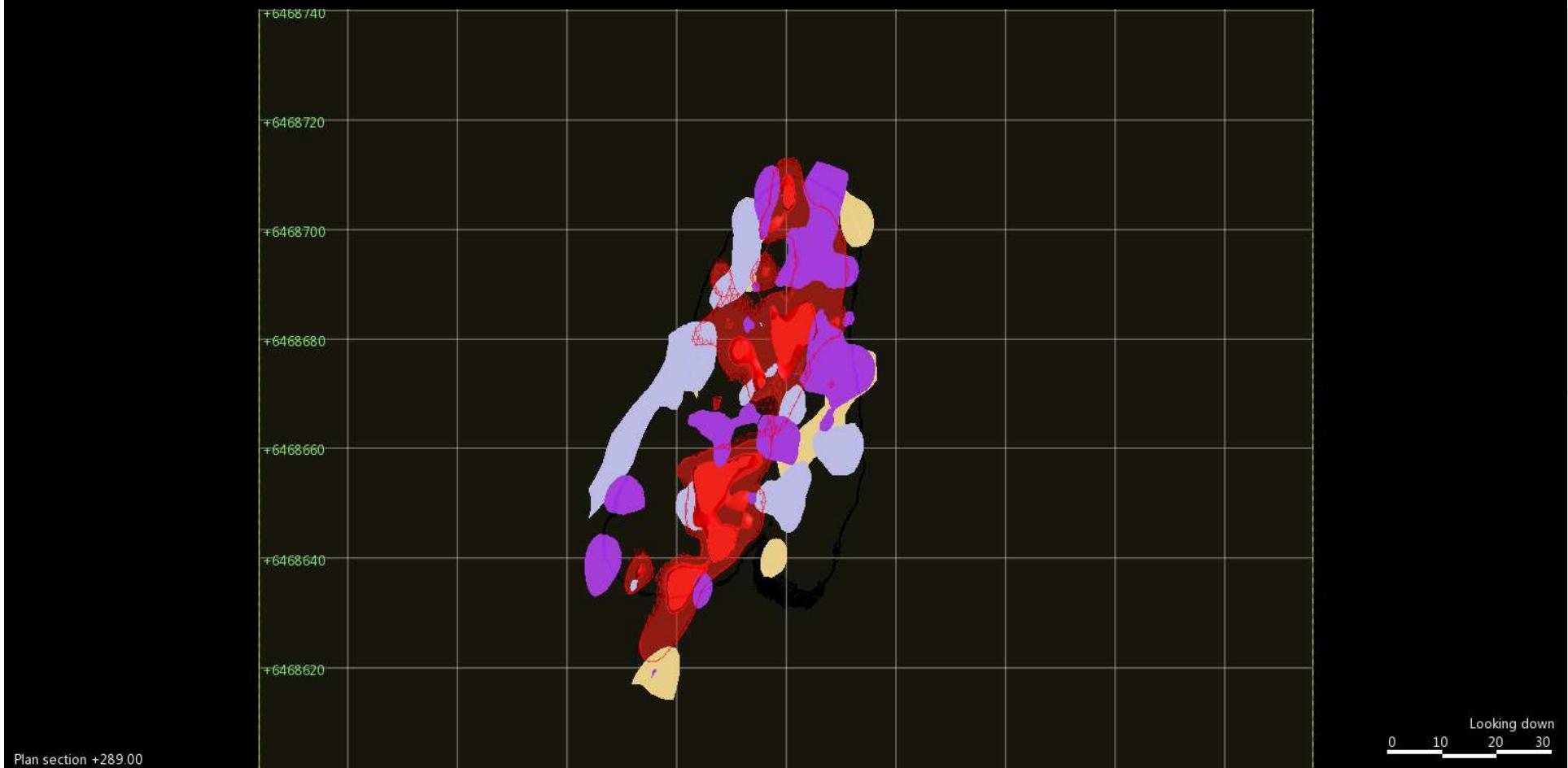
290 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



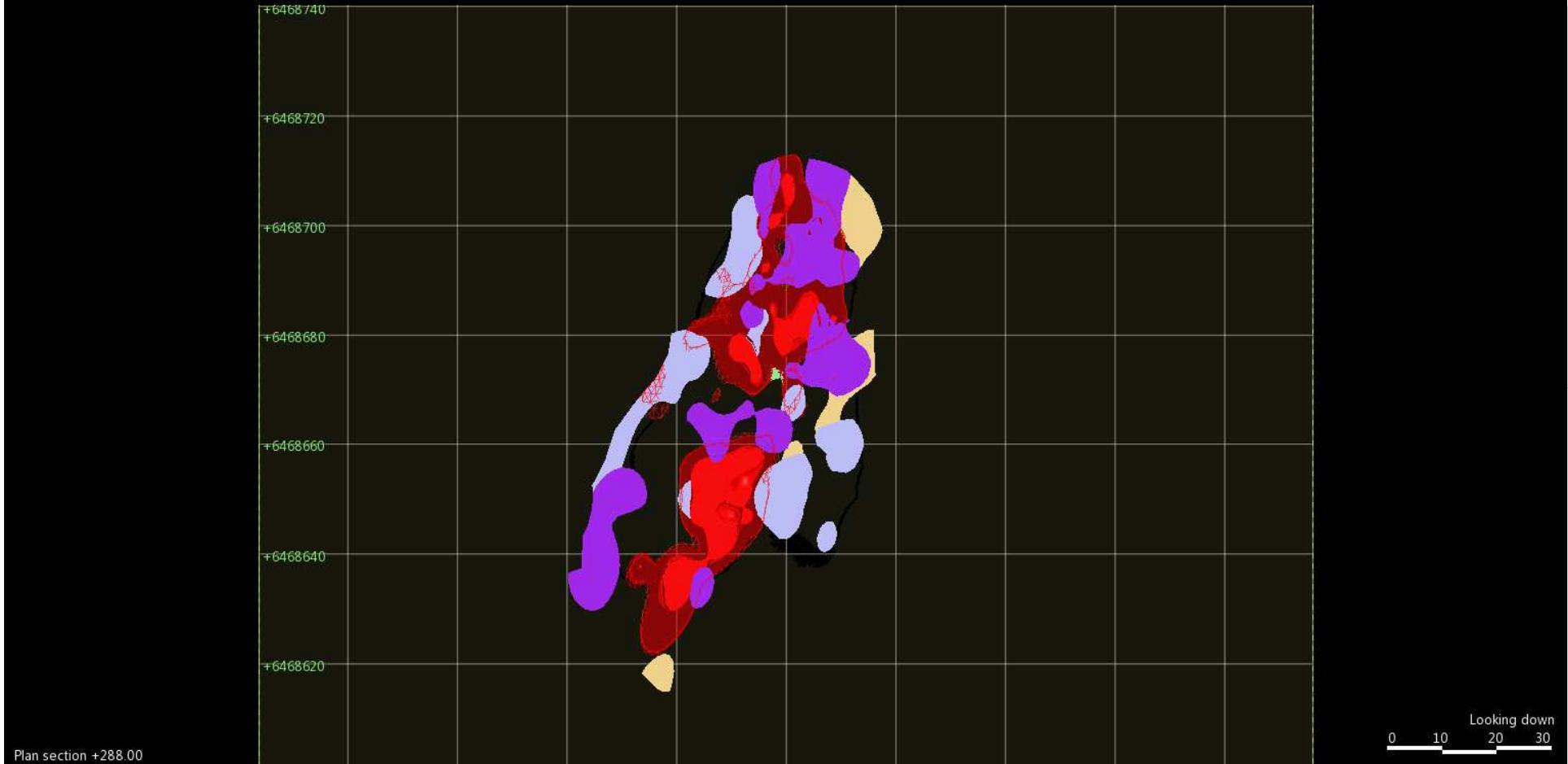
289 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



