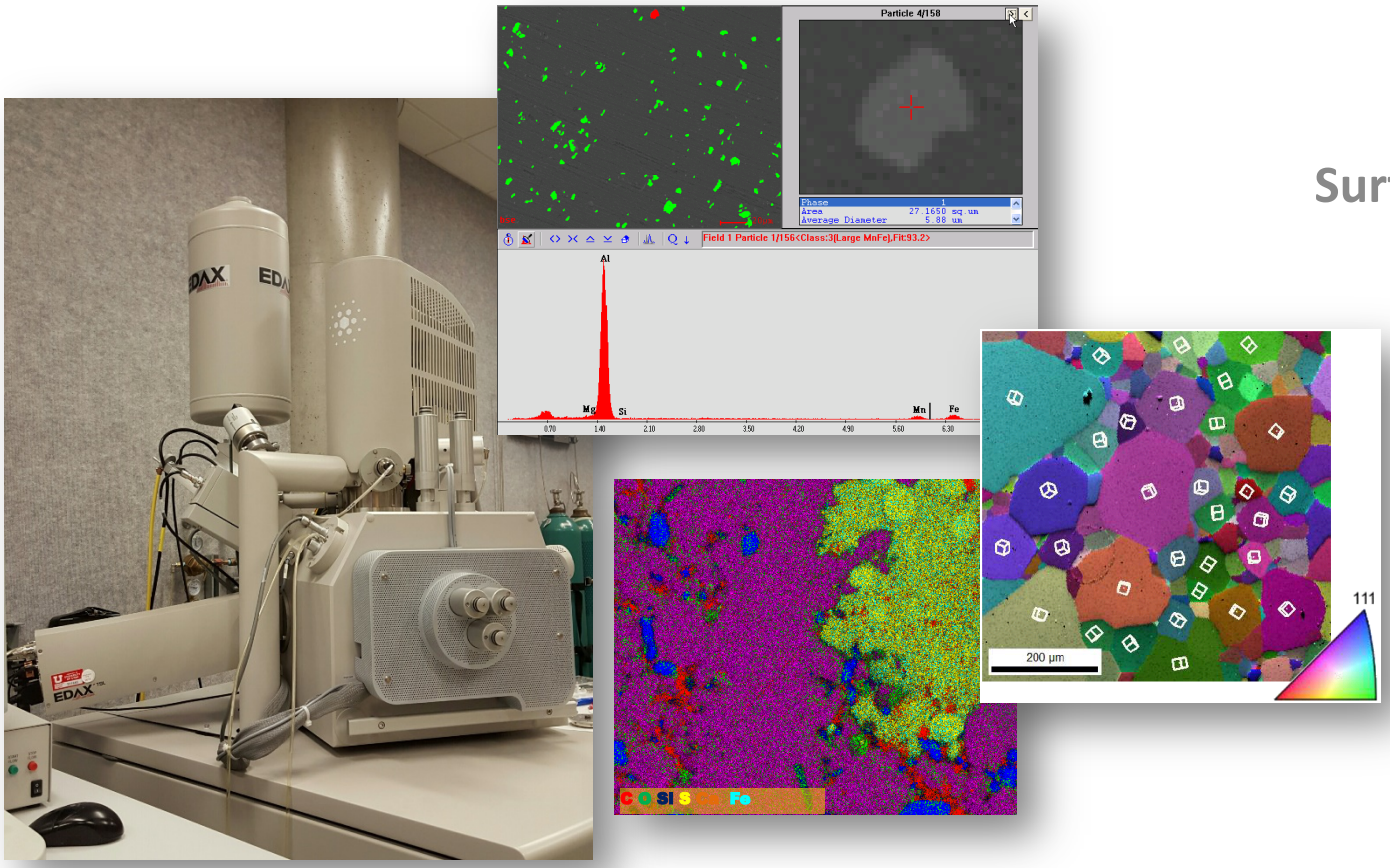
EDAX Particle Phase Analysis:

