

4 April 2024

Olympus Vanta VMR Air

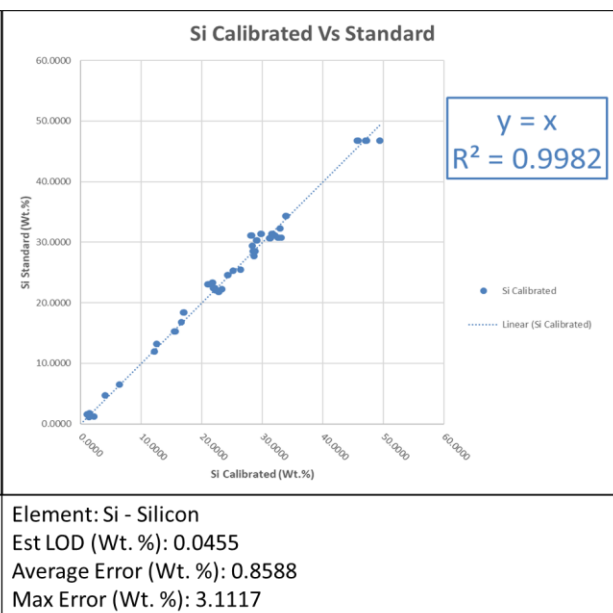
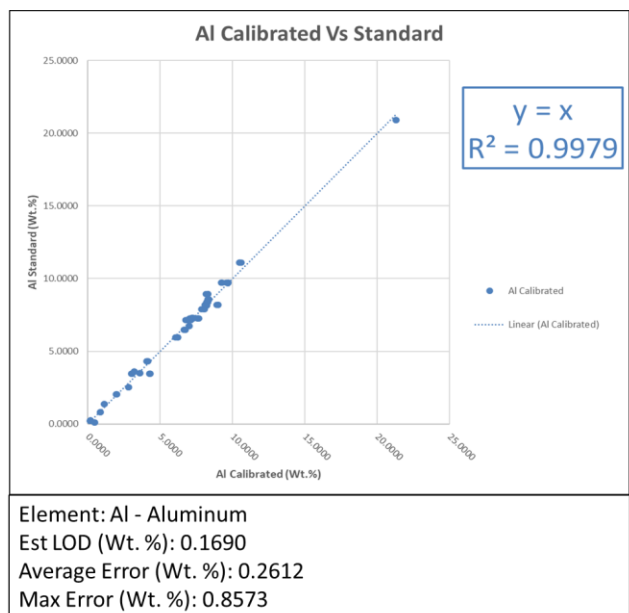
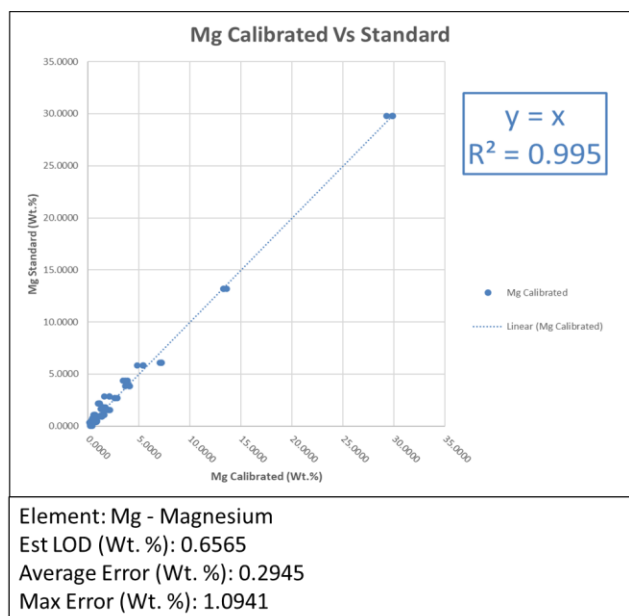
XRF Solutions LOD and Calibrations for 41 Elements w/ Olympus Vanta VMR Handheld XRF Instrument – Air