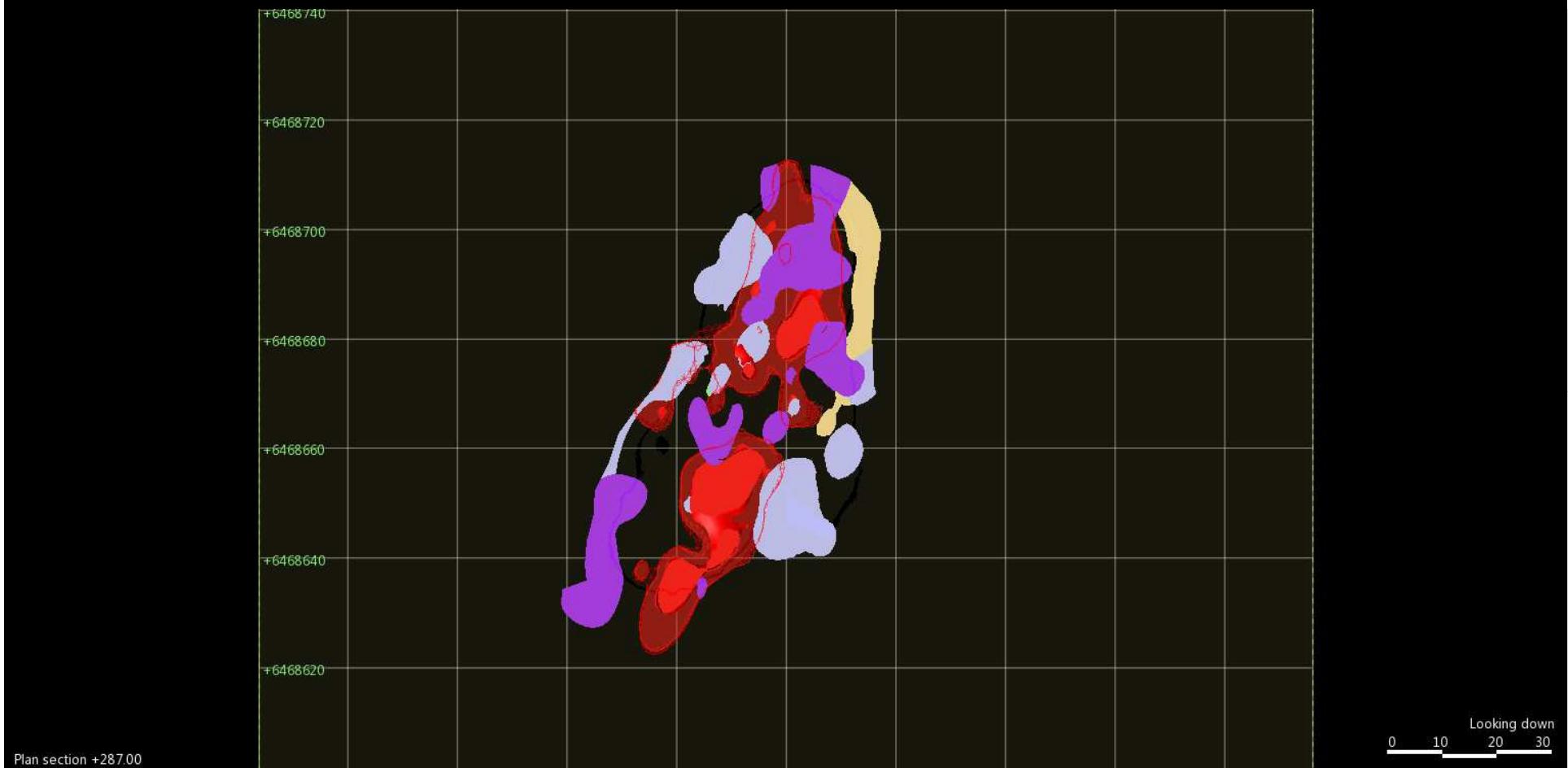
288 m RL



Cs > 1 %; **Cs > 4% (pollucite);** Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)



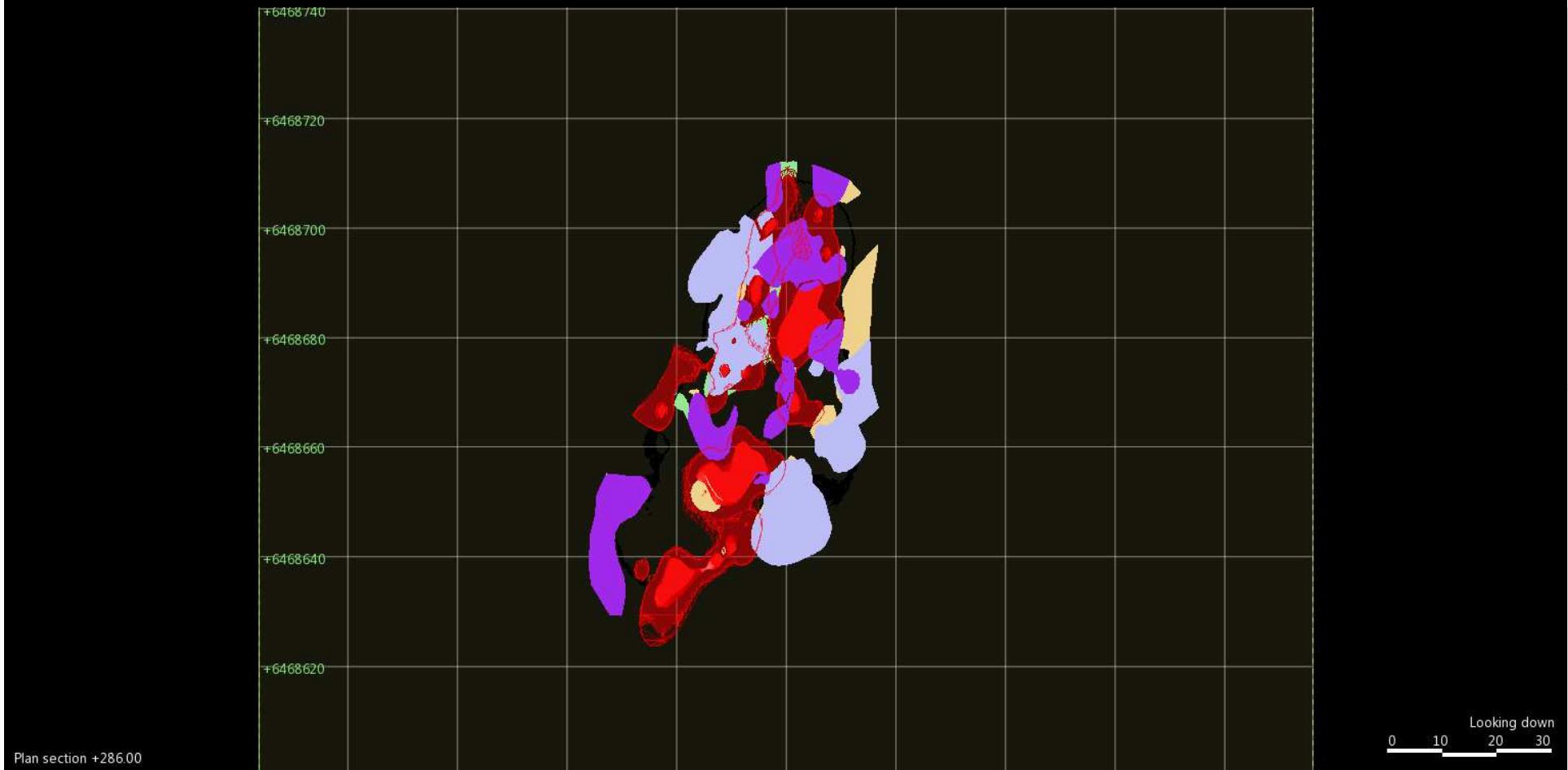
287 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