A New SEM Capability for Automated Elemental and Morphological Analysis of Dispersed Particles and Precipitates

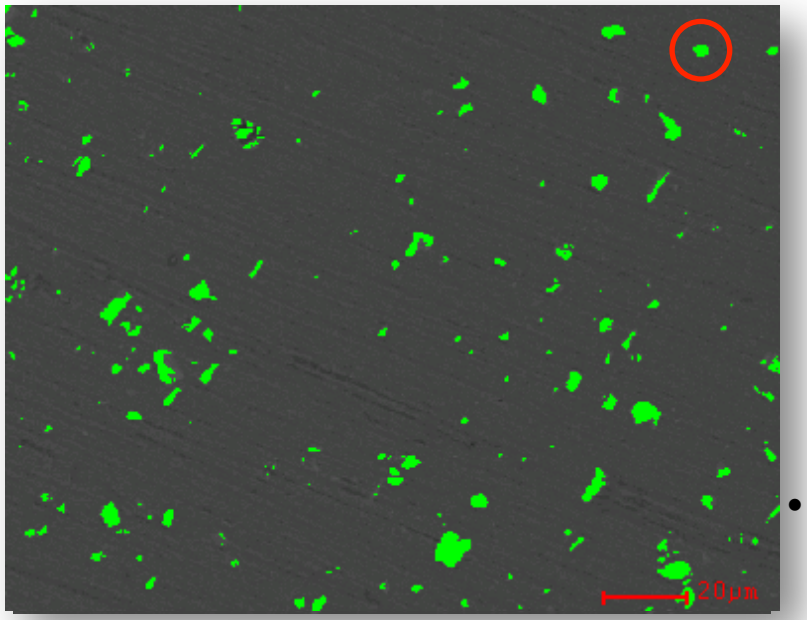


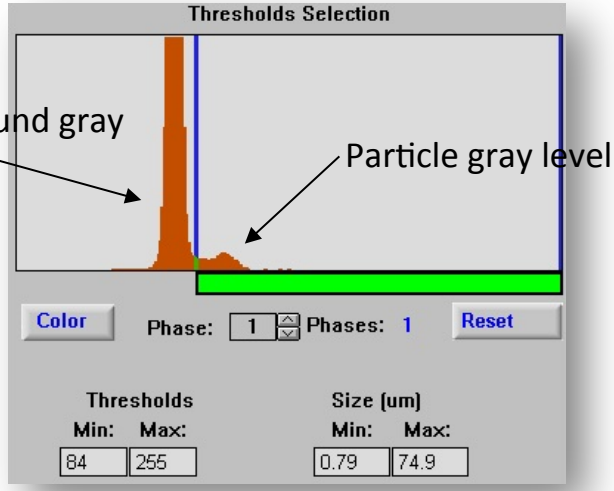
Paulo Perez

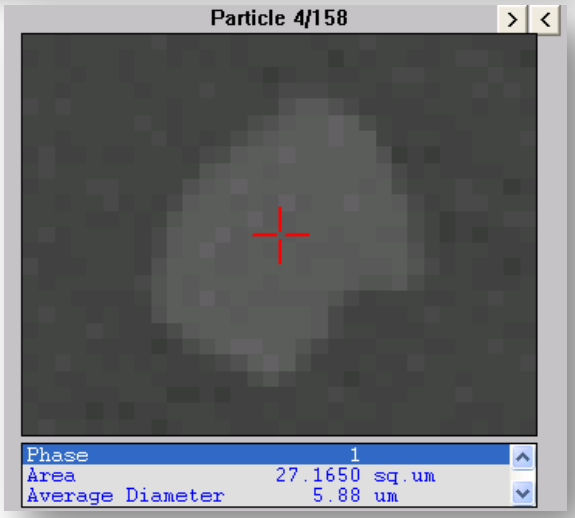
Surface Scientist

Surface Analysis Lab

Morphology Analysis

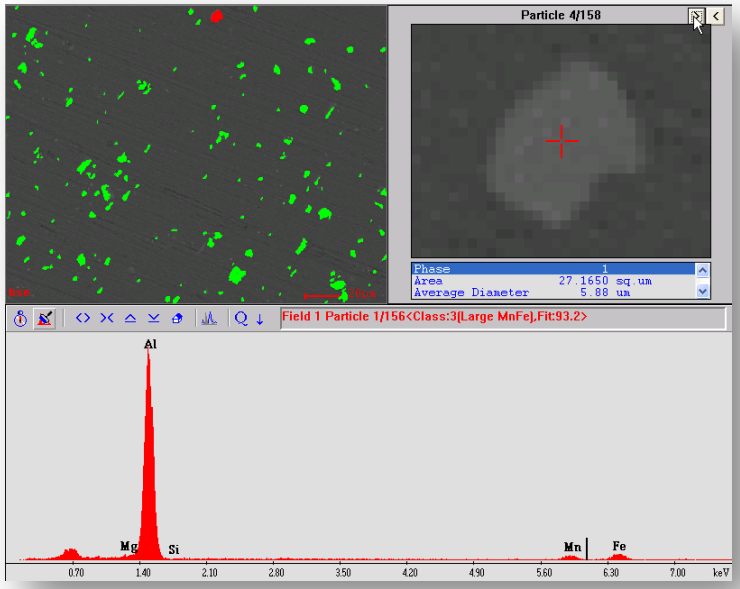


