

# **Hyper-enrichment of heavy rare earth element in highly evolved granites through multiple hydrothermal mobilization**

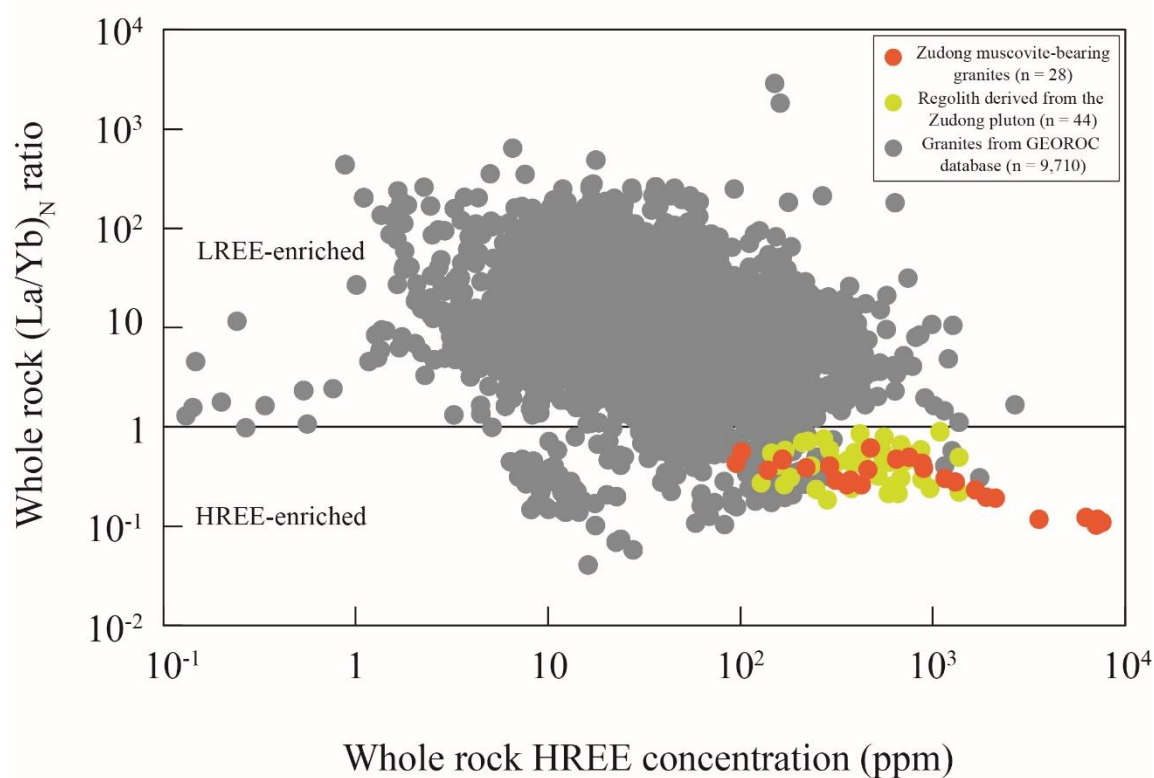
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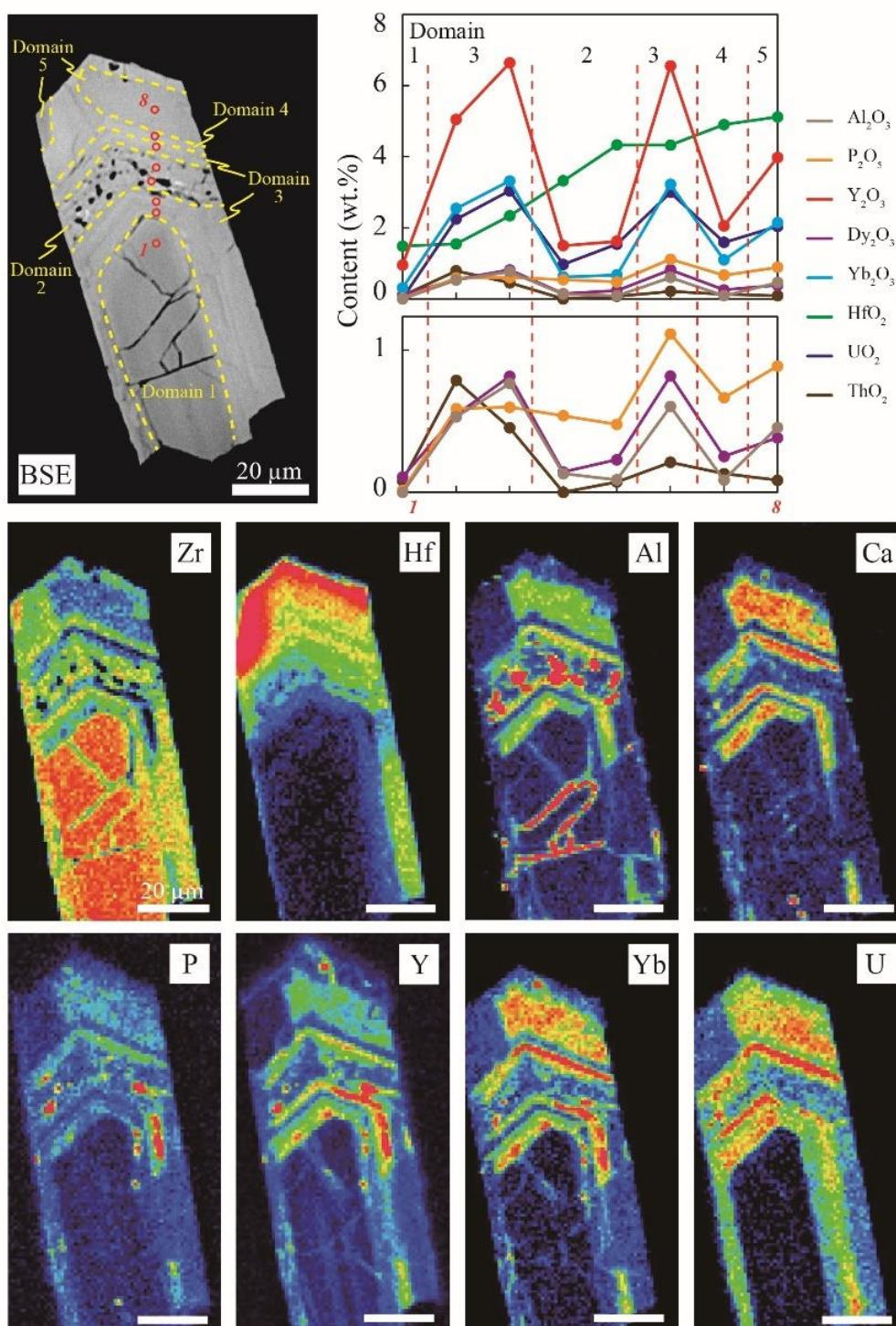
## **Supplementary Information**

