Mineral Resources Tasmania

Mineralogical/Petrology Report
LJN2021-074

MINERALOGICAL ANALYSES, STOLZITE /WULFENITE, KARA MINE

An unpublished Mineral Resources Tasmania Report for:

M. Latham

By: R.S. Bottrill

Date: 17/8/2021

Department of Infrastructure, Energy and Resources
Mineral Resources Tasmania

Tasmania
Explore the possibilities

SUMMARY

Two samples of stolzite/wulfenite from the Kara mine were analysed. Wulfenite $Pb(MoO_4)$ and stolzite $Pb(WO_4)$ are the end-members of an isomorphic series where tungsten and molybdenum may substitute for each other. The pale-yellow micareous crystals were found to be tungsten bearing wulfenite $Pb(Mo_{0.8}W_{0.2})$*.and the red-orange crystals contained mostly stolzite with minor strontium and molybdenum* $(Pb_{0.9}Sr_{0.1})(Mo_{0.1}W_{0.9})$*. However, previous study of the Kara mine minerals revealed some yellow-orange wulfenite specimen may contain high W-stolzite component (~40 mol. %) and, vice versa, red-orange specimens may contain high Mo-wulfenite (~40 mol. %)f. After comparison with previous study, it appears unlikely that we can visually distinguish the stolzites and wulfenites from the Kara mine, and they should be labelled stolzite/wulfenite.*

INTRODUCTION

One mineral sample (comprising several related specimens) was received from Mathew Latham, for mineralogical analysis. Sample details are shown in Table 1. As it visually appeared to contain rare minerals not well described in Tasmania it was selected for a detailed mineralogical study.

TABLE 1: SAMPLE DETAILS.

Reg. No	Location	Description
C113537a	Kara	Stolzite/wulfenite-pale yellow
C113537b	Kara	Stolzite/wulfenite -red-orange

PROCESSES

Some small representative parts of two subsamples were extracted and mounted on Al stubs for SEM/EDS analysis in the CSL.

SAMPLE DESCRIPTIONS

C113537a is a medium grained, weathered epidote skarn with a surface speckled with numerous pale yellow to cream coloured, translucent, tetragonal platey to micaceous crystals to about 2mm across (Figs. 1 - 2).

Fig. 1: Sample C113537a, showing drusy, pale yellow wulfenite crystals. FOV: about 35 mm.

Fig. 2: Sample C113537a, showing drusy, pale yellow wulfenite crystals. FOV: about 25 mm.

C113537b is a coarsely crystalline, vuggy quartz - fluorite -skarn rock with cavities containing bright orange, translucent, tetragonal, irregular platey to lenticular crystals to about 2mm across (Figs. 3 - 4).

Fig. 4: Sample C113537b showing orange stolzite crystals with purple fluorite, white quartz and green epidote skarn. FOV: about 25 mm.

Fig. 4: Sample C113537b showing orange stolzite crystals with purple fluorite, white quartz and green epidote skarn. FOV: about 25 mm.

SEM/EDAX ANALYSES

The sample was analysed by SEM-EDS, in the CSL, University of Tasmania, with analytical conditions shown in Appendix 1. The results are given in Appendix 2 and summarised below.

C113537a Kara Wulfenite, pale yellow

The bladed crystals (Fig. 5) are all tungsten-bearing wulfenite, averaging about $Pb(Mo_{0.8}W_{0.2})$.