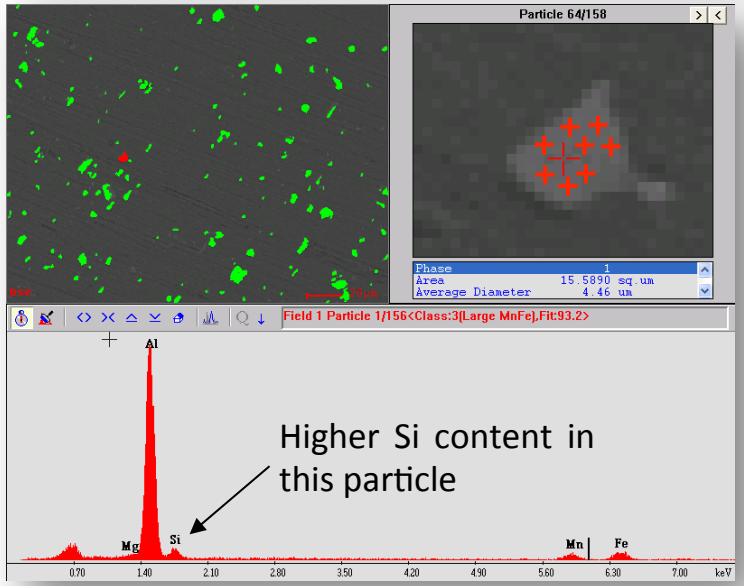




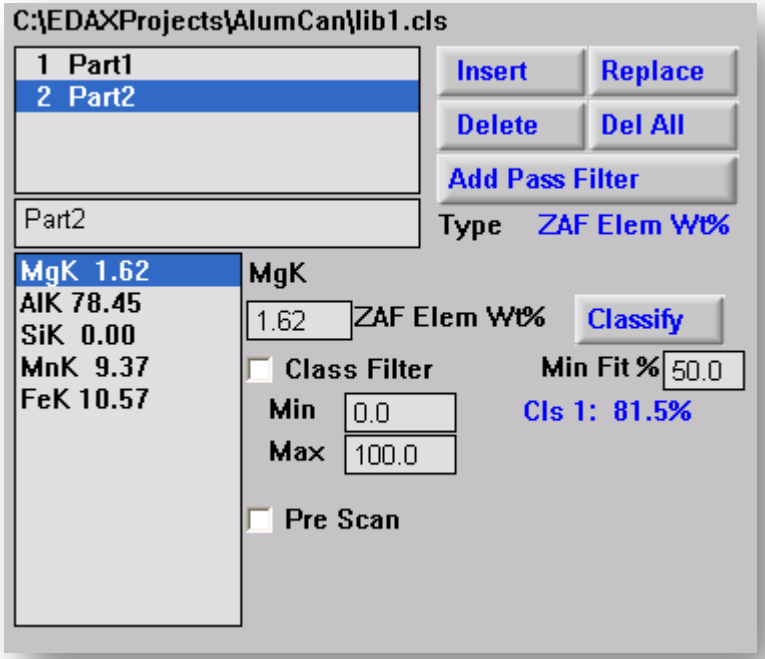
- Particles are identified from the matrix based on image contrast from a BSE image
- Size, shape, and morphology of each individual particle in the field of view is characterized by the image processing software based on the number of pixels contained by a particle