### **This PDF file includes:**

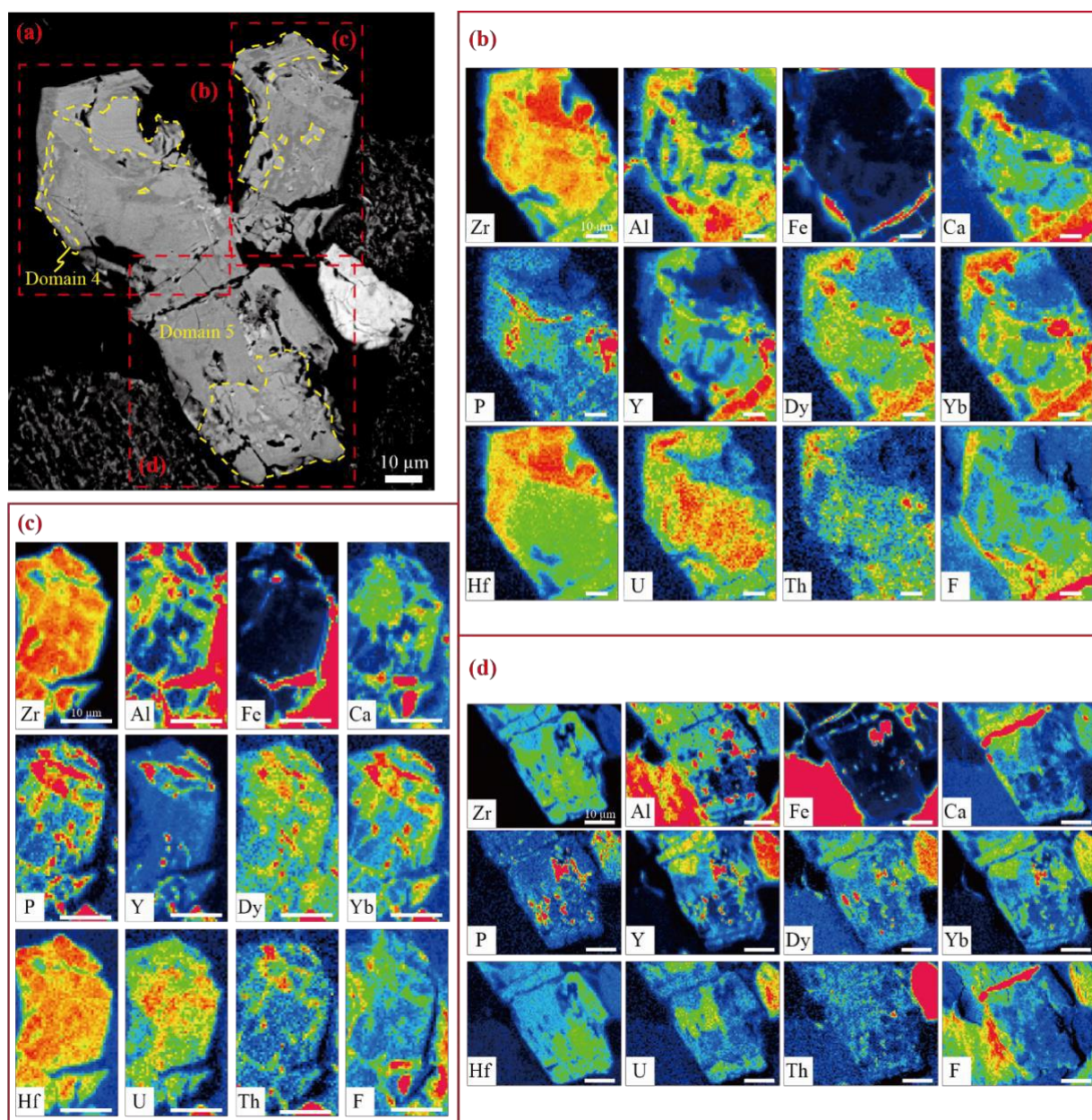
Figure S1 – S6  
Representative EDS spectra of synchysite



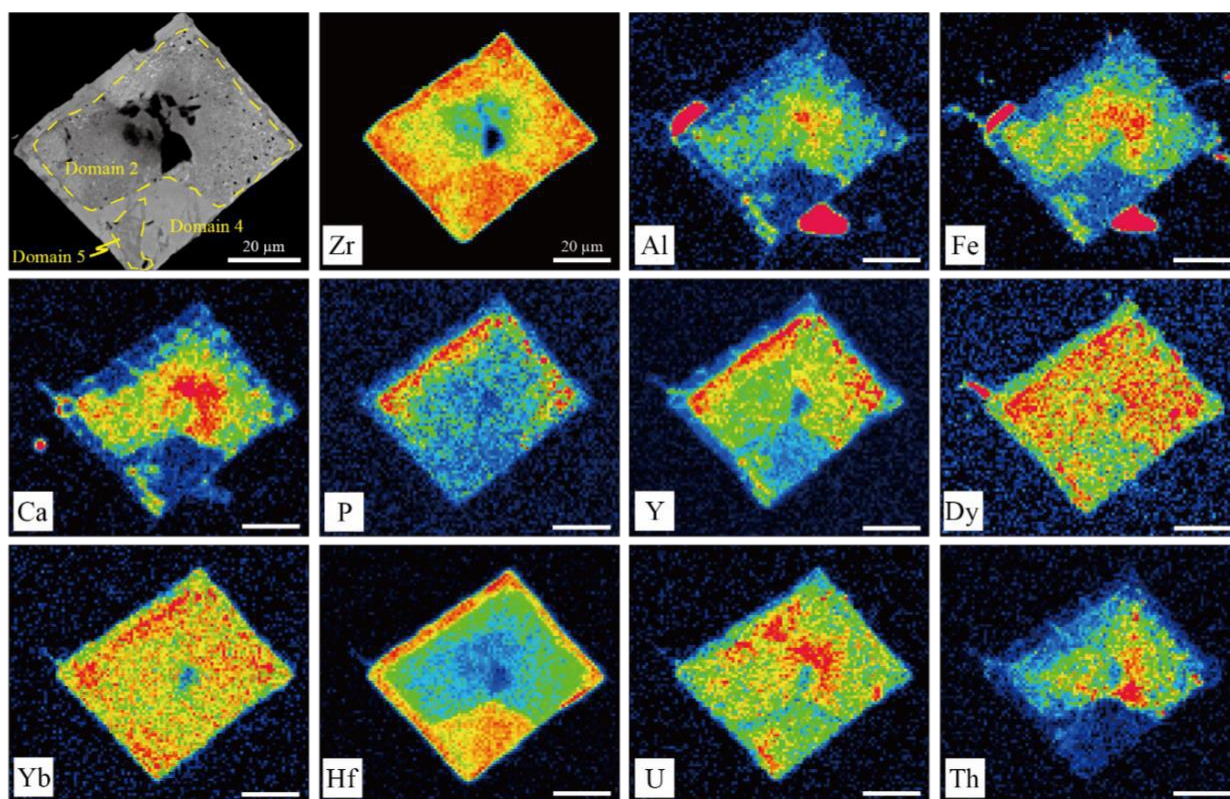
**Figure S1.** Whole-rock HREE concentrations and (La/Yb)<sub>N</sub> ratios of Zudong muscovite-bearing granites and the regolith derived from the Zudong pluton compared to those from the GEOROC database.



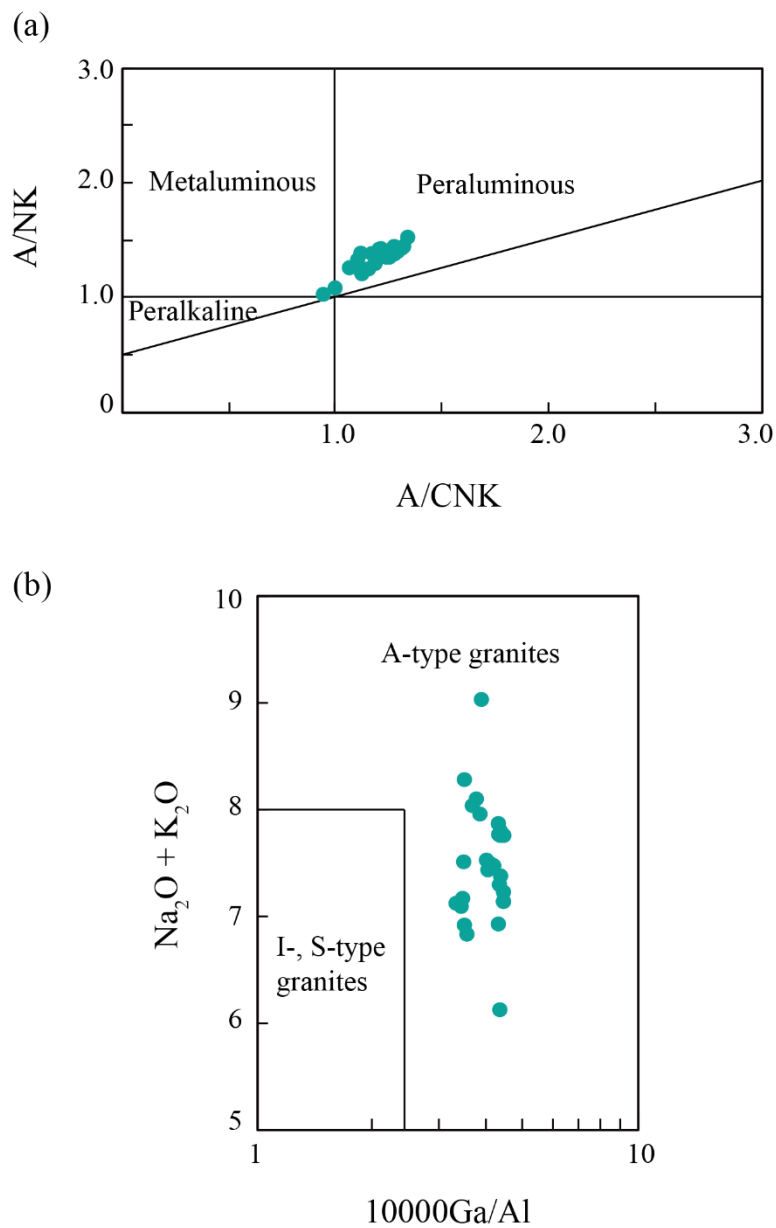
**Figure S2.** Images and elemental compositions of representative zircon grain in the Zudong granite.