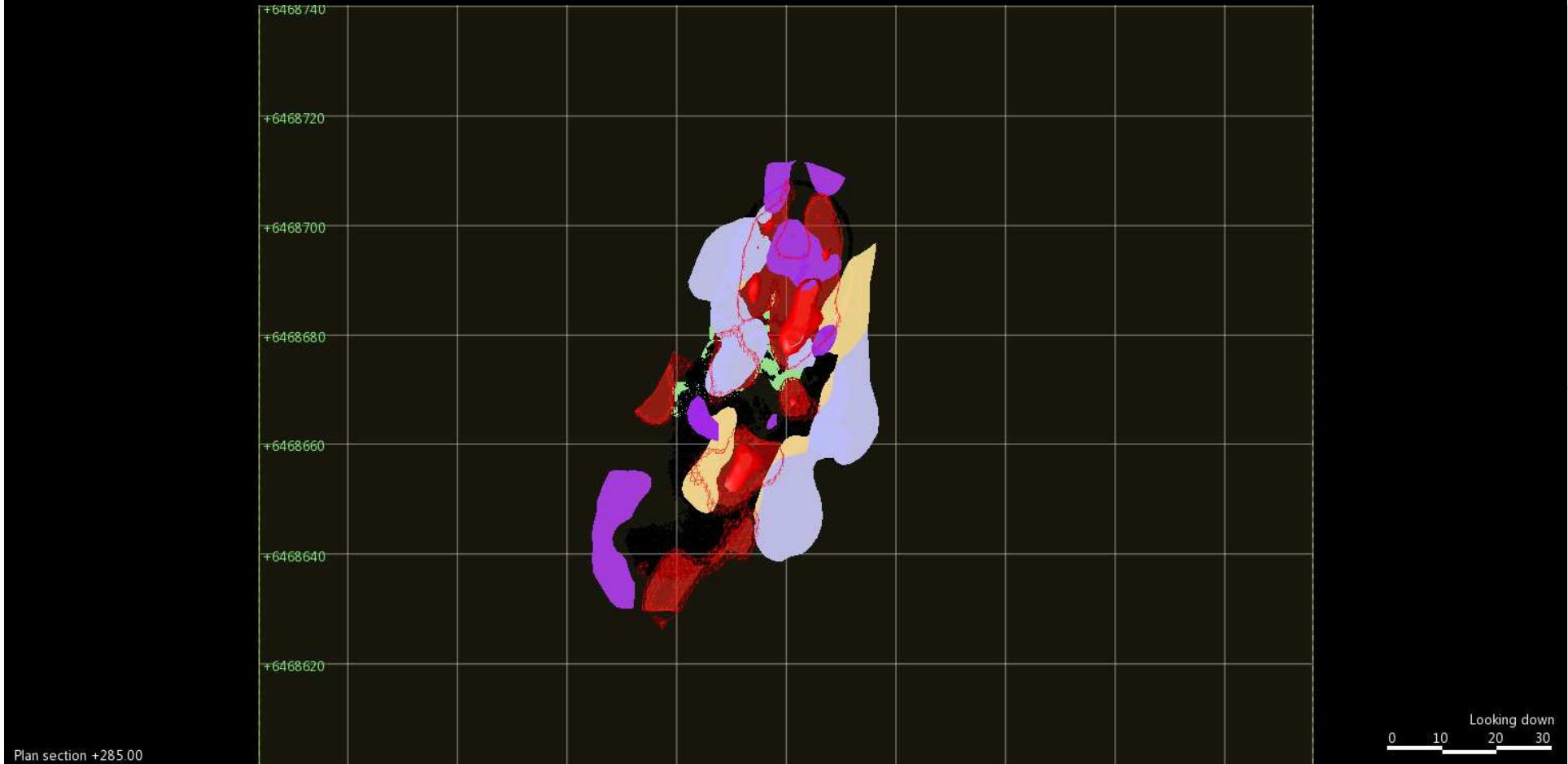
286 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



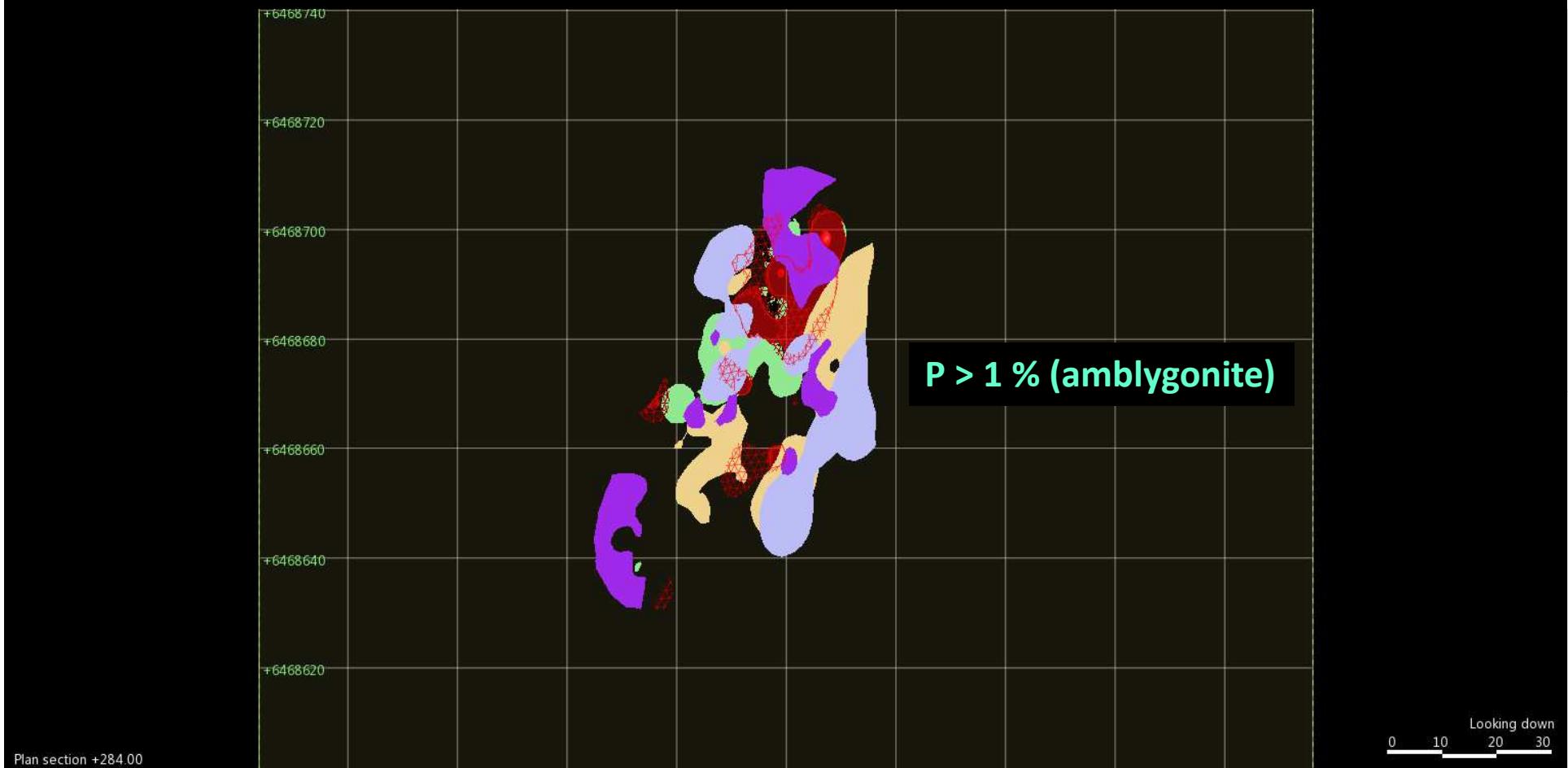
285 m RL



Cs > 1%; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10% (microcline);
Mn > 0.25 (lepidolite); P > 1% (amblygonite); Rb > 0.6% (lepidolite/microcline)