  - Area
  - Diameter
  - Perimeter
  - Orientation
  - Aspect ratio
  - Shape (roundness)

Elemental Analysis

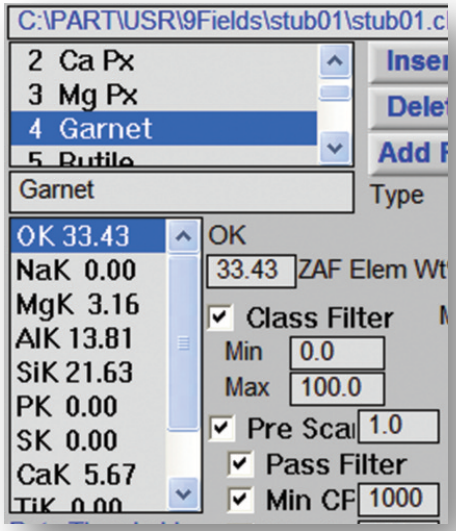




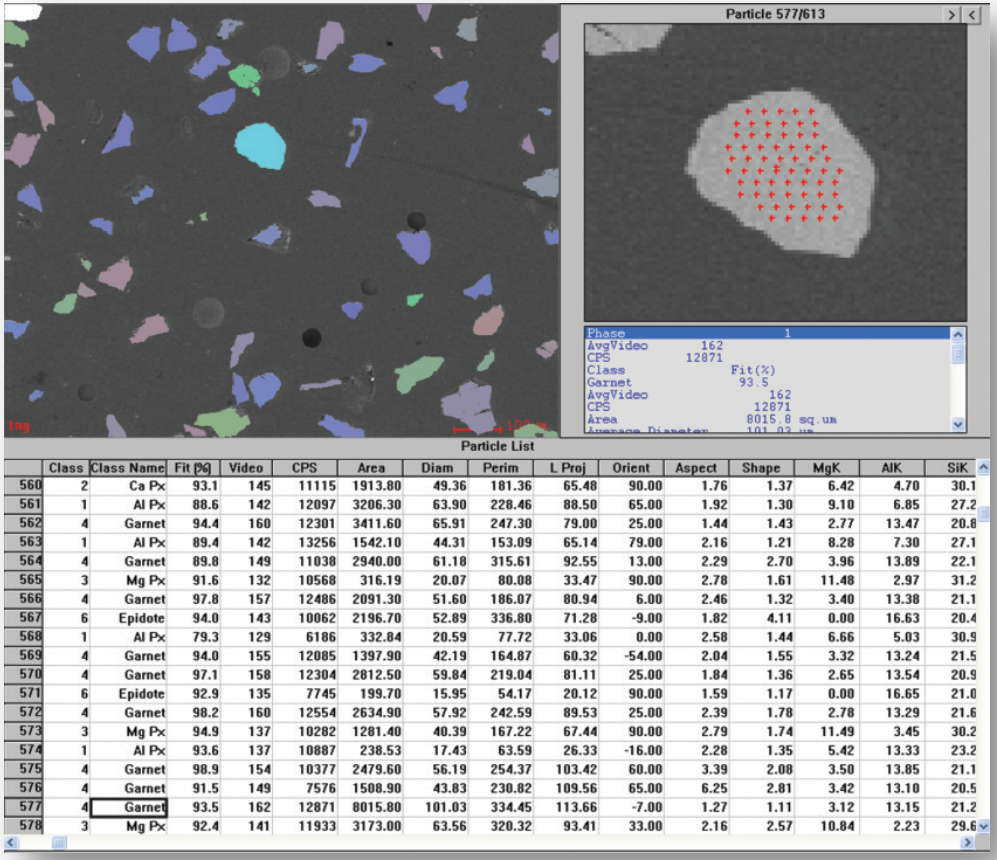
Allows classification of each particle into different groups based on its elemental components