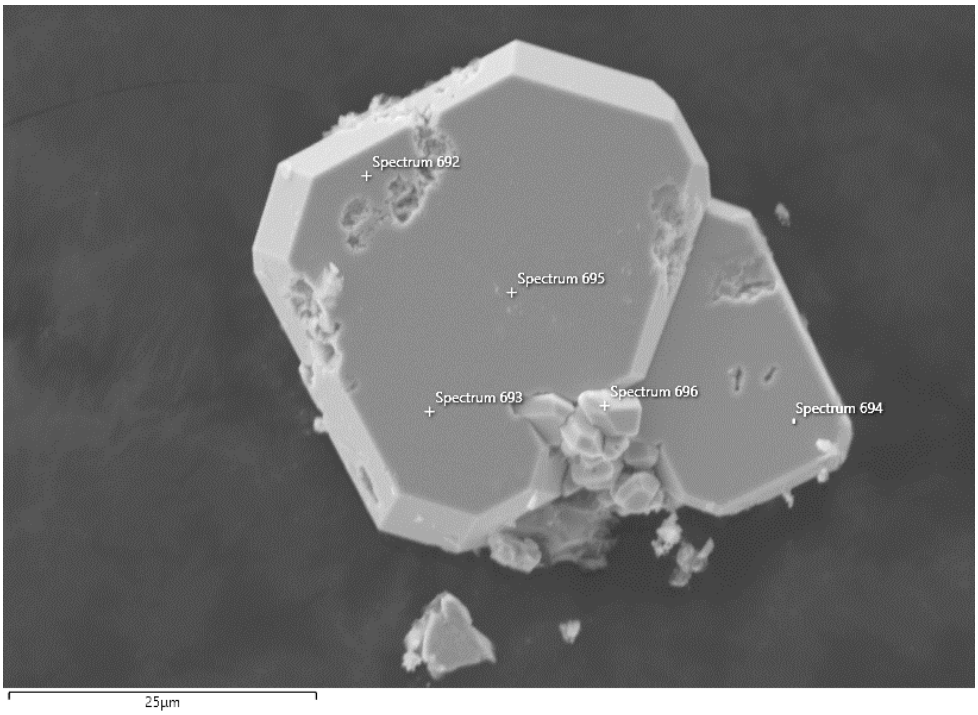

Fig. 5. C113537a Bladed stolzite crystals, with some botryoidal saponite. Backscattered electron image (BSE).

The associated green crystals are epidote: $(Ca_{1.8}Fe_{0.1})(Al_{2.2}Fe_{0.8})Si_{3.1}O_{11}(OH)$

C113537b Kara Stolzite: red-orange

The blocky crystals (Fig. 6) are mostly stolzite, with minor Mo and Sr, with minor W-bearing wulfenite, overall averaging about $(Pb_{0.9}Sr_{0.1})(Mo_{0.1}W_{0.9})$.