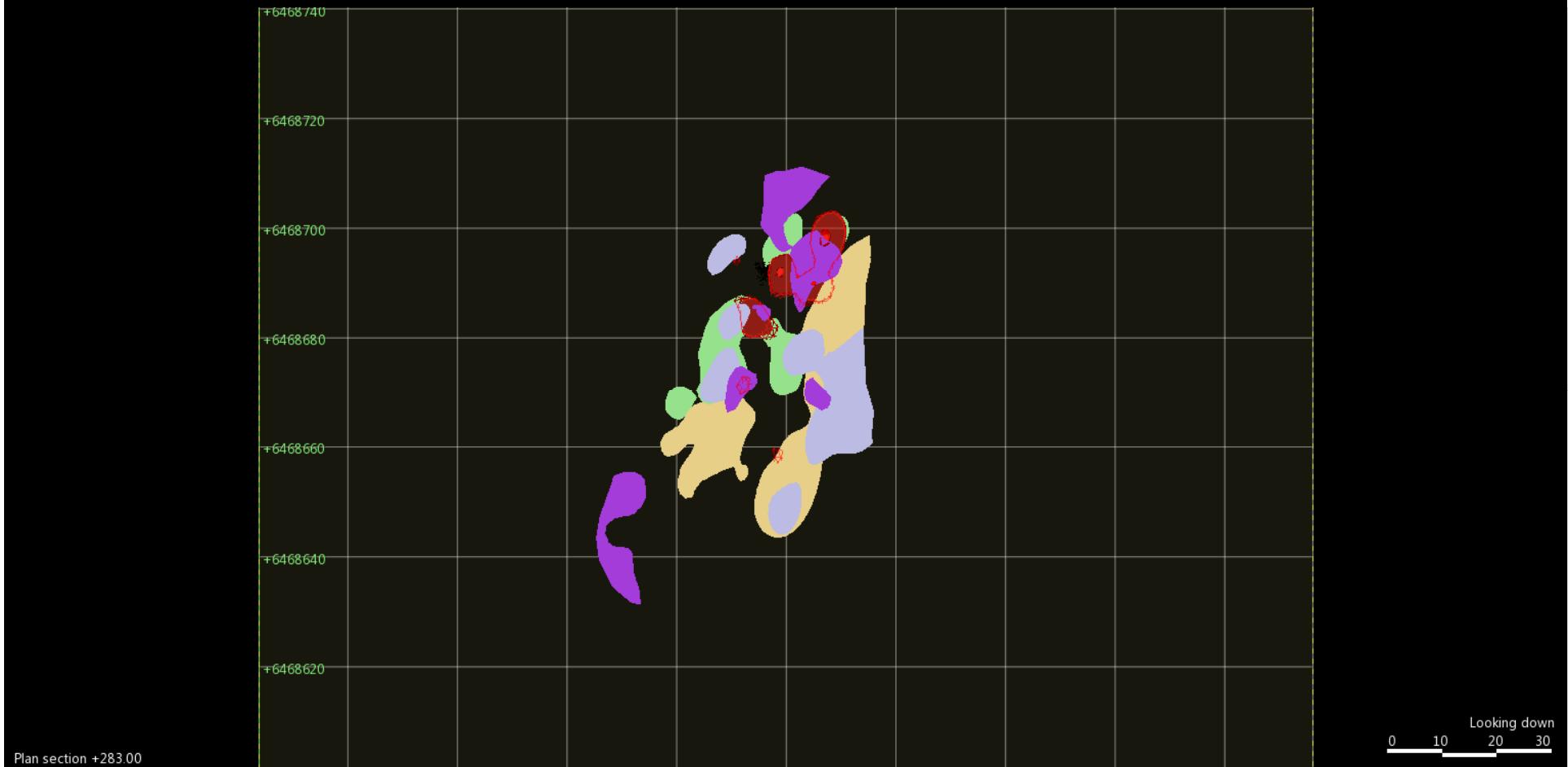
284 m RL



Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)



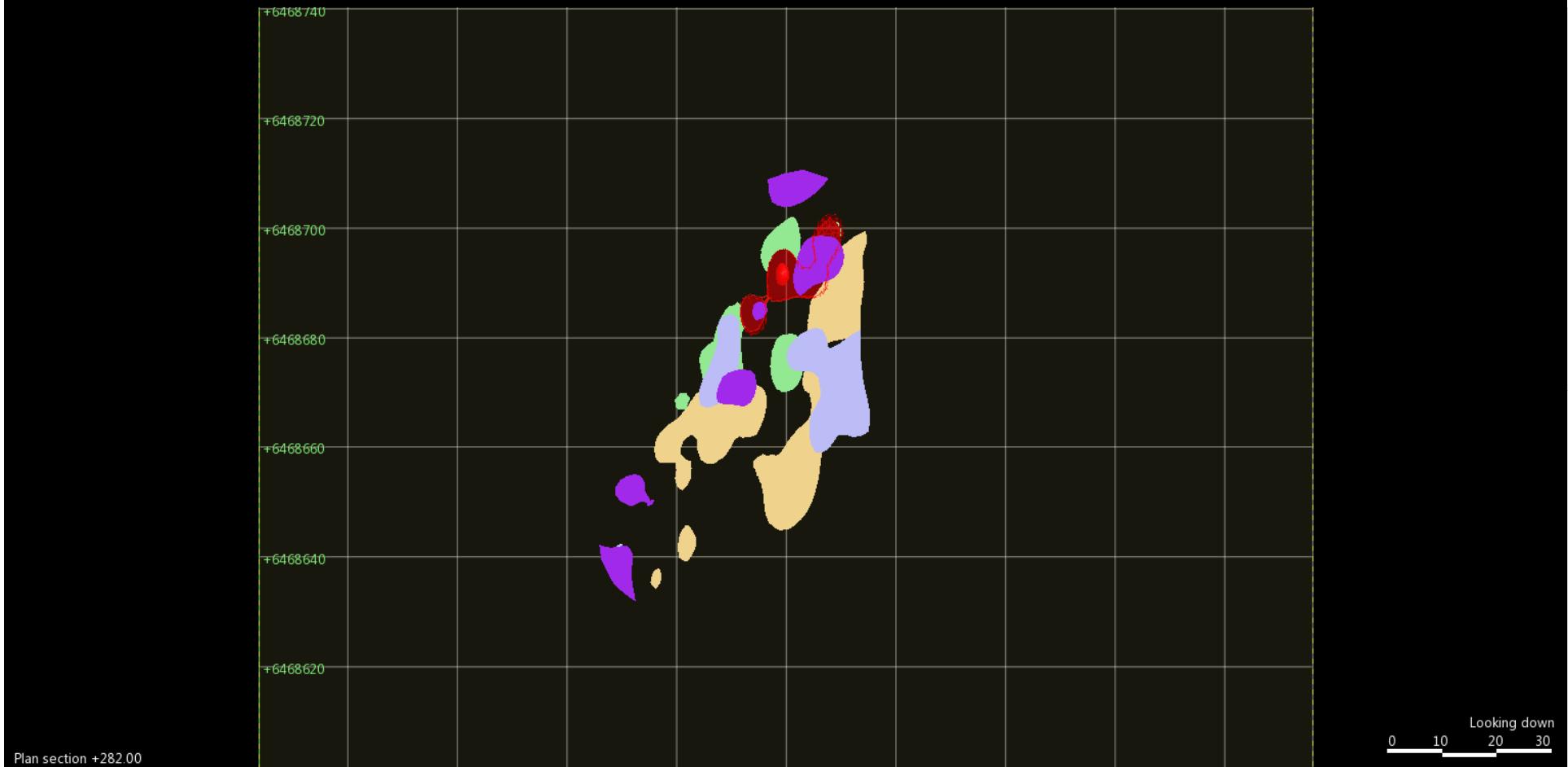
283 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



282 m RL



Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)