Elemental Analysis

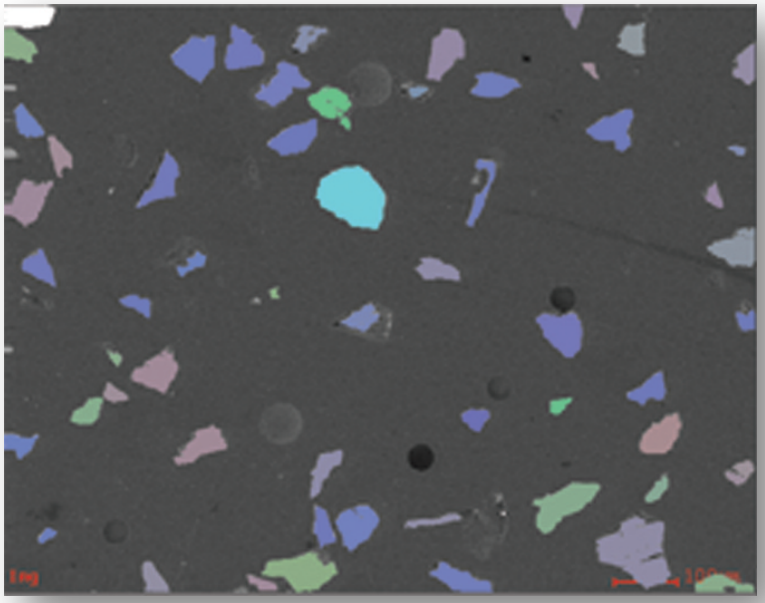


Precipitated minerals in a polished rock are classified and color-coded based on their identified elemental components