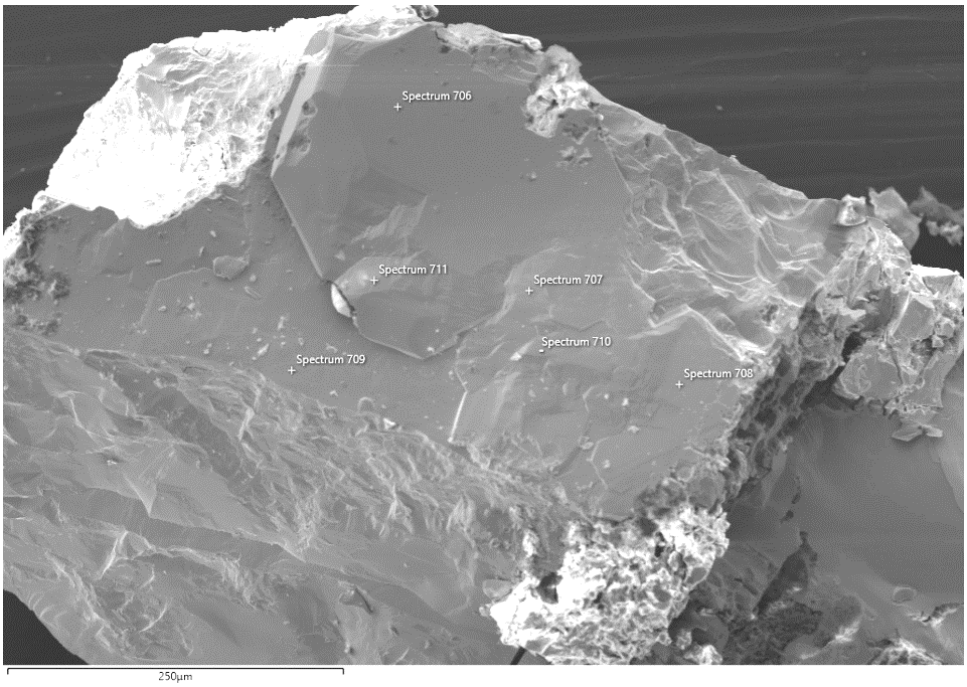

Fig. 6. C113537b Irregular wulfenite crystals, with some botryoidal saponite. Backscattered electron image (BSE).

DISCUSSION

C113537a is a medium grained, weathered epidote skarn with pale yellow, micaceous wulfenite crystals.

C113537b is a coarsely crystalline, vuggy quartz - fluorite -skarn rock with cavities containing bright orange, irregular platy crystals of stolzite.

In previous work, another sample from Kara very similar to C113537b was found to contain a W-rich wulfenite, with about 40 mol.% of stolzite, plus epidote (Bottrill & Unwin, 2019), while a more blocky yellow-orange crystal was about 60% stolzite.

It appears unlikely that we can visually distinguish the stolzite and wulfenite specimens from the Kara mine, and they should be labelled stolzite/wulfenite if not specifically analysed.

References

Bottrill, R.S. and Unwin, L, 2019. Mineralogical Analyses, Mineralogical analyses, Kara, Avebury & Luina. MRT Laboratory Report. LJN2019-116

R.S. Bottrill
MINERALOGIST/PETROLOGIST

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Appendix 1: Laboratory Report –SEM analytical conditions

Hitachi SU-70 analytical field emission SEM

- Installed February 2011
- Schottky thermal field emission source
- ultra-high resolution (1.0 nm @ 15kV, 1.6 nm @ 1kV for SE imaging)
- high vacuum operation only (i.e. no variable pressure in chamber)
- Hitachi in-chamber and in-lens scintillation detectors, Super ExB filter, beam deceleration
- Hitachi in-chamber 5-segment solid state BSE detector, retractable
- in-column Faraday cup with picoammeter for beam current measurement
- anticontamination cold plate, liquid nitrogen cooled
- 5 axis motorised fully eucentric stage, XYZ range 110x110x40mm
- Oxford AZtec EDS/EBSD system with
    - X-Max 80 SDD EDS, MnKa 125 eV resolution, elements B-U, large area hyperspectral mapping, standardless and standards-based quantification, feature analysis
    - HKL NordlysNano EBSD camera & forescatter detector system, HKL & Channel 5 software packages, Synergy EDS/EBSD integration, HKL, ICSD & American Mineralogist phase databases
- Gatan ChromaCL2 colour cathodoluminescence imaging system with integrated BSE detector, Digital Micrograph 3 software, automated mosaic acquisition, simultaneous acquisition of SE, iBSE and colour CL images.

Label:	am 179
Element List Type:	Current
Processing Option:	All Elements
Specimen Coating:	On
Beam Calibration Element Coating:	Off
Coating Element:	Carbon
Coating Thickness:	20 nm
Coating Density:	2.25 g/cm³
Automatic Line Selection:	Disabled
Normalization:	Enabled
Thresholding:	Sigma level = 1
Detector Window Correction:	Enabled
Deconvolution Elements:	None
Selected Standards:	Minerals_15kV_2017-10-20 [User]
Pulse Pile Up Correction:	Succeeded
Detector file:	X-Max 3
Efficiency:	File based

Appendix 2: Laboratory Report –SEM Analyses

Client: M Latham
Sample Location: Kara mine
Job Number: LJN2021-074
Analyses: Mineral chemistry
Methods: SEM-EDS
Analyst: R Bottrill
Date: 11/8/2021

Table 1: C113537a Wulfenite EDS analyses (at. %, 2 cations).