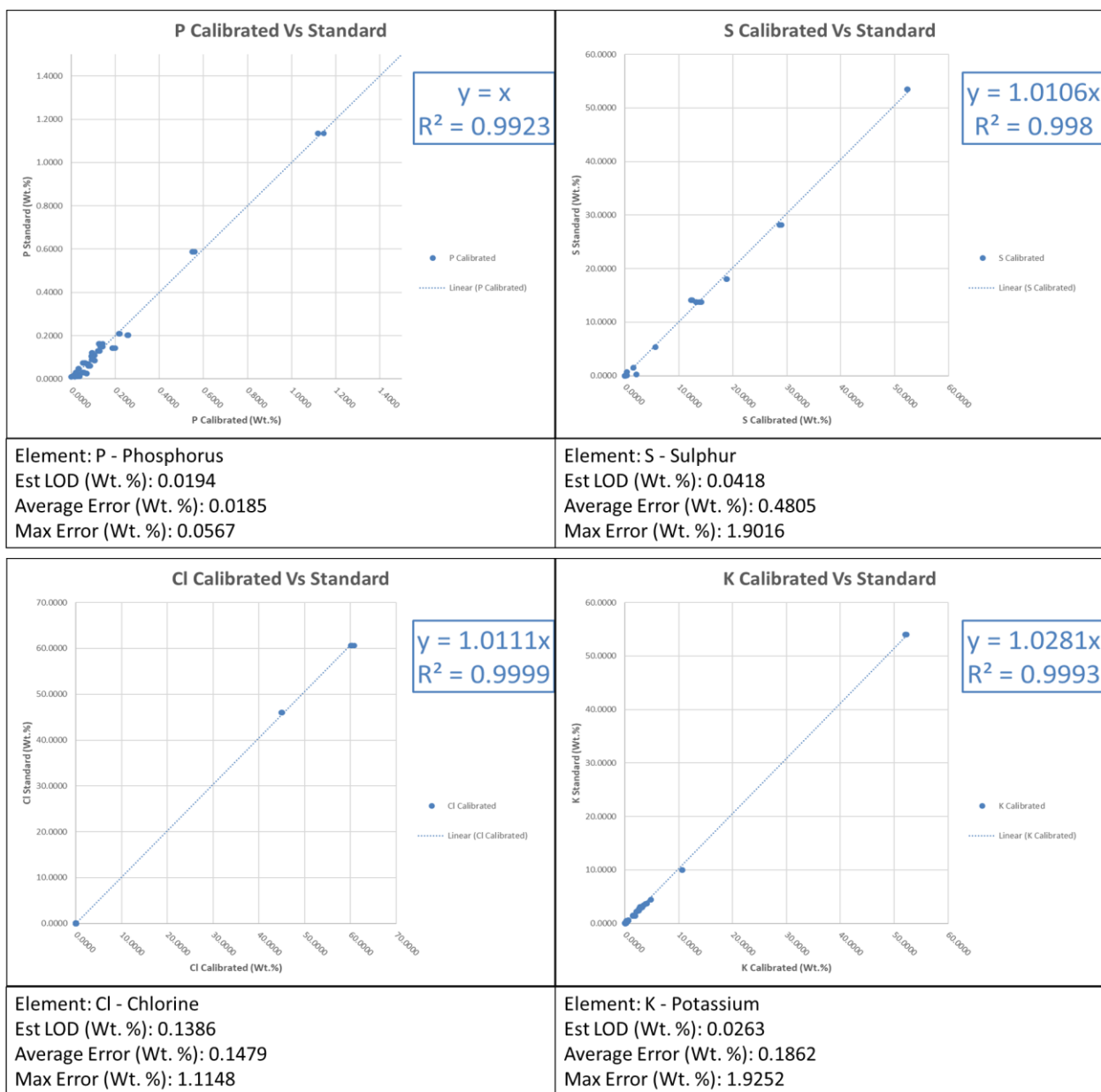
Our method uses a factory triple beam geoChem3-Extra calibration provided by Olympus in air with a factory prolene window on the instrument. Loose samples are placed in a sample cup with a 3um prolene window for the analysis. There is no additional sample preparation conducted. Solid samples are place directly on the XRF analysis window with a 3um prolene film between. This mode uses a 50kV high energy beam for 30 seconds to detect very heavy elements, a 40kV high energy beam for 15 seconds to detect heavy elements and a 10 kV low energy beam for 15 seconds to detect lighter elements. There are 41 elements (Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Rb, Sr, Y, Zr, Nb, Mo, Ag, Cd, Sn, Sb, Ba, La, Ce, Pr, Nd, W, Hg, Pb, Bi Th, U) reported. XRF Solutions use proprietary secondary calibration software on all data reported from the geoChem3-Extra mode. This software is necessary to help correct for instrument variation, matrix effects, porosity, and element-element interference. Our calibration database currently has 41 standards which are listed in a table below.