	Class	Class Name	Fit (%)	Video	CPS	Area	Diam	Perim	L Proj	Orient	Aspect	Shape	MgK	AlK	SiK
560	2	Ca Px	93.1	145	11115	1913.80	49.36	181.36	65.48	90.00	1.76	1.37	6.42	4.70	30.1
561	1	Al Px	88.6	142	12097	3206.30	63.90	228.46	88.50	65.00	1.92	1.30	9.10	6.85	27.2
562	4	Garnet	94.4	160	12301	3411.60	65.91	247.30	79.00	25.00	1.44	1.43	2.77	13.47	20.8
563	1	Al Px	89.4	142	13256	1542.10	44.31	153.09	65.14	79.00	2.16	1.21	8.28	7.30	27.1
564	4	Garnet	89.8	149	11038	2940.00	61.18	315.61	92.55	13.00	2.29	2.70	3.96	13.89	22.1
565	3	Mg Px	91.6	132	10568	316.19	20.07	80.08	33.47	90.00	2.78	1.61	11.48	2.97	31.2
566	4	Garnet	97.8	157	12486	2091.30	51.60	186.07	80.94	6.00	2.46	1.32	3.40	13.38	21.1
567	6	Epidote	94.0	143	10062	2196.70	52.89	336.80	71.28	-9.00	1.82	4.11	0.00	16.63	20.4
568	1	Al Px	79.3	129	6186	332.84	20.59	77.72	33.06	0.00	2.58	1.44	6.66	5.03	30.9
569	4	Garnet	94.0	155	12085	1397.90	42.19	164.87	60.32	-54.00	2.04	1.55	3.32	13.24	21.5
570	4	Garnet	97.1	158	12304	2812.50	59.84	219.04	81.11	25.00	1.84	1.36	2.65	13.54	20.9
571	6	Epidote	92.9	135	7745	199.70	15.95	54.17	20.12	90.00	1.59	1.17	0.00	16.65	21.0
572	4	Garnet	98.2	160	12554	2634.90	57.92	242.59	89.53	25.00	2.39	1.78	2.78	13.29	21.6
573	3	Mg Px	94.9	137	10282	1281.40	40.39	167.22	67.44	90.00	2.79	1.74	11.49	3.45	30.2
574	1	Al Px	93.6	137	10887	238.53	17.43	63.59	26.33	-16.00	2.28	1.35	5.42	13.33	23.2
575	4	Garnet	98.9	154	10377	2479.60	56.19	254.37	103.42	60.00	3.39	2.08	3.50	13.85	21.1
576	4	Garnet	91.5	149	7576	1508.90	43.83	230.82	109.56	65.00	6.25	2.81	3.42	13.10	20.5
577	4	Garnet	93.5	162	12871	8015.80	101.03	334.45	113.66	-7.00	1.27	1.11	3.12	13.15	21.2
578	3	Mg Px	92.4	141	11933	3173.00	63.56	320.32	93.41	33.00	2.16	2.57	10.84	2.23	29.6

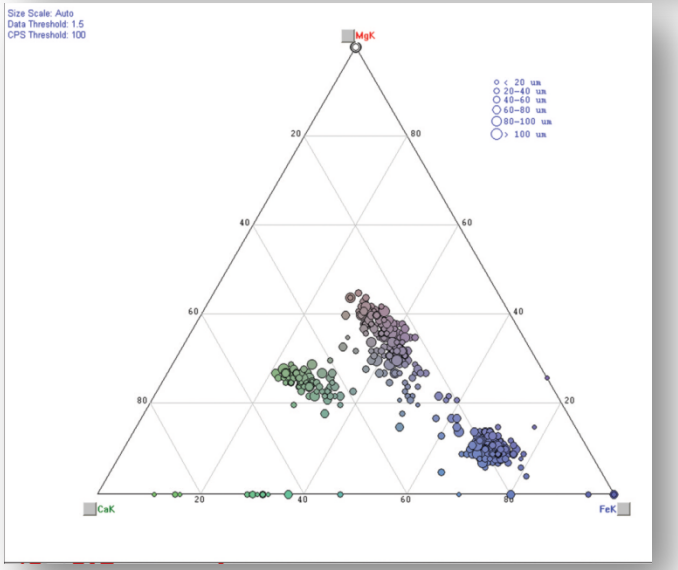
Elemental Analysis



Expands the EDS capability of the SEM

Allows automated analysis of precipitates embedded on a matrix

Makes it easier to obtain physical statistics of particles that require larger field of view



Ternary diagram showing the distribution of sizes and elemental ratios of the particles

Limitations

Energy resolution: **130 eV**

Spatial resolution: **~1 μm³**

Limit of Detection

1000 – 3000 ppm (0.1 – 0.3%)

Accuracy: ~95 %

Relative Error: 1% for polished sample with standards

5% for particulates and rough surfaces without standard

major components (>10%) ± 5%

minor components (1 – 10%) ± 5 – 10%

trace components (<1 %) ± 10 – 20%

Not a surface analysis technique!!!

References:

Particles Analysis Software training videos
Expanding EDS Analysis with Advanced Particle, EDAX EDS technical note