Label	Ca	Mn	Fe	Sr	Mo	W	Pb
682	0.00	0.00	0.00	0.00	0.72	0.23	1.05
683	0.00	0.00	0.00	0.00	0.74	0.22	1.04
684	0.00	0.00	0.00	0.00	0.73	0.22	1.04
685	0.00	0.00	0.00	0.00	0.73	0.22	1.04
686	0.00	0.00	0.00	0.00	0.73	0.23	1.04
689	0.02	0.00	0.02	0.00	0.76	0.19	1.01
692	0.00	0.00	0.00	0.00	0.75	0.22	1.03
693	0.00	0.00	0.00	0.00	0.74	0.21	1.04
694	0.00	0.00	0.00	0.00	0.76	0.21	1.04
695	0.00	0.00	0.00	0.00	0.74	0.21	1.05
697	0.00	0.00	0.00	0.00	0.73	0.23	1.04
698	0.00	0.00	0.00	0.00	0.71	0.22	1.07
699	0.00	0.00	0.00	0.00	0.74	0.21	1.05
700	0.00	0.00	0.00	0.04	0.73	0.22	1.01
701	0.00	0.00	0.00	0.00	0.72	0.21	1.06
702	0.00	0.00	0.00	0.05	0.71	0.22	1.02
703	0.00	0.00	0.00	0.03	0.77	0.17	1.03
705	0.02	0.02	0.00	0.02	0.73	0.21	0.99
ave.	0.00	0.00	0.00	0.03	0.73	0.21	1.02

Table 2: C113537a Epidote EDS analyses (at. %, 8 cations).

Label	Al	Si	Ca	Mn	Fe
687	2.14	3.08	1.80	0.07	0.92
688	2.25	3.16	1.72	0.02	0.86
690	2.07	3.03	1.92	0.05	0.94
691	2.28	3.14	1.74	0.00	0.84
704	2.39	3.14	1.74	0.00	0.73
ave.	2.23	3.11	1.78	0.03	0.86

Table 3: C113537b Stolzite/wulfenite EDS analyses (at. %, 2 cations).

Label	Sr	Mo	W	Pb
706	0.00	0.00	0.95	1.05
707	0.00	0.00	0.95	1.05
708	0.17	0.00	0.83	1.00
709	0.17	0.00	0.84	0.99
710	0.17	0.00	0.84	1.00
711	0.15	0.06	0.80	0.98
712	0.16	0.16	0.71	0.97
713	0.14	0.00	0.79	1.07
714	0.00	0.00	0.90	1.10
715	0.00	0.00	0.89	1.11
716	0.00	0.00	0.91	1.09
718	0.14	0.00	0.80	1.06
719	0.15	0.00	0.78	1.07
721	0.00	0.20	0.75	1.04
724	0.00	0.71	0.24	1.05
725	0.14	0.00	0.80	1.06
726	0.00	0.00	0.91	1.09
727	0.14	0.00	0.79	1.07
average	0.09	0.06	0.81	1.05