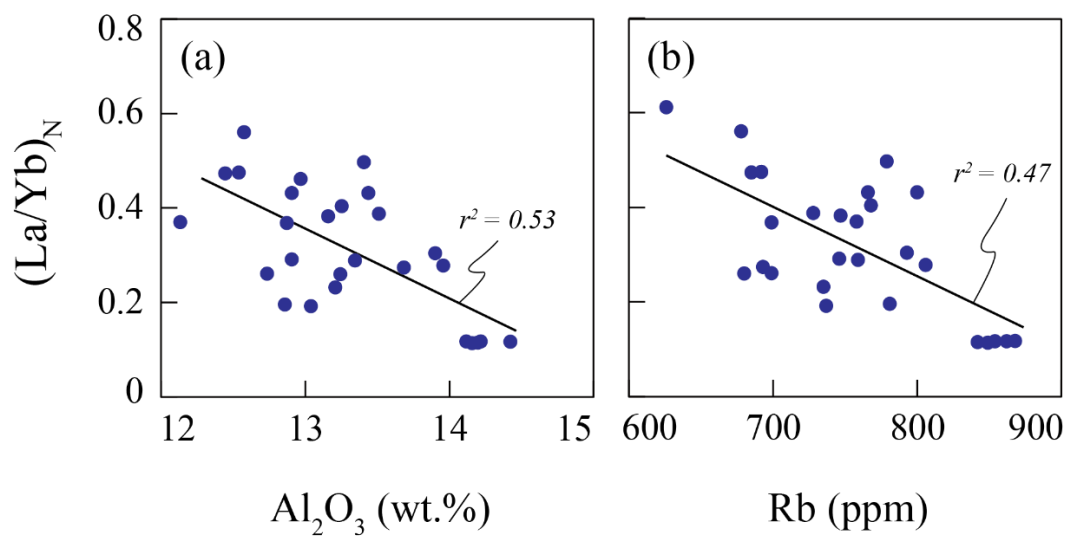
**Figure S3.** Elemental mapping of a representative zircon grain in the Zudong granite.



**Figure S4.** Elemental mapping of a representative zircon grain in the Zudong granite.



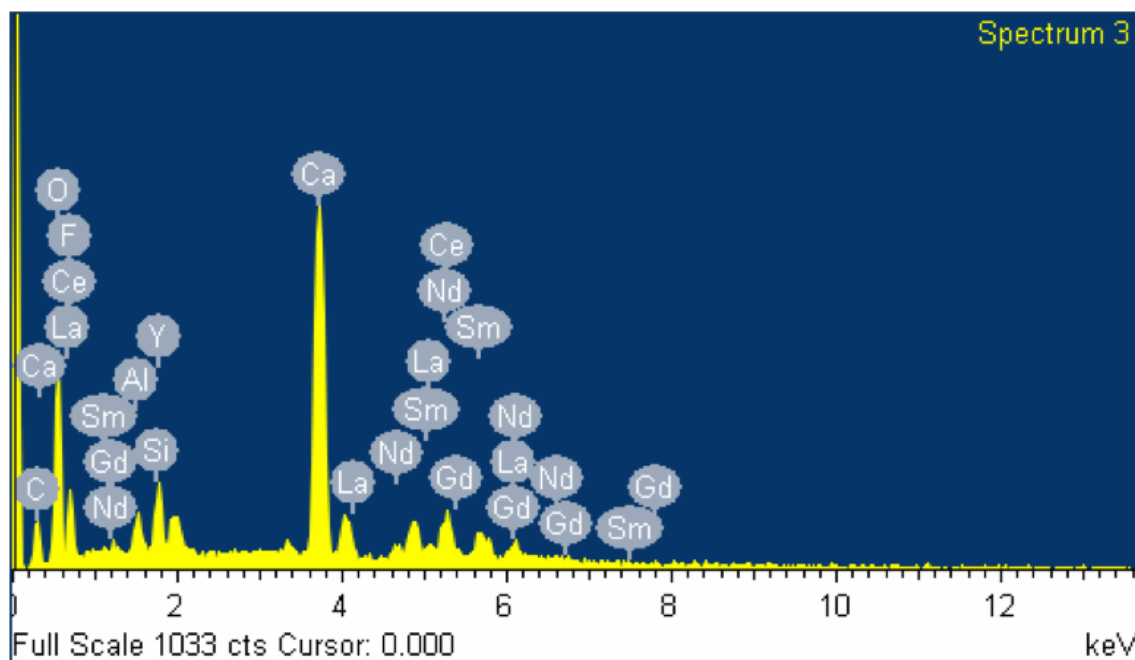
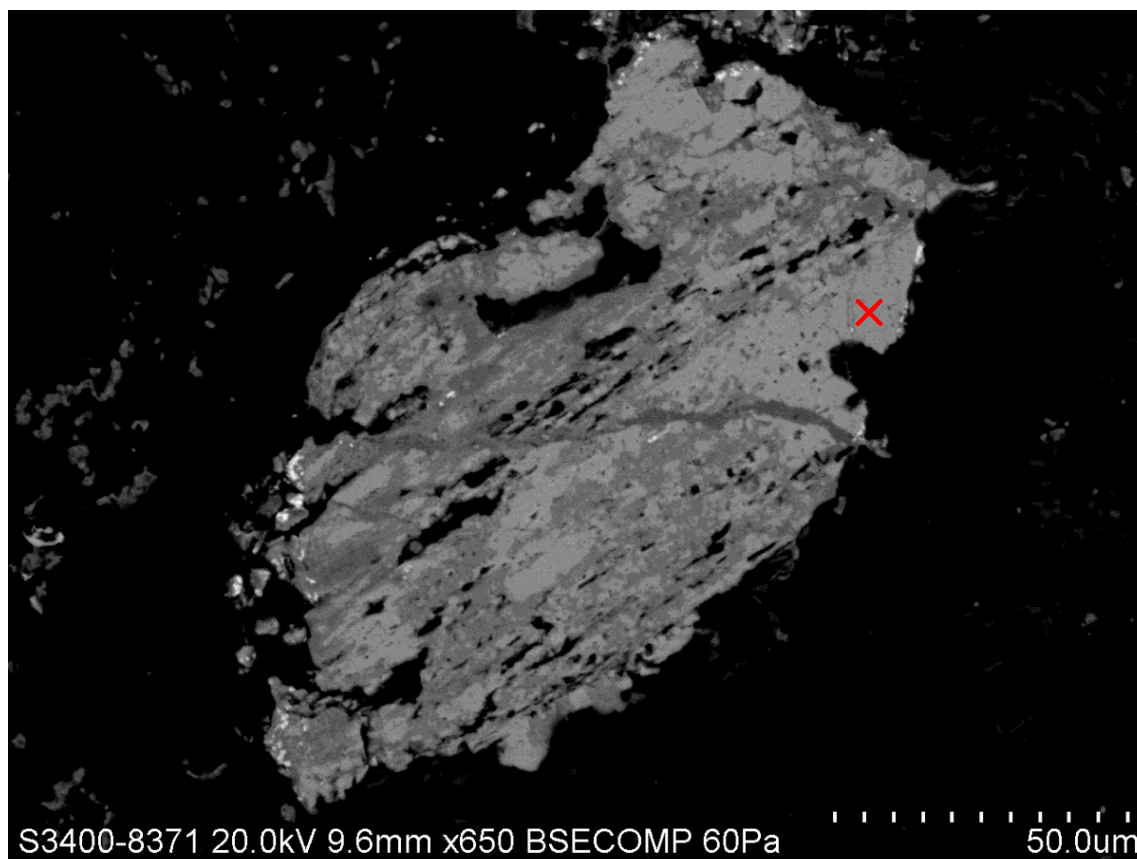
**Figure S5.** Discrimination diagrams for the affinity of the Zudong granites.