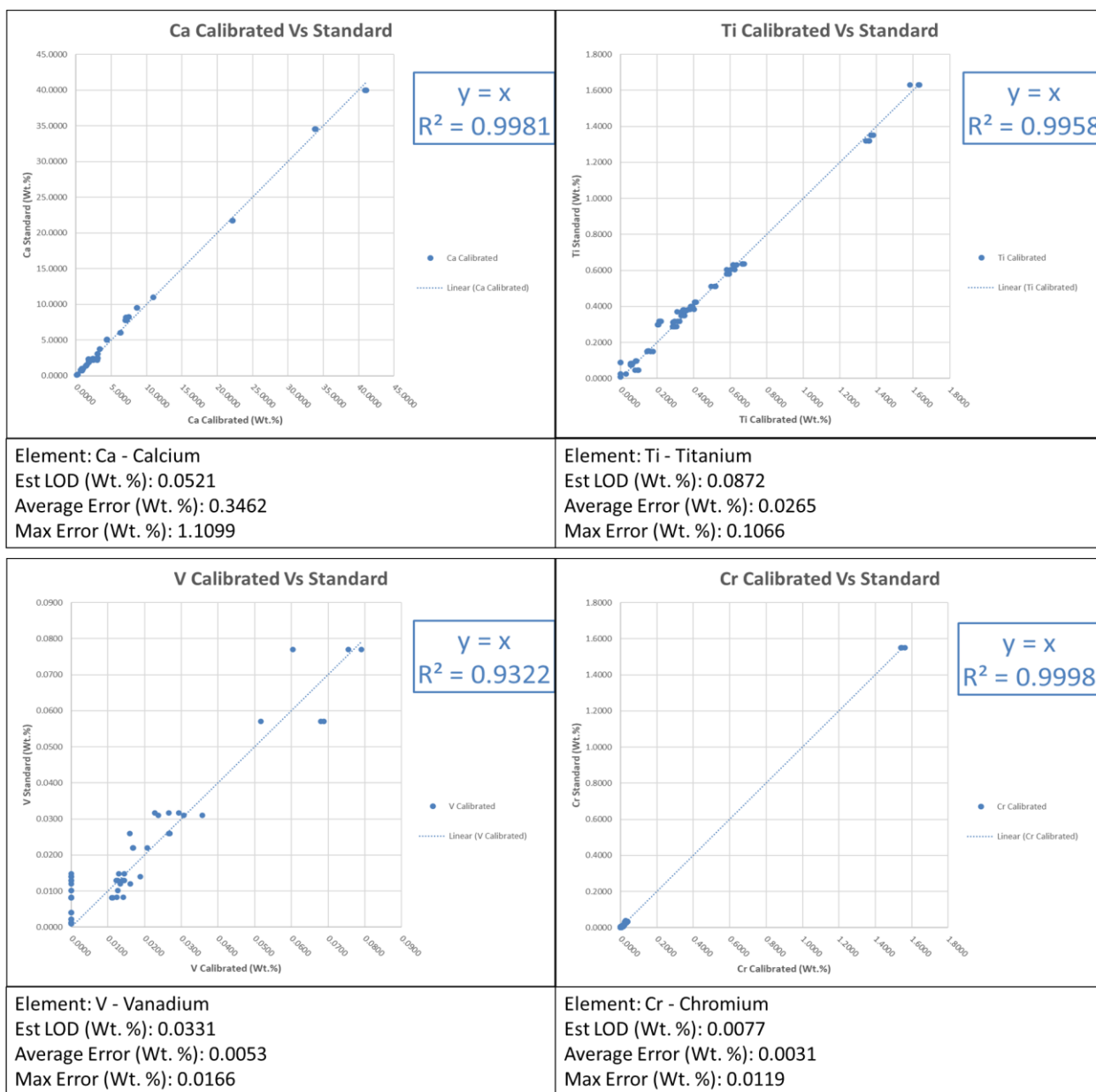
Standard #	Standard Name	Standard Description	Standard #	Standard Name	Standard Description
1	NIST 2710A	Montana Soil	21	SBC 1	Brush Creek Shale
2	NIST 2711A	Montana Soil	22	SGR 1B	Green River Shale
3	BCR 1	Basalt	23	RGM 2	Rhyolite
4	BCR 2	Basalt	24	GSP 2	Granodiorite
5	USGSCS	Shale	25	SDC 1	Mica Schist
6	USGS OS	Shale	26	QLO 1A	Quartz Latite
7	AGV 1	Andesite	27	STM 2	Syenite
8	USGSG2	Granite	28	W 2A	Diabase
9	SiO2	Ground Quartz	29	BHVO 2	Basalt
10	SiO2	Small Glass Beads	30	BIR 1A	Basalt
11	SiO2	Fine Quartz Sand	31	DNC 1A	Diabase
12	KAOL	Ground Kaolinite	32	NaCl	Table Salt
13	CALCITE	Ground Calcite	33	KCl	Ground Potash
14	DOLOMITE	Ground Dolomite	34	K-Spar	Ground K-Feldspar
15	DTS 2B	Dunite (Olivine Rich)	35	Barite	Ground Barite
16	COQ 1	Carbonatite	36	REE-1	Rare Eart Elements
17	NOD A1	Manganese Nodule	37	Mp-1b	Zinc, Tin, Copper Lead Ore
18	NOD P1	Manganese Nodule	38	IOC-1	Iron Ore
19	CLB 1	Coal	39	WMS-1	Massive Sulphide
20	PYRITE	Ground Pyrite	40	SU-1b	Nickel-Copper-Cobalt Ore
			41	TPO-1	Iron Sulphide