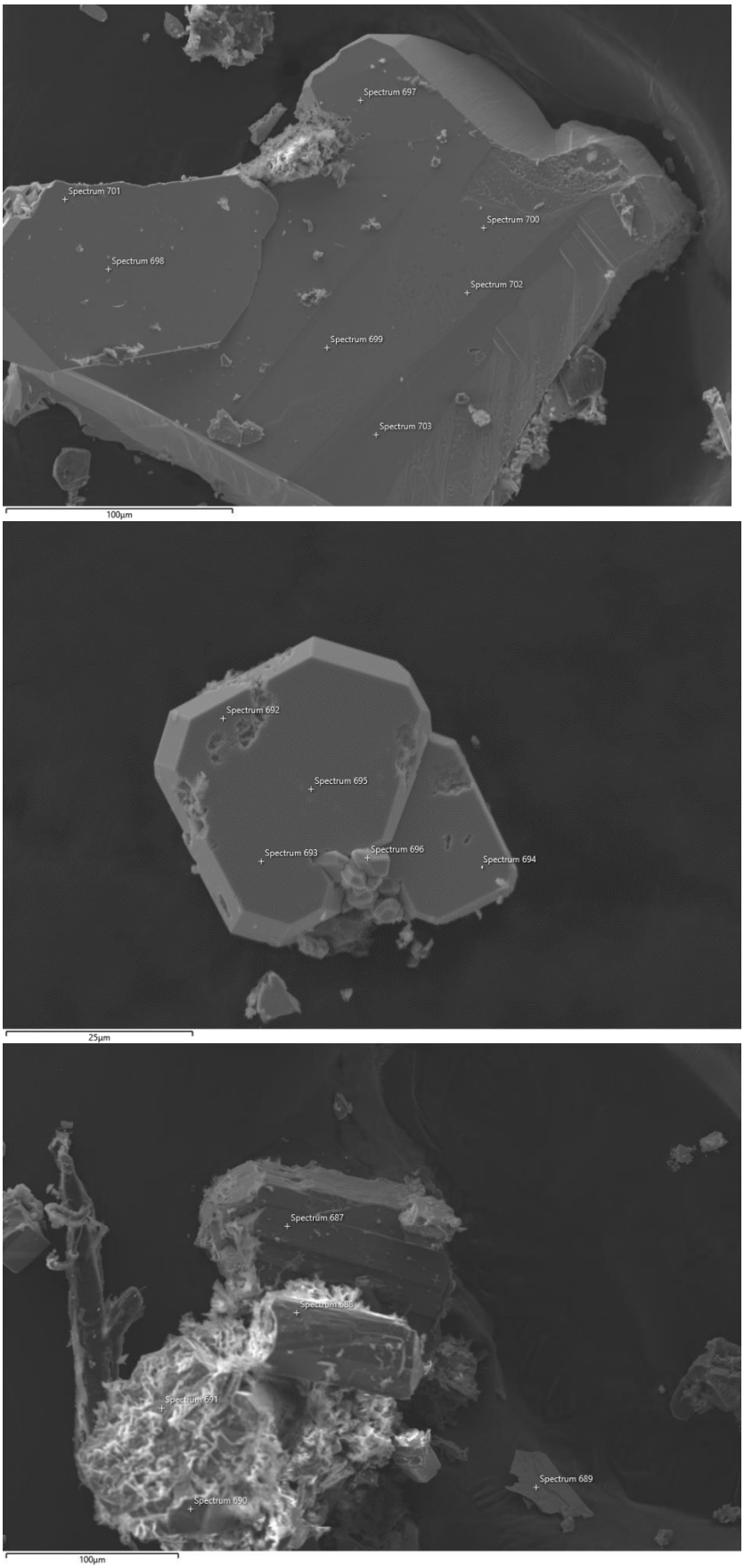

Fig. 1: Electron micrographs with sample points: C113537a

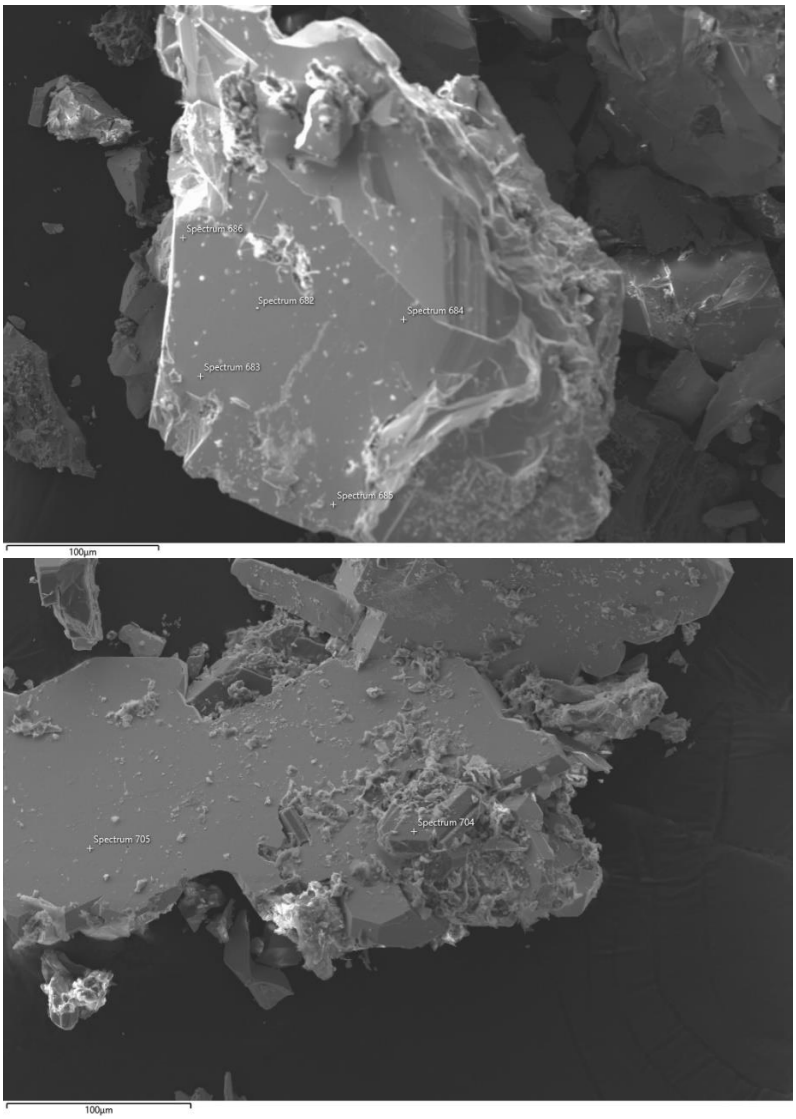