**Figure S6.** Bivariant correlations between the whole-rock (La/Yb)<sub>N</sub> ratio and selected elements.

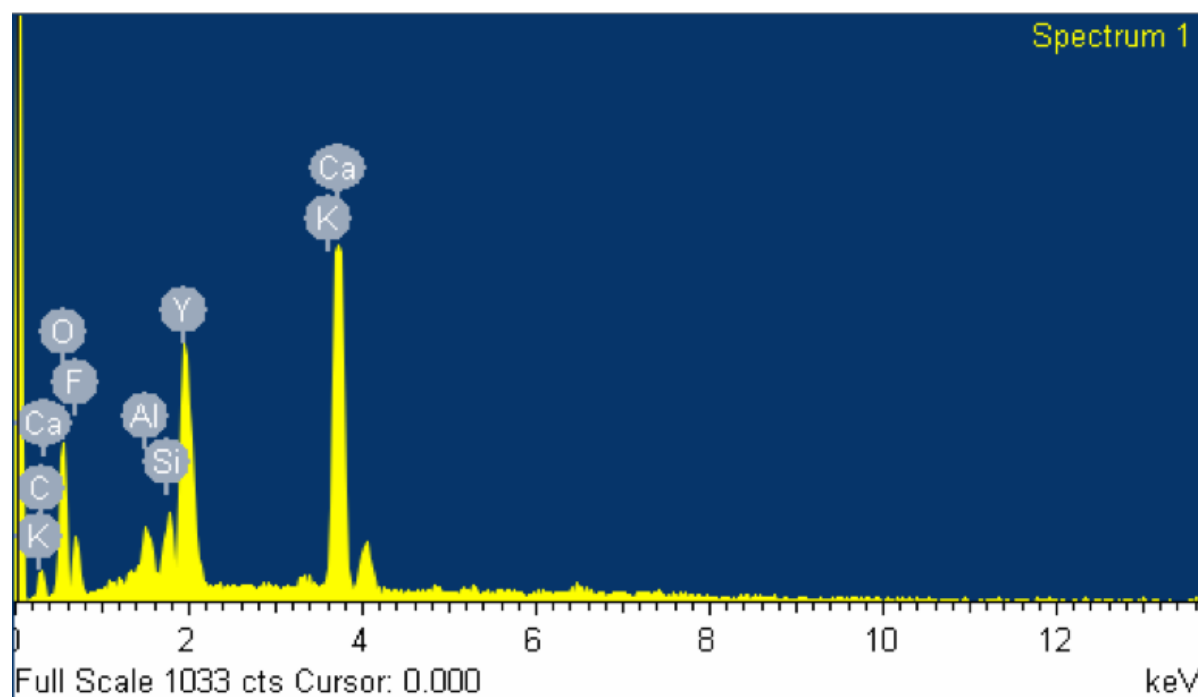
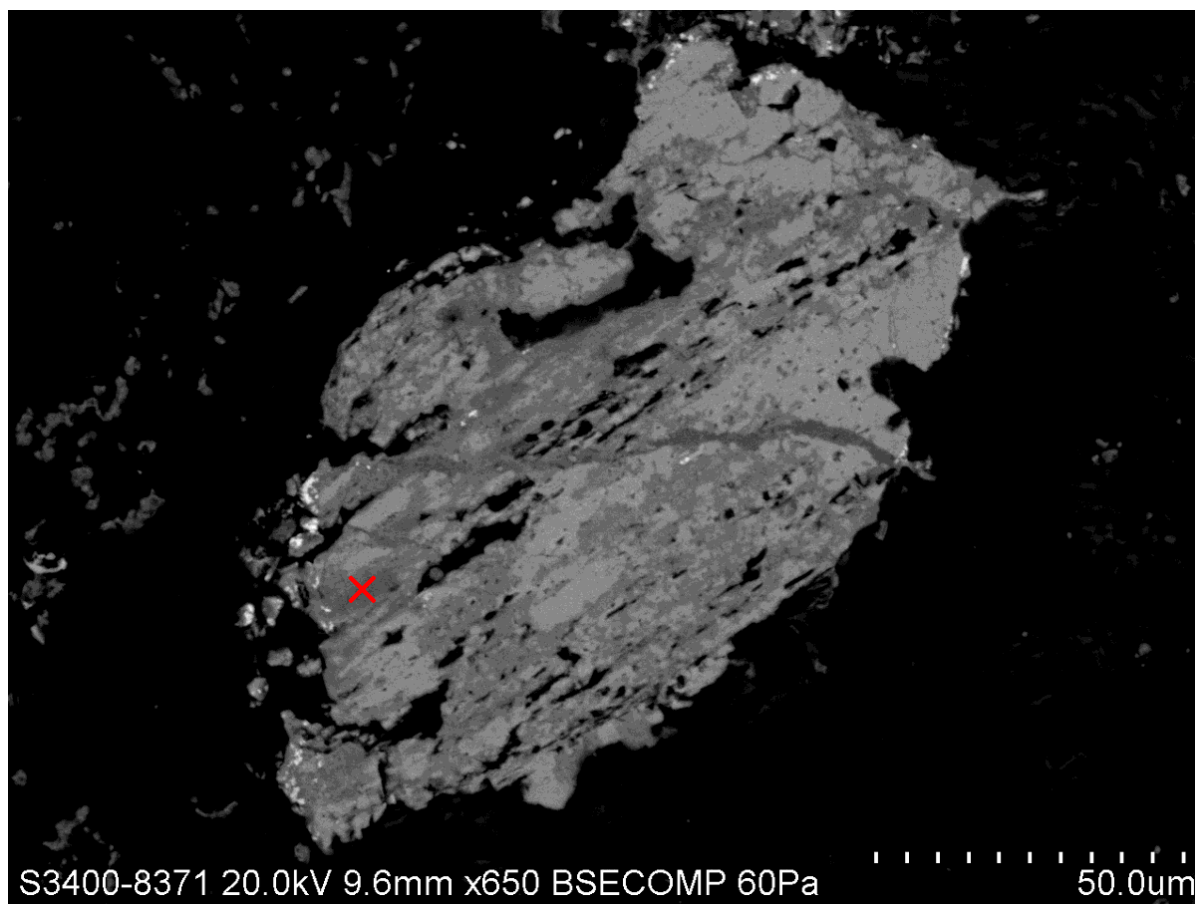
## Representative EDS analytical results