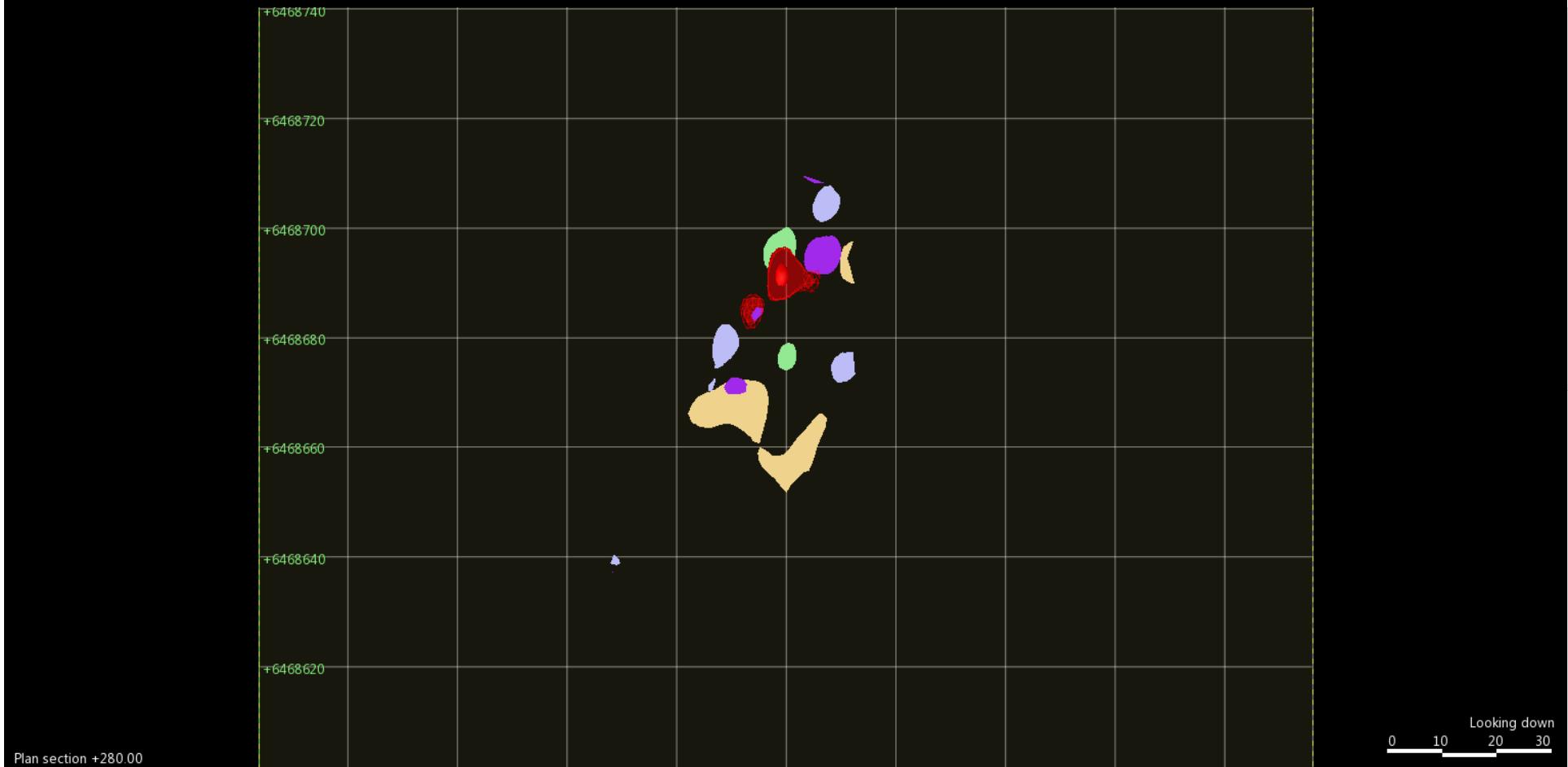
281 m RL



**Cs > 1 %; Cs > 4% (pollucite); Ca > 0.18% (Ca albite); K > 10 % (microcline);
Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**



280 m RL



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Mn > 0.25 (lepidolite); P > 1 % (amblygonite) ; Rb > 0.6 % (lepidolite/microcline)**

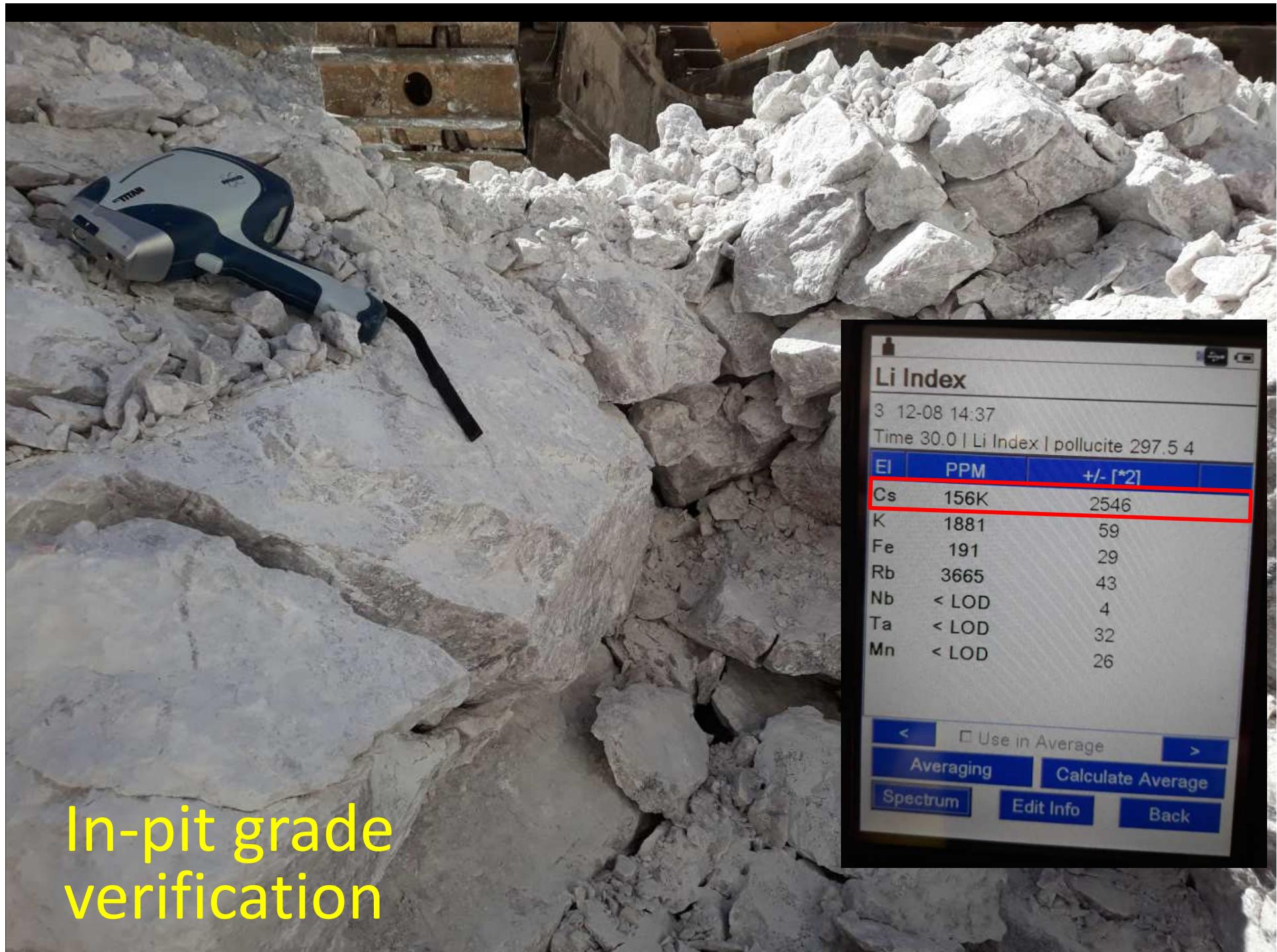


Delineation (grade control data)