Fig. 2. Electron micrographs with sample points: C113537a

B

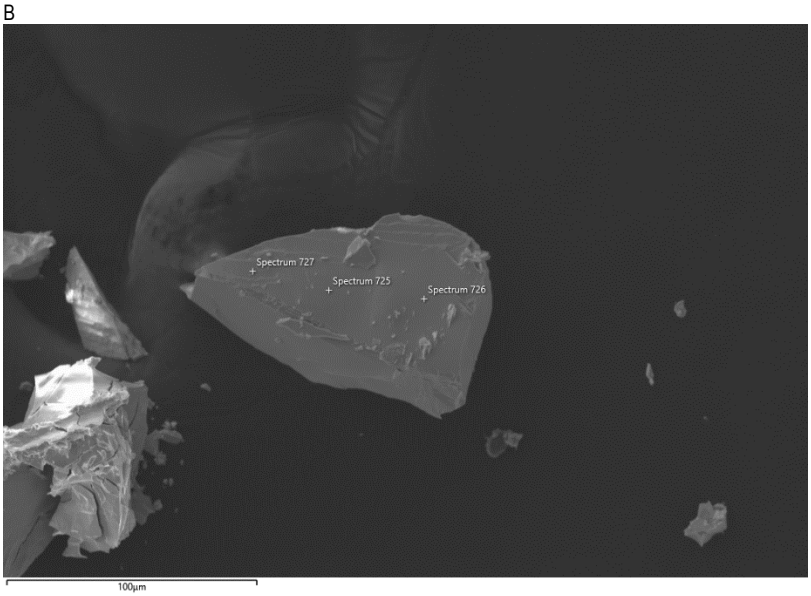

Fig. 3: Electron