### Point #1 – Synchysite-(Ce)



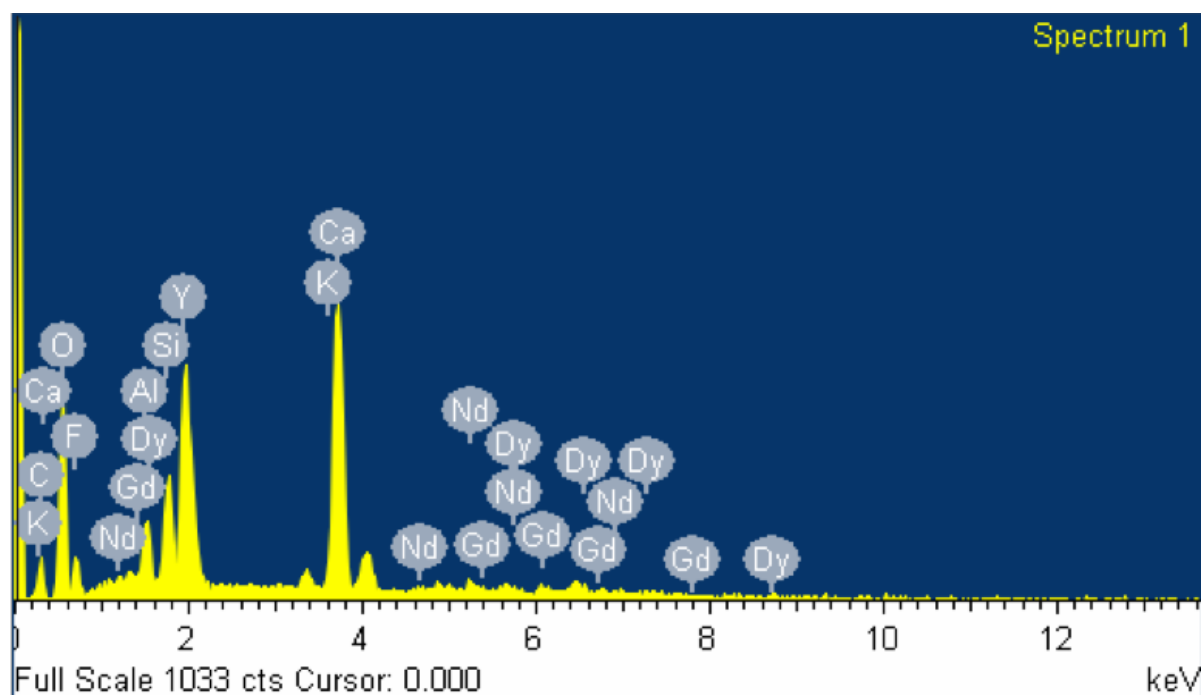
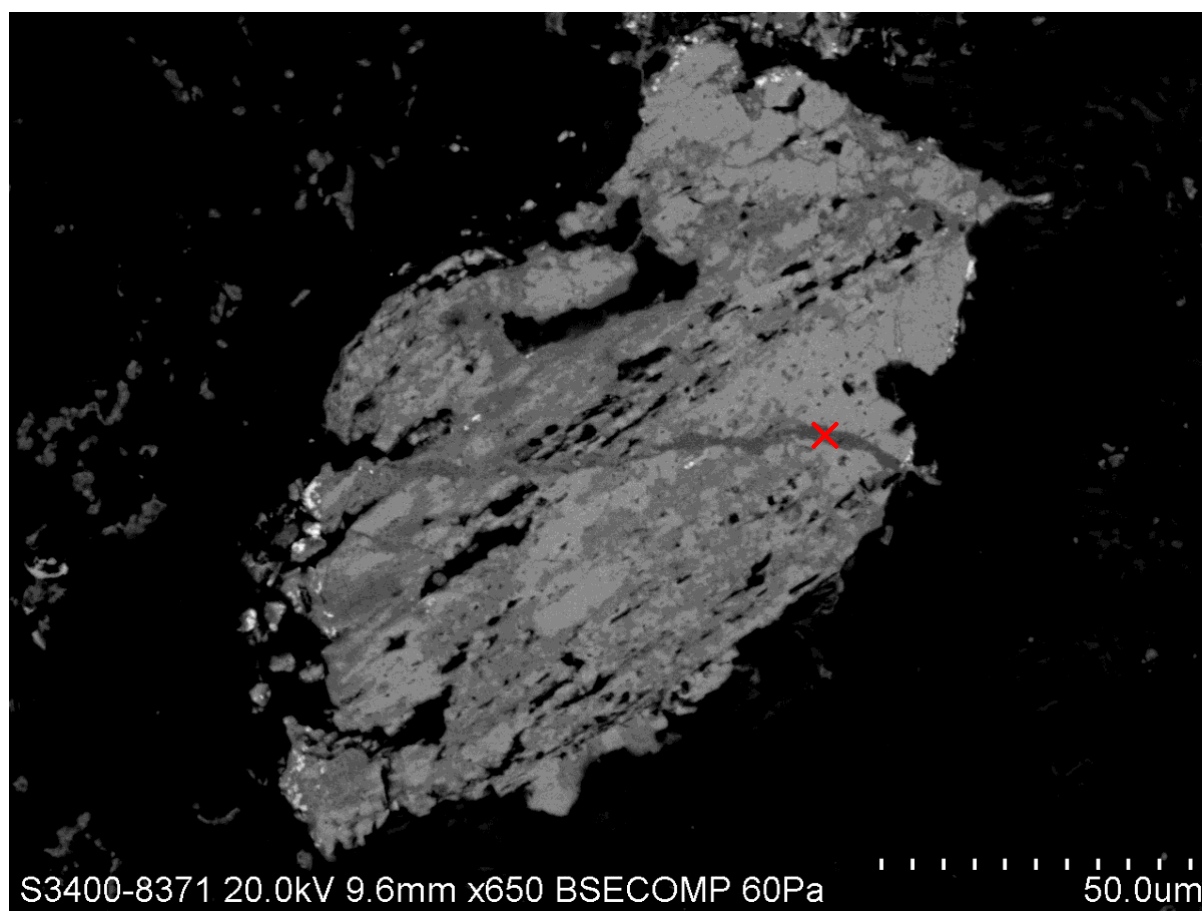
Element	Line type	Standard	Weight %	$\sigma_{\text{Weight \%}}$	Atomic %
C	K $\alpha$	CaCO <sub>3</sub>	8.42	0.75	17.82
O	K $\alpha$	SiO <sub>2</sub>	30.29	1.04	48.13
F	K $\alpha$	CaF <sub>2</sub>	9.73	0.87	13.02
Al	K $\alpha$	Al <sub>2</sub> O <sub>3</sub>	1.40	0.19	1.32
Si	K $\alpha$	SiO <sub>2</sub>	2.65	0.18	2.40
Ca	K $\alpha$	Wollastonite	18.54	0.52	11.76
Y	L $\alpha$	Y	4.14	0.55	1.18
La	L $\beta$	LaB <sub>6</sub>	3.06	0.56	0.56
Ce	L $\beta$	CeO <sub>2</sub>	8.66	0.69	1.57
Nd	L $\beta$	NdF <sub>3</sub>	6.88	0.67	1.21
Totals			100.00		

Point #2 – Synchysite-(Y) [Sct-1]



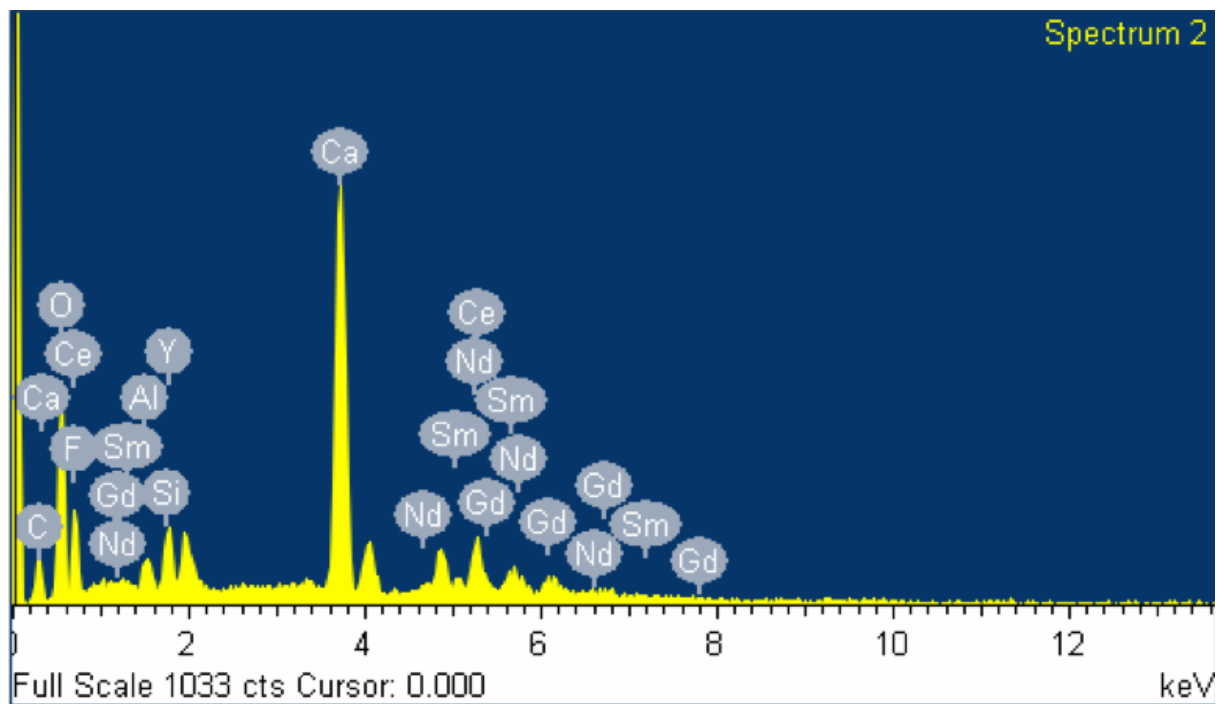
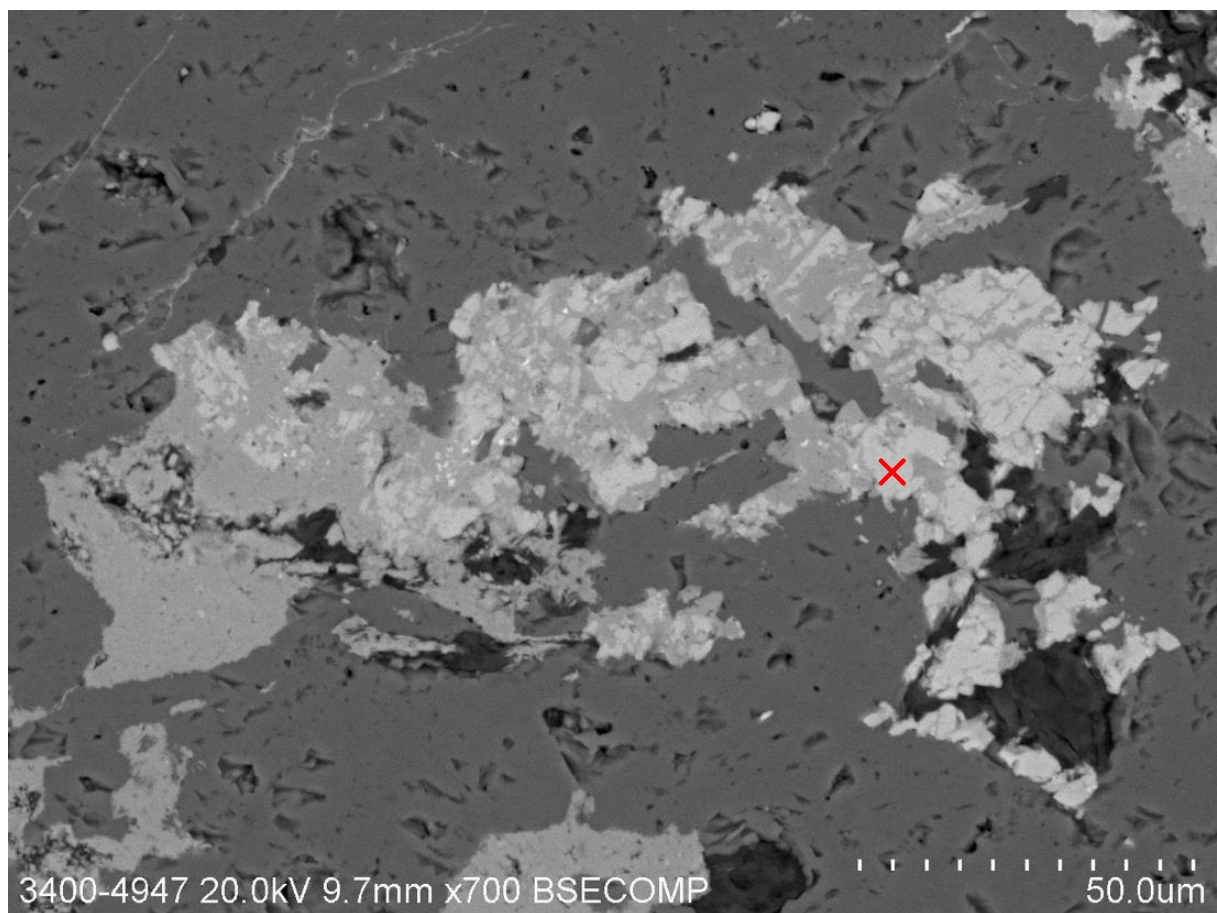
Element	Line type	Standard	Weight %	$\sigma_{\text{Weight \%}}$	Atomic %
C	K $\alpha$	CaCO <sub>3</sub>	12.31	1.78	22.57
O	K $\alpha$	SiO <sub>2</sub>	33.83	1.28	46.57
F	K $\alpha$	CaF <sub>2</sub>	10.53	0.83	12.21
Al	K $\alpha$	Al <sub>2</sub> O <sub>3</sub>	1.29	0.18	1.06
Si	K $\alpha$	SiO <sub>2</sub>	2.08	0.16	1.63
K	K $\alpha$	KBr	0.53	0.13	0.30
Ca	K $\alpha$	Wollastonite	19.52	0.62	10.72
Y	L $\alpha$	Y	19.91	0.84	4.93
Totals			100.00		