In-pit grade verification





Pollucite Stockpile

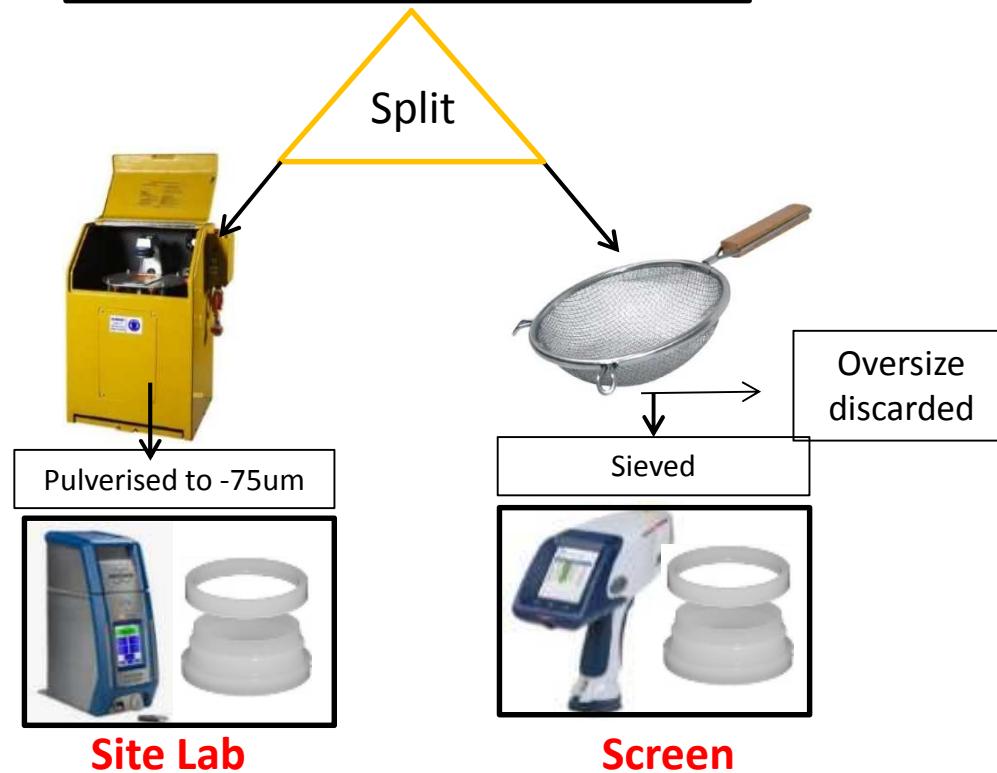


Stockpile Crushing Grade Control



Primary stockpile Grade Control

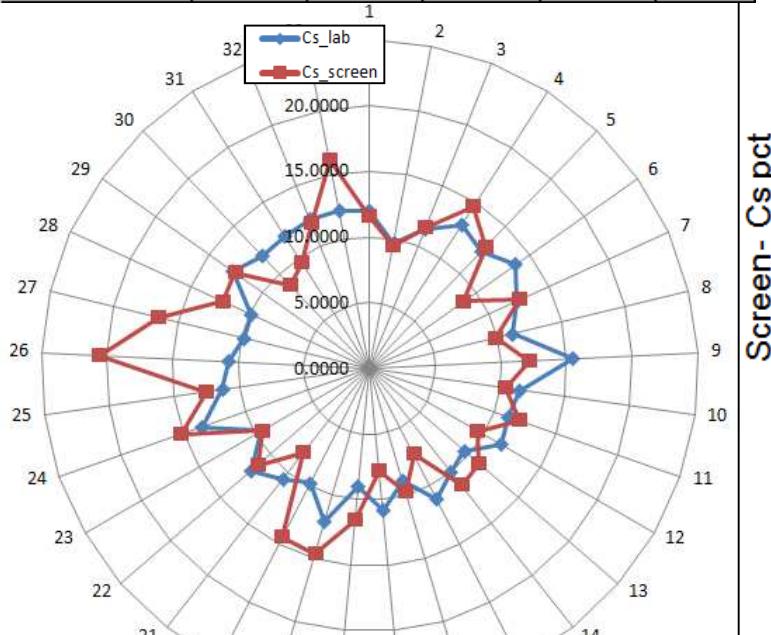
collected using 4 trenching shovels, combined then
riffle split, every 15 minutes



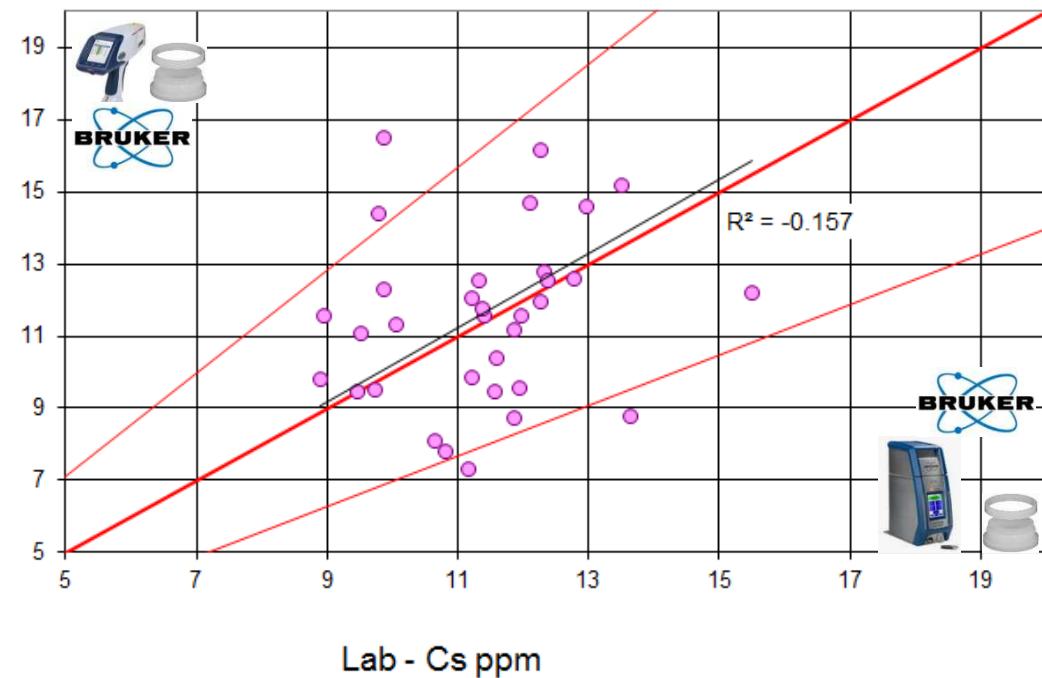
Stockpile Crushing Grade Control

Poor sample vs sample reproducibility - good “group” comparison – overall unacceptable

Rill2	Min	Max	Mean	RSD	Sdev
Cs_screen	7.32	20.58	11.76	24.07	2.83
Cs_lab	8.89	15.50	11.37	12.87	1.46