micrographs with sample points: C113537b

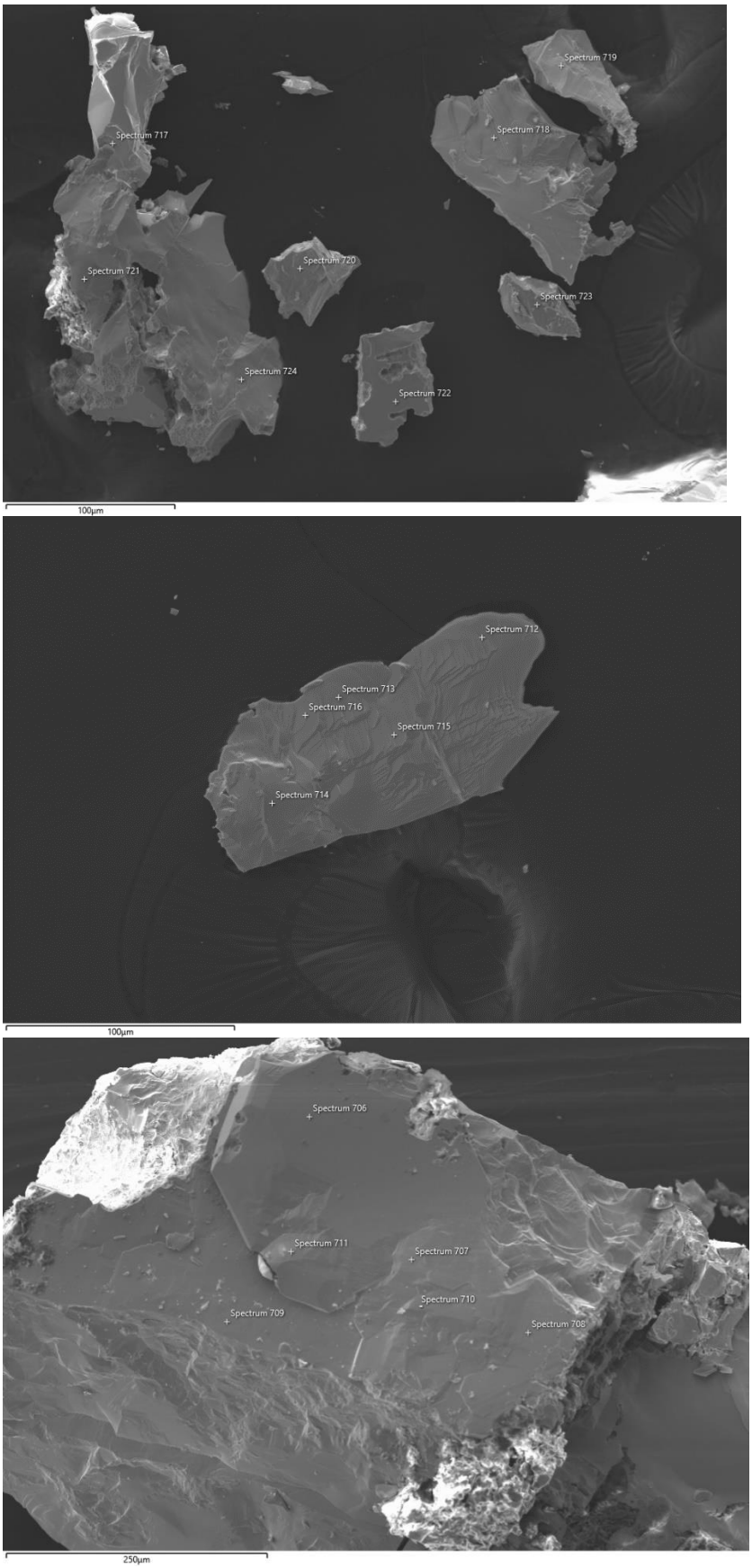

Fig. 4: Electron micrographs with sample points: C113537b