Point #3 - Synchysite-(Y) [Sct-2]



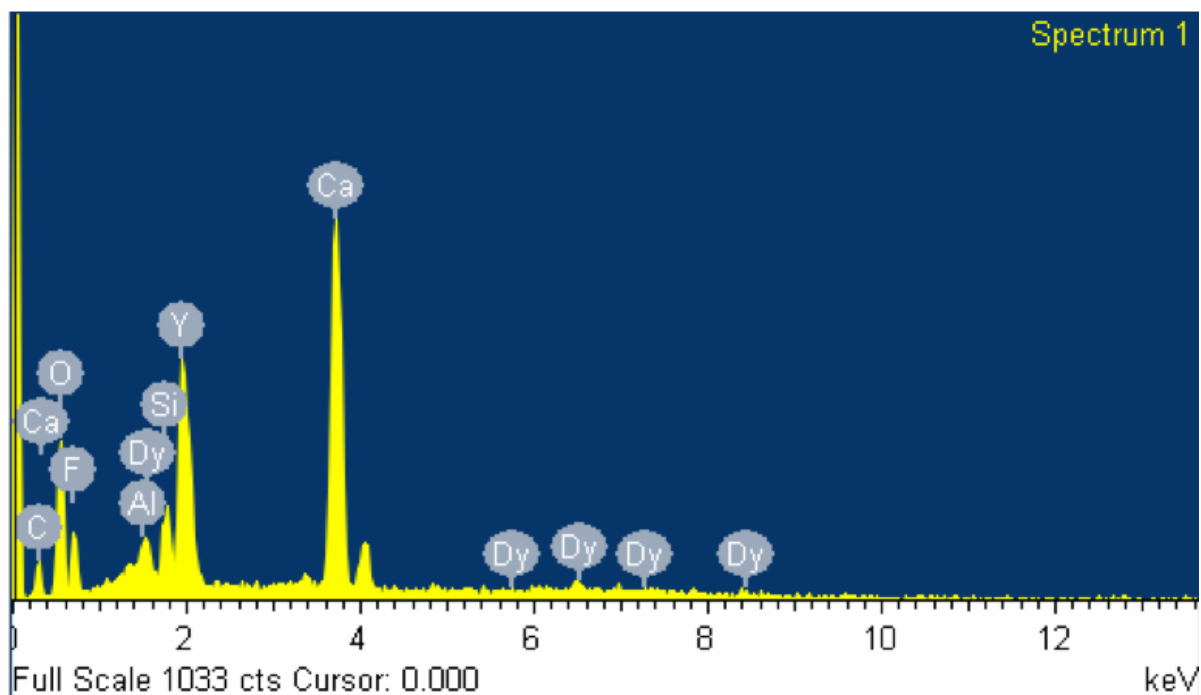
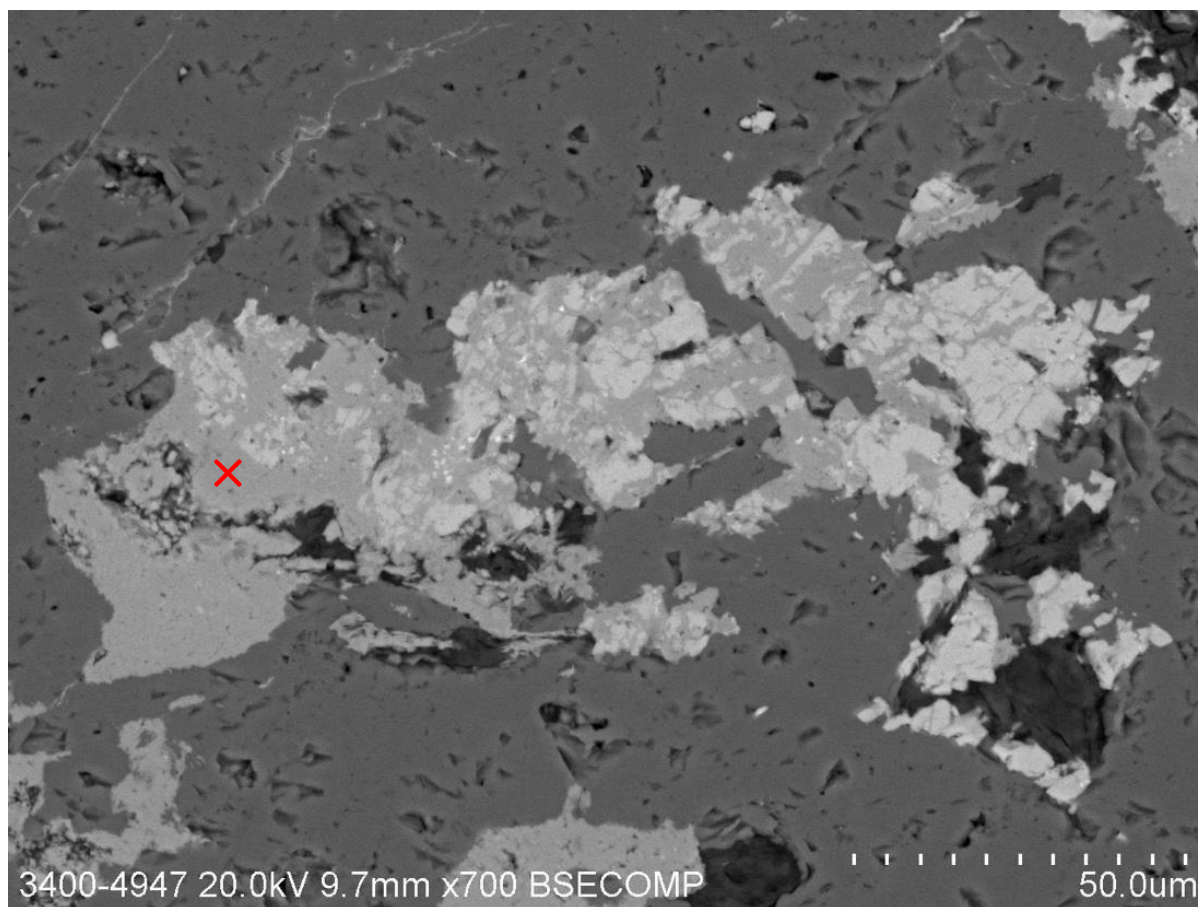
Element	Line type	Standard	Weight %	$\sigma_{\text{Weight \%}}$	Atomic %
C	K $\alpha$	CaCO <sub>3</sub>	13.33	1.75	24.78
O	K $\alpha$	SiO <sub>2</sub>	35.25	1.24	49.19
F	K $\alpha$	CaF <sub>2</sub>	6.60	0.70	7.76
Al	K $\alpha$	Al <sub>2</sub> O <sub>3</sub>	2.07	0.18	1.72
Si	K $\alpha$	SiO <sub>2</sub>	3.20	0.19	2.54
K	K $\alpha$	KBr	0.75	0.13	0.43
Ca	K $\alpha$	Wollastonite	14.59	0.49	8.13
Y	L $\alpha$	Y	18.37	0.82	4.61
Nd	L $\beta$	NdF <sub>3</sub>	1.63	0.44	0.25
Gd	L $\beta$	GdF <sub>3</sub>	2.22	0.53	0.32
Dy	L $\beta$	DyF <sub>3</sub>	1.98	0.63	0.27
Totals			100.00		