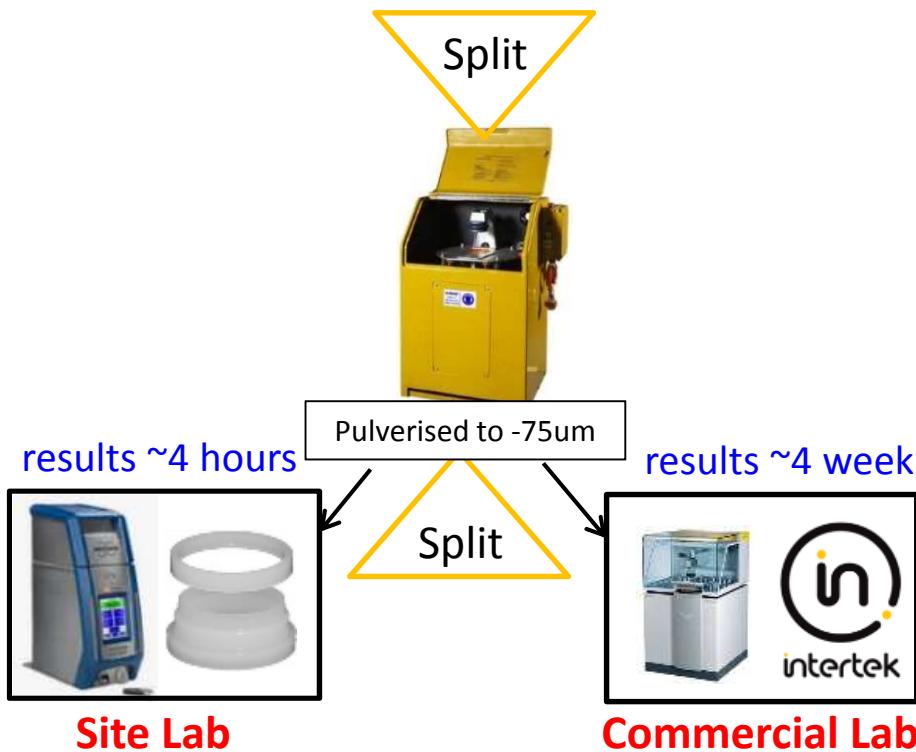


Sinclair Stockpile - Rill2
n = 34, mean screen 11.76% Cs, mean lab = 11.37% Cs

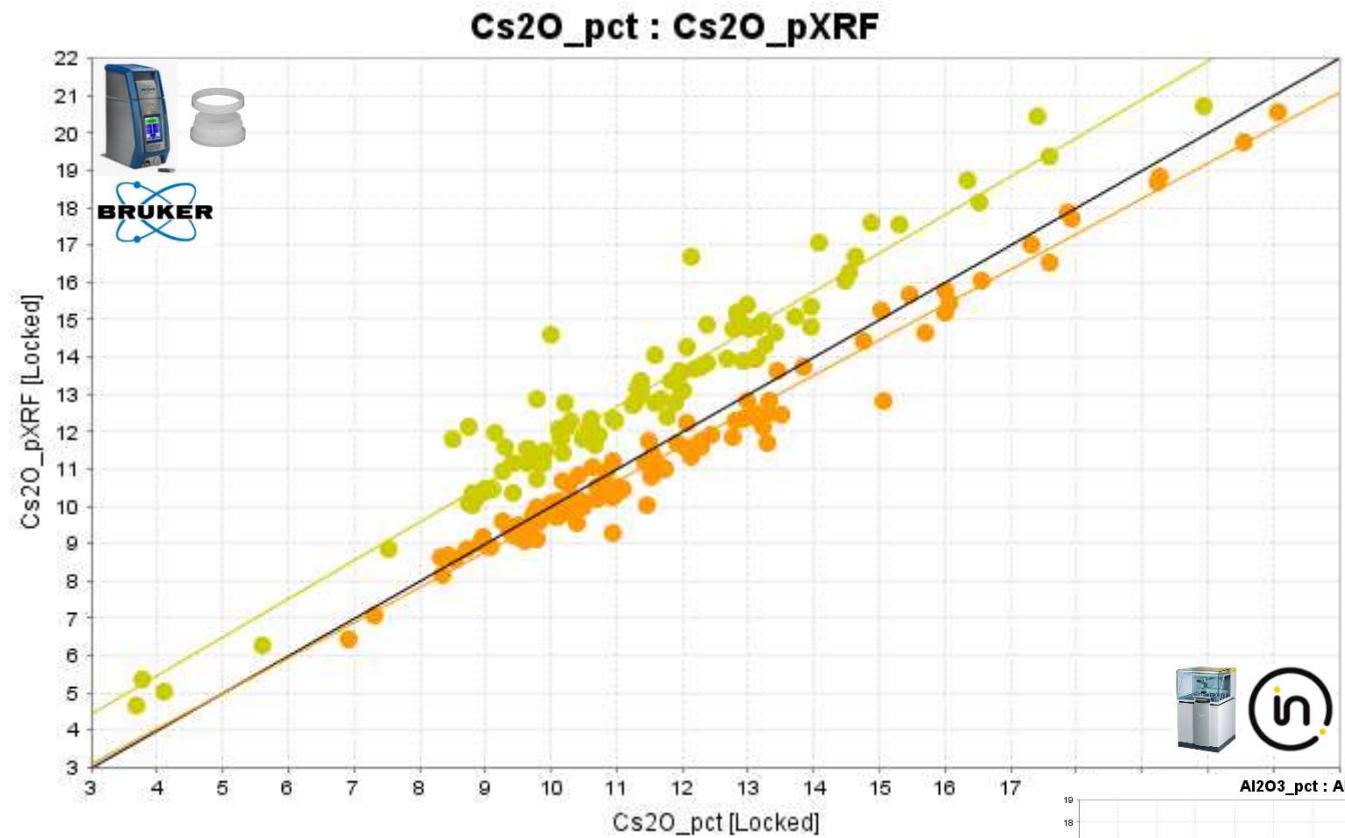


Primary stockpile Grade Control

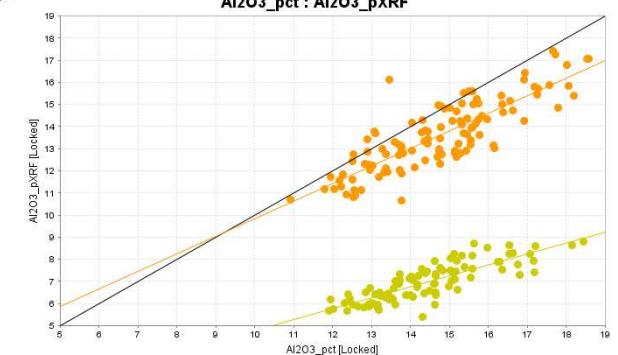
collected using 4 trenching shovels, combined then
riffle split, every 15 minutes



Stockpile – Crushing Lab check



Conundrum due to contaminated pXRF cups being reused
resulting in an increase in Cs and reduction of Al -



Mining Completed



ABN: 44 103 423 981

Tel: +61 8 9322 6974

Fax: +61 8 9486 9393

email: dcrook@PIOresources.com.au

Address: G/72 Kings Park Road
West Perth Western Australia 6005

POLLUCITE MINING COMPLETED FIRST SHIPMENT TO LEAVE AUSTRALIA THIS MONTH

Perth, Western Australia: 22 January 2019: Pioneer Resources Limited ("Pioneer" or the "Company") (ASX: PIO) is pleased to provide an update for its 100%-owned Sinclair Mine, Australia's first operation to extract the caesium mineral, pollucite, located 40km north of Norseman, Western Australia.

The contained caesium, being 1,640 tonnes, has outperformed the start-up Resource Estimate of 1,047 tonnes by an increase of 593 tonnes or 57%.

Mining
Completed



Shipment control

A large dump truck is shown from a low angle, its bed tilted to pour a massive, towering mound of white material, likely salt or grain, into a large industrial building. The building has a high ceiling with metal beams and fluorescent lighting. The text "Port Delivery" is overlaid in the upper right corner.