Point #4 – Synchysite-(Ce)



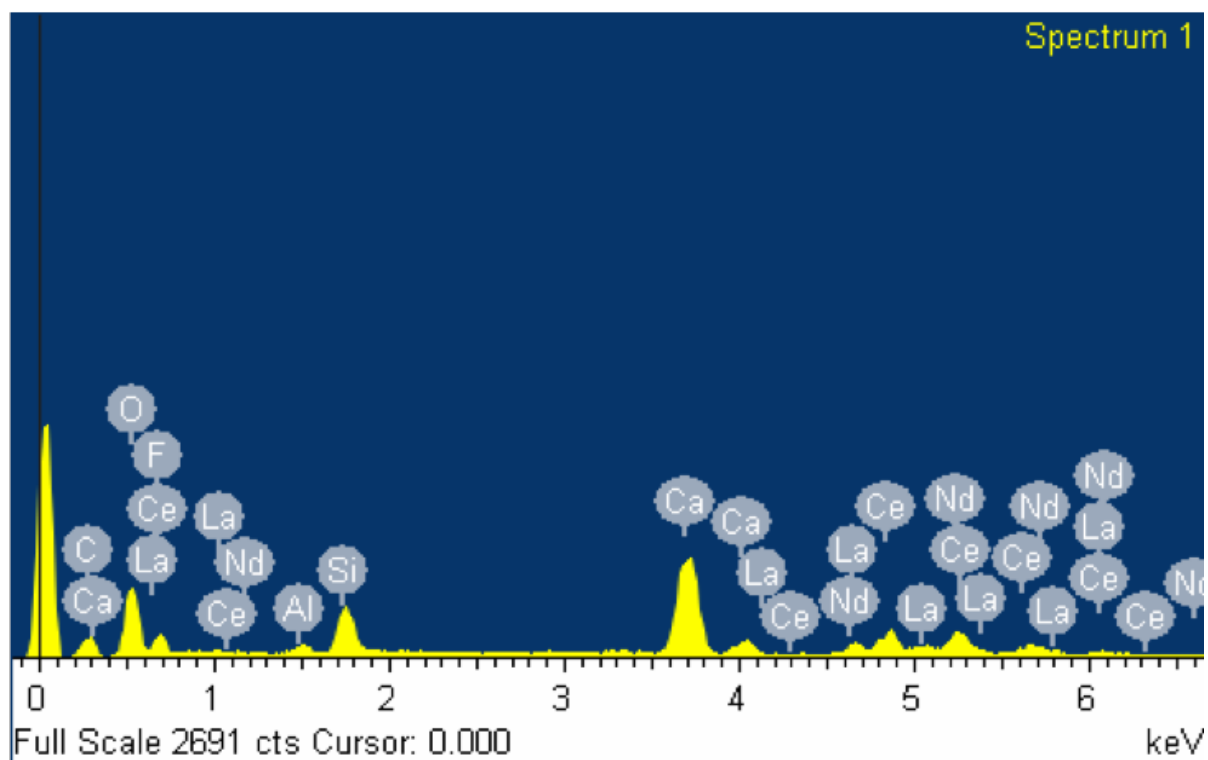
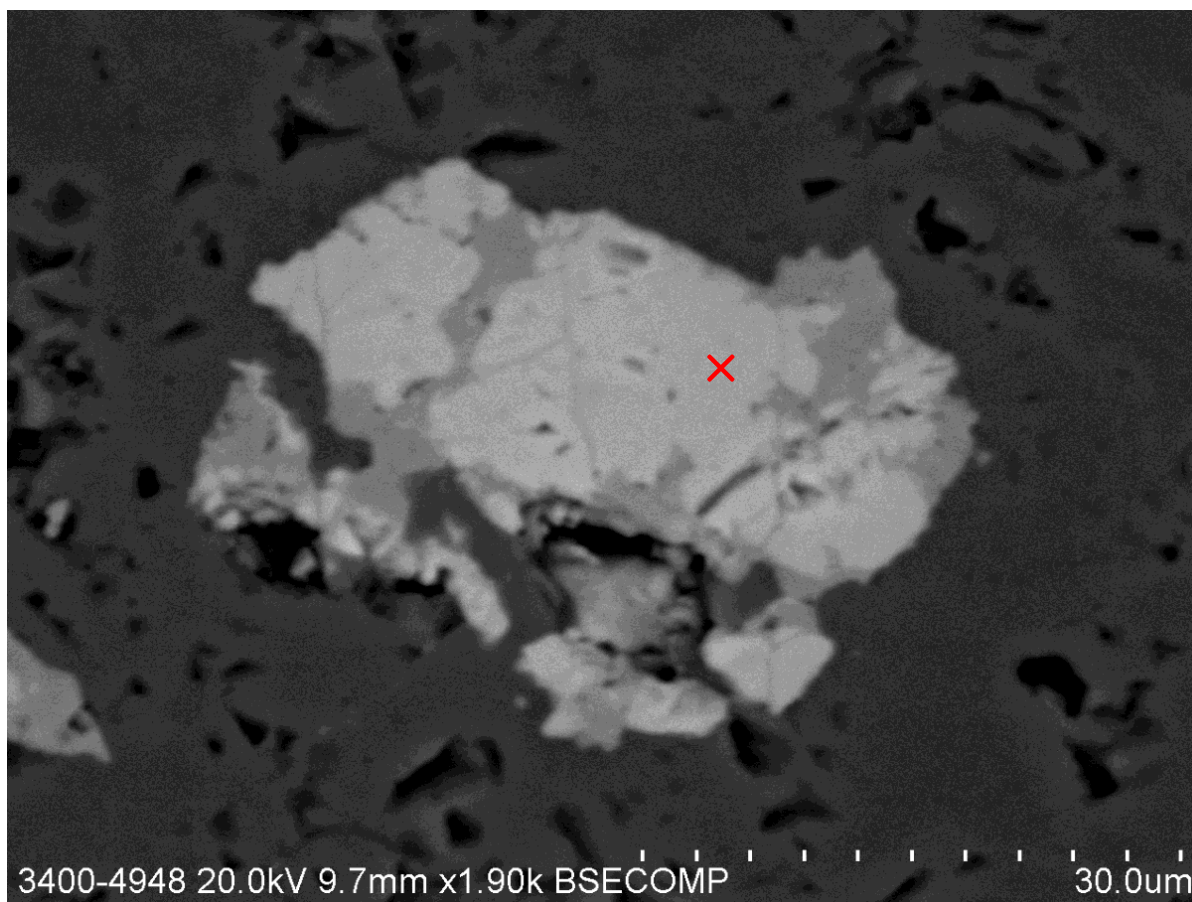
Element	Line type	Standard	Weight %	$\sigma_{\text{Weight \%}}$	Atomic %
C	K $\alpha$	CaCO <sub>3</sub>	7.99	0.76	16.32
O	K $\alpha$	SiO <sub>2</sub>	31.76	1.05	48.70
F	K $\alpha$	CaF <sub>2</sub>	11.64	0.93	15.03
Al	K $\alpha$	Al <sub>2</sub> O <sub>3</sub>	1.34	0.18	1.22
Si	K $\alpha$	SiO <sub>2</sub>	2.14	0.17	1.87
Ca	K $\alpha$	Wollastonite	19.66	0.54	12.03
Y	L $\alpha$	Y	4.89	0.56	1.35
Ce	L $\beta$	CeO <sub>2</sub>	7.16	0.67	1.25
Nd	L $\beta$	NdF <sub>3</sub>	7.17	0.68	1.22
Sm	L $\beta$	SmF <sub>3</sub>	2.67	0.67	0.44
Gd	L $\beta$	GdF <sub>3</sub>	3.58	0.70	0.56
Totals			100.00		

Point #5 – Synchysite-(Y) [Sct-1]