Port Delivery

Shipment Grade Control

Shipment Grade Control

collected using spear, combined then riffle split

Split



Pulverised to -75um

Split



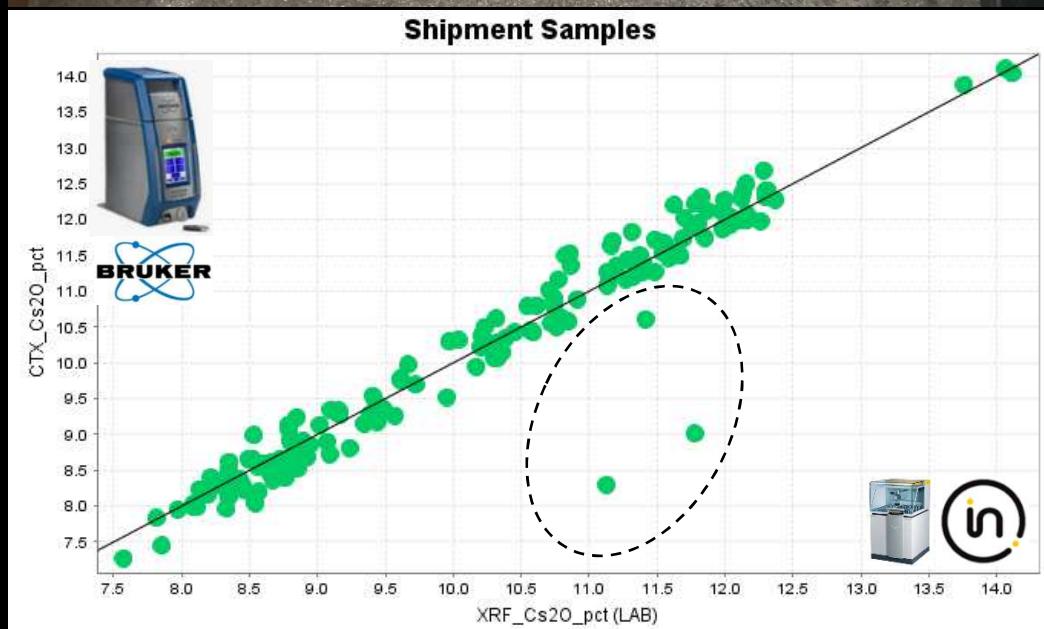
Site Lab



Commercial Lab



Shipment Grade control



Shipment Grade Control



Shipments Commence



ABN: 44 103 423 981

Tel: +61 8 9322 6974

email: pioneer@PIOresources.com.au

Address: Ground floor, 72 Kings Park Road

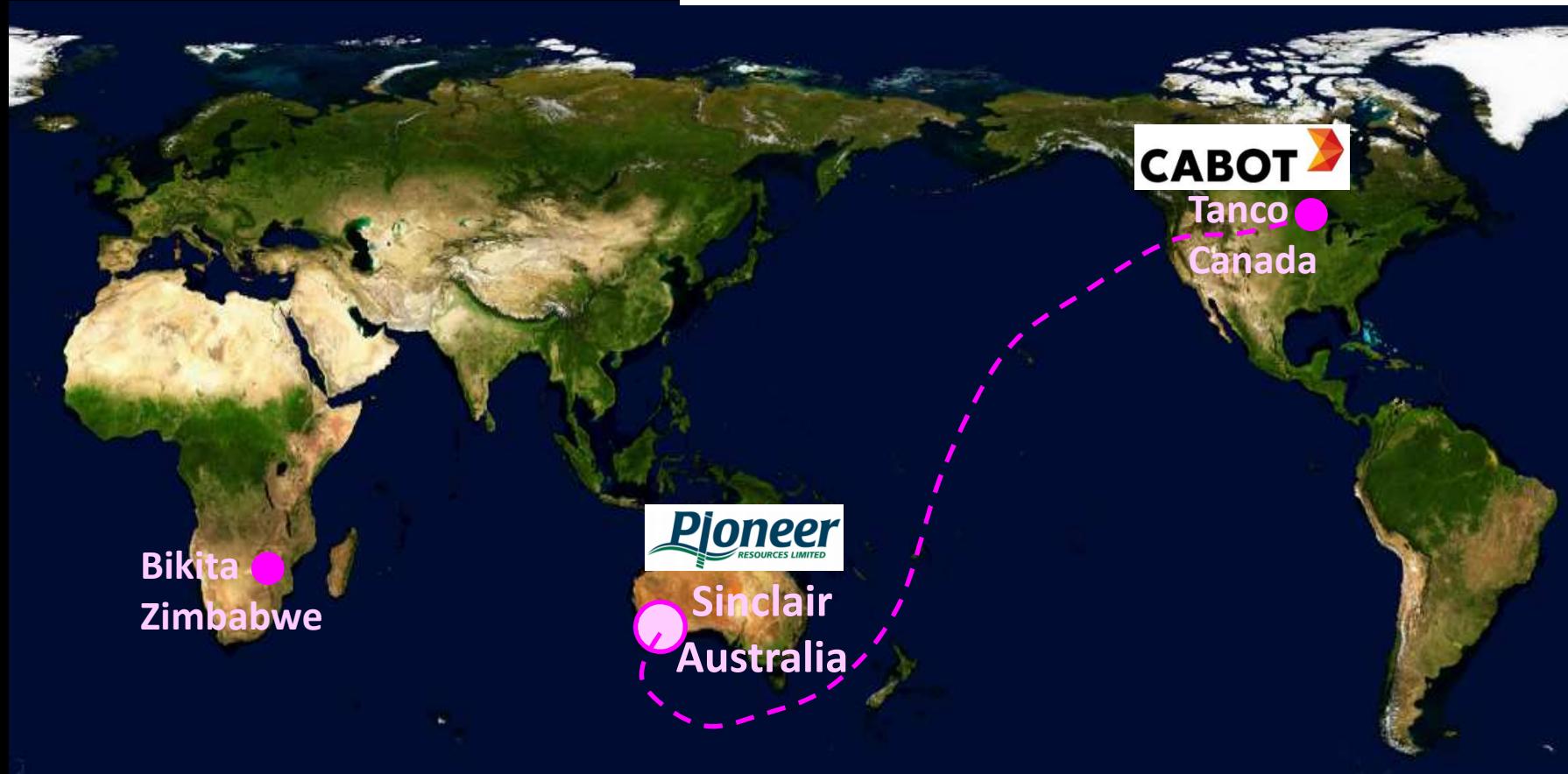
West Perth Western Australia 6005

Postal: PO Box 1787

West Perth Western Australia 6872

SINCLAIR MINE: SHIPMENTS OF POLLUCITE COMMENCE

Perth, Western Australia: 1 February 2019: Pioneer Resources Limited (ASX:PIO) ("Pioneer" or "the Company") is pleased to provide a further update in relation to the sale to pollucite ore to Cabot Specialty Fluids Ltd ("CabotSF") under the binding offtake and funding agreement between the parties (refer ASX release 20 June 2018).



Delivery: Shipment Arrives



ABN: 44 103 423 981

Tel: +61 8 9322 6974

Fax: +61 8 9486 9393

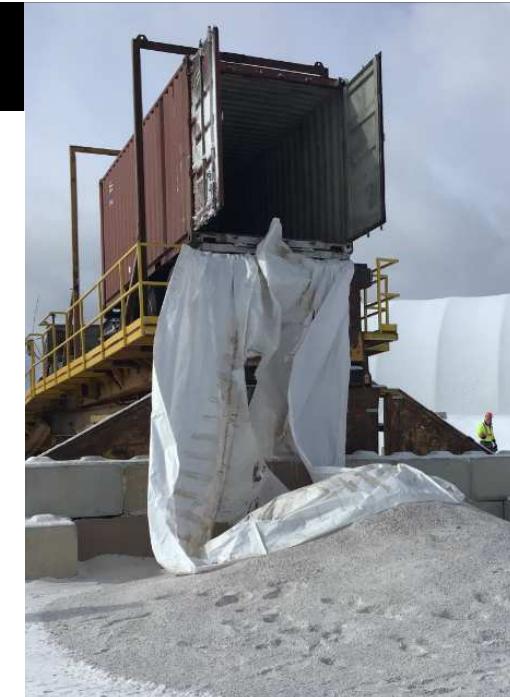
email: dcrook@PIOresources.com.au

Address: G/72 Kings Park Road
West Perth Western Australia 6005

FIRST POLLUCITE ARRIVES IN CANADA

REVISED SHIPMENT AND PAYMENT SCHEDULE SET OUT

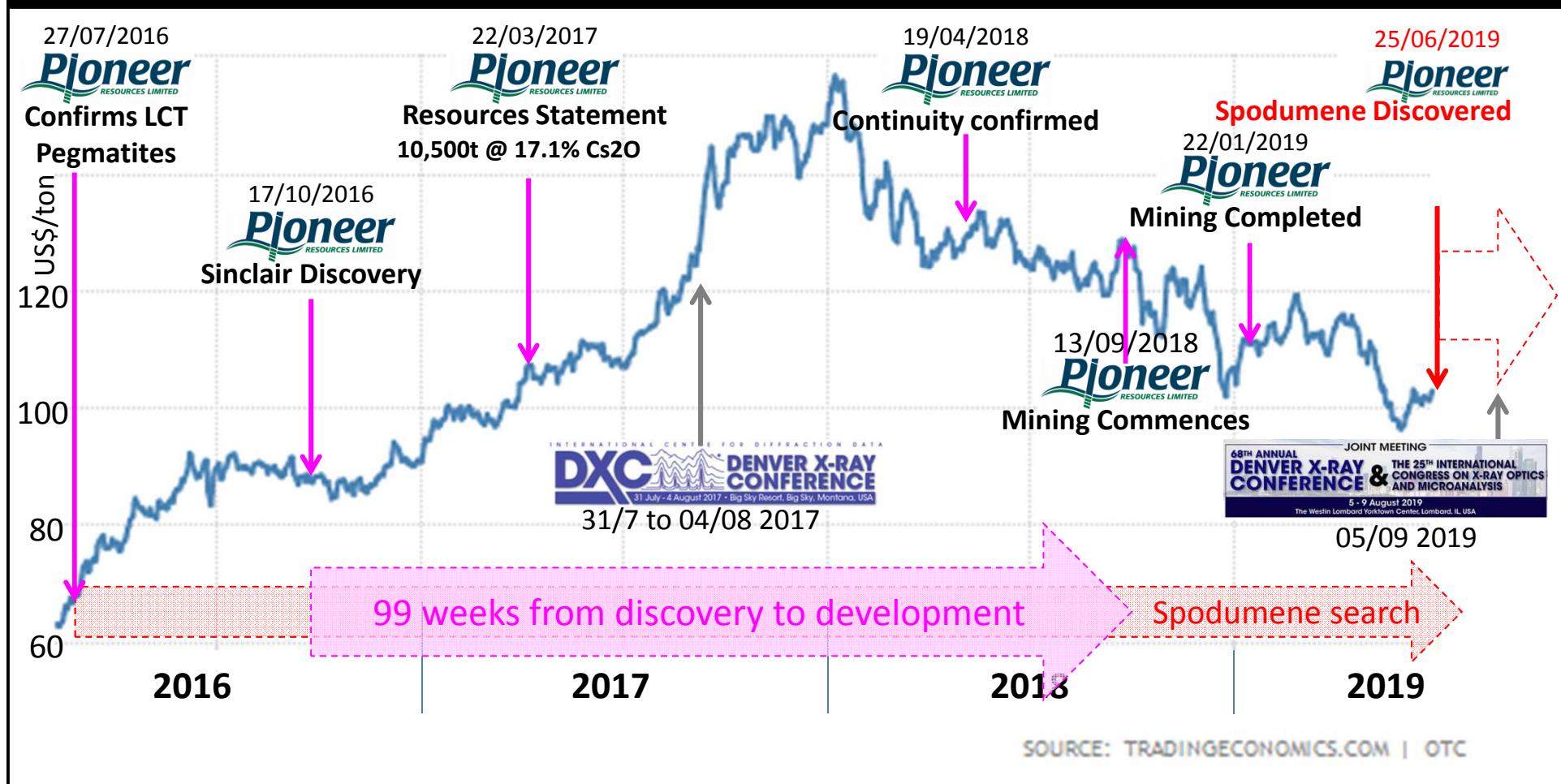
Perth, Western Australia: 17 April 2019: Pioneer Resources Limited ("Pioneer" or the "Company") (ASX: PIO) is pleased to provide an update for its 100%-owned Sinclair mining operation, Australia's first mine to extract the caesium mineral, pollucite, located 40km north of Norseman, Western Australia.



Summary

Stage	Instrument	Calibration	Validation
• Discovery		Lithium Index calibration	
• Delineation		Matrix matched Cs custom calibration v1	
• R&D		Matrix matched Cs custom calibration v2	
• Development		Matrix matched Cs custom calibration & Lithium Index calibration	
• Delivery		Matrix matched Cs custom calibration	

Discovery, Delineation, Development of Sinclair and the future...





Acknowledgements

- Denver X-Ray
- PIO
- pXRFs
- Bruker





HISTORY MAKING
First time Sodium measured in
the field on a pXRF in AIR
13th July 2018, Kalgoorlie