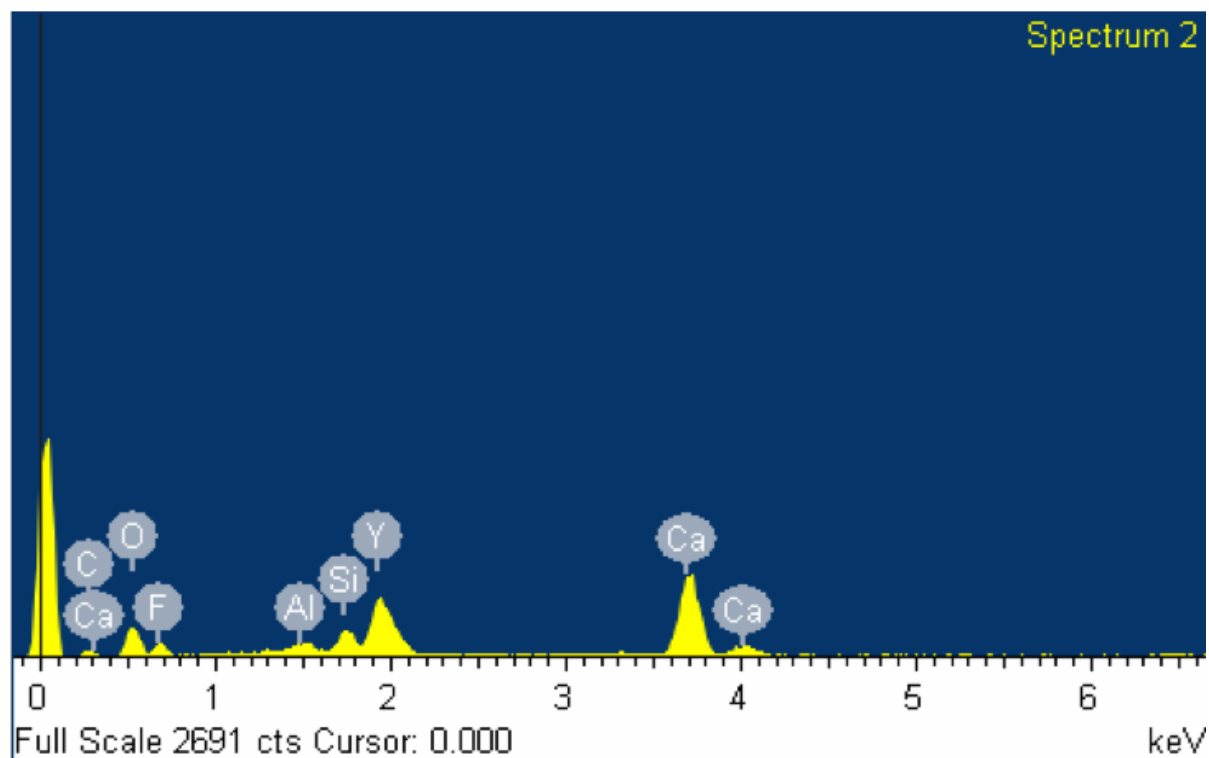
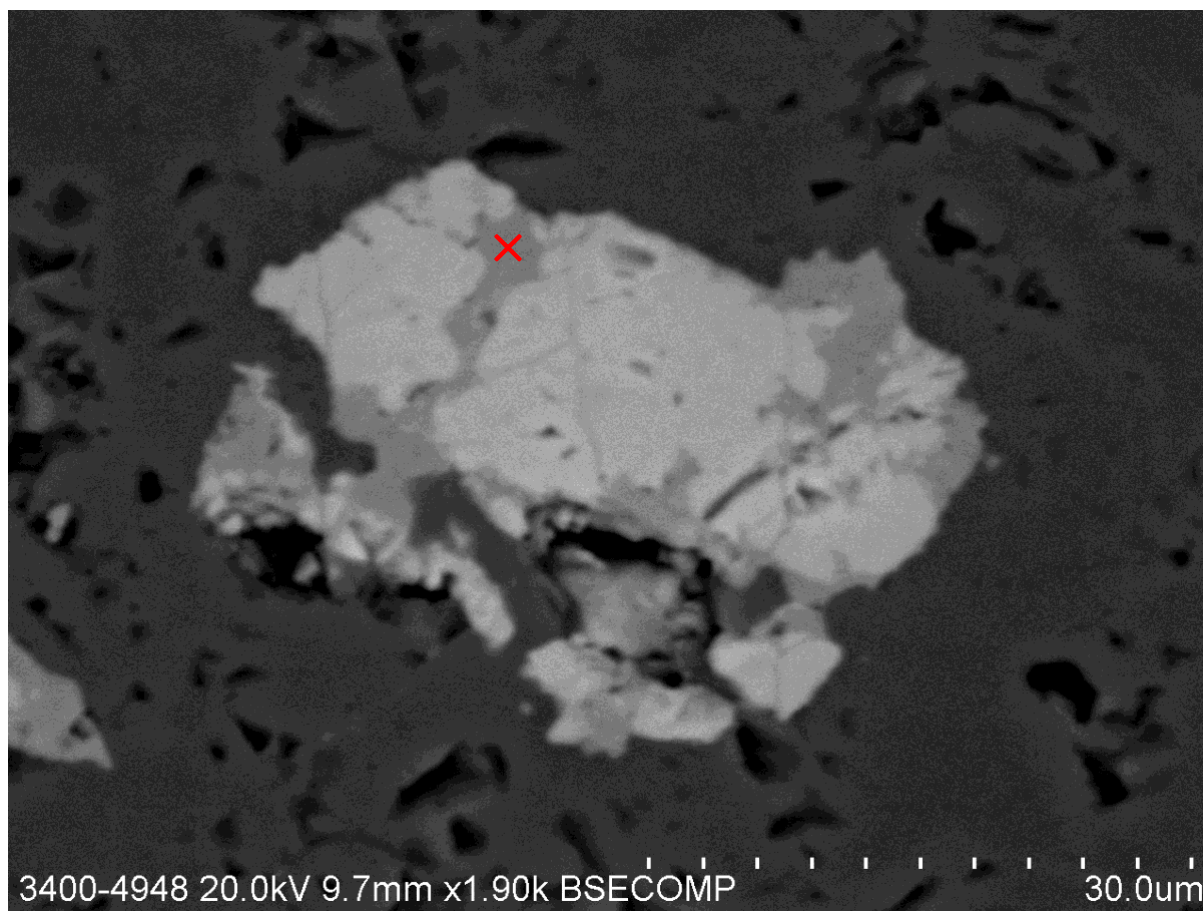
Element	Line type	Standard	Weight %	$\sigma_{\text{Weight \%}}$	Atomic %
C	K $\alpha$	CaCO <sub>3</sub>	9.23	0.99	17.78
O	K $\alpha$	SiO <sub>2</sub>	33.66	1.15	48.68
F	K $\alpha$	CaF <sub>2</sub>	11.07	0.83	13.49
Al	K $\alpha$	Al <sub>2</sub> O <sub>3</sub>	0.90	0.19	0.77
Si	K $\alpha$	SiO <sub>2</sub>	2.44	0.17	2.01
Ca	K $\alpha$	Wollastonite	20.46	0.56	11.82
Y	L $\alpha$	Y	19.34	0.80	5.04
Dy	L $\beta$	DyF <sub>3</sub>	2.90	0.71	0.41
Totals			100.00		

Point #6 – Synchysite-(Ce)



Element	Line type	Standard	Weight %	$\sigma_{\text{Weight \%}}$	Atomic %
C	K $\alpha$	CaCO <sub>3</sub>	10.96	0.92	22.52
O	K $\alpha$	SiO <sub>2</sub>	30.99	1.10	47.79
F	K $\alpha$	CaF <sub>2</sub>	7.55	1.15	9.81
Al	K $\alpha$	Al <sub>2</sub> O <sub>3</sub>	1.15	0.20	1.05
Si	K $\alpha$	SiO <sub>2</sub>	5.16	0.26	4.53
Ca	K $\alpha$	Wollastonite	15.96	1.0548	14.90
La	L $\beta$	LaB <sub>6</sub>	14.90	0.48	9.17
Ce	L $\beta$	CeO <sub>2</sub>	6.79	0.74	1.21
Nd	L $\beta$	NdF <sub>3</sub>	14.34	0.89	2.52
Totals			100.00		

Point #7 – Synchysite-(Y) [Sct-1]



Element	Line type	Standard	Weight %	$\sigma$ Weight %	Atomic %
C	K $\alpha$	CaCO <sub>3</sub>	10.34	1.52	19.60
O	K $\alpha$	SiO <sub>2</sub>	32.83	1.60	46.72
F	K $\alpha$	CaF <sub>2</sub>	10.95	1.17	13.12
Al	K $\alpha$	Al <sub>2</sub> O <sub>3</sub>	1.14	0.26	0.97
Si	K $\alpha$	SiO <sub>2</sub>	3.38	0.27	2.74
Ca	K $\alpha$	Wollastonite	20.08	0.76	11.41
Y	L $\alpha$	Y	21.28	1.09	5.45
Totals			100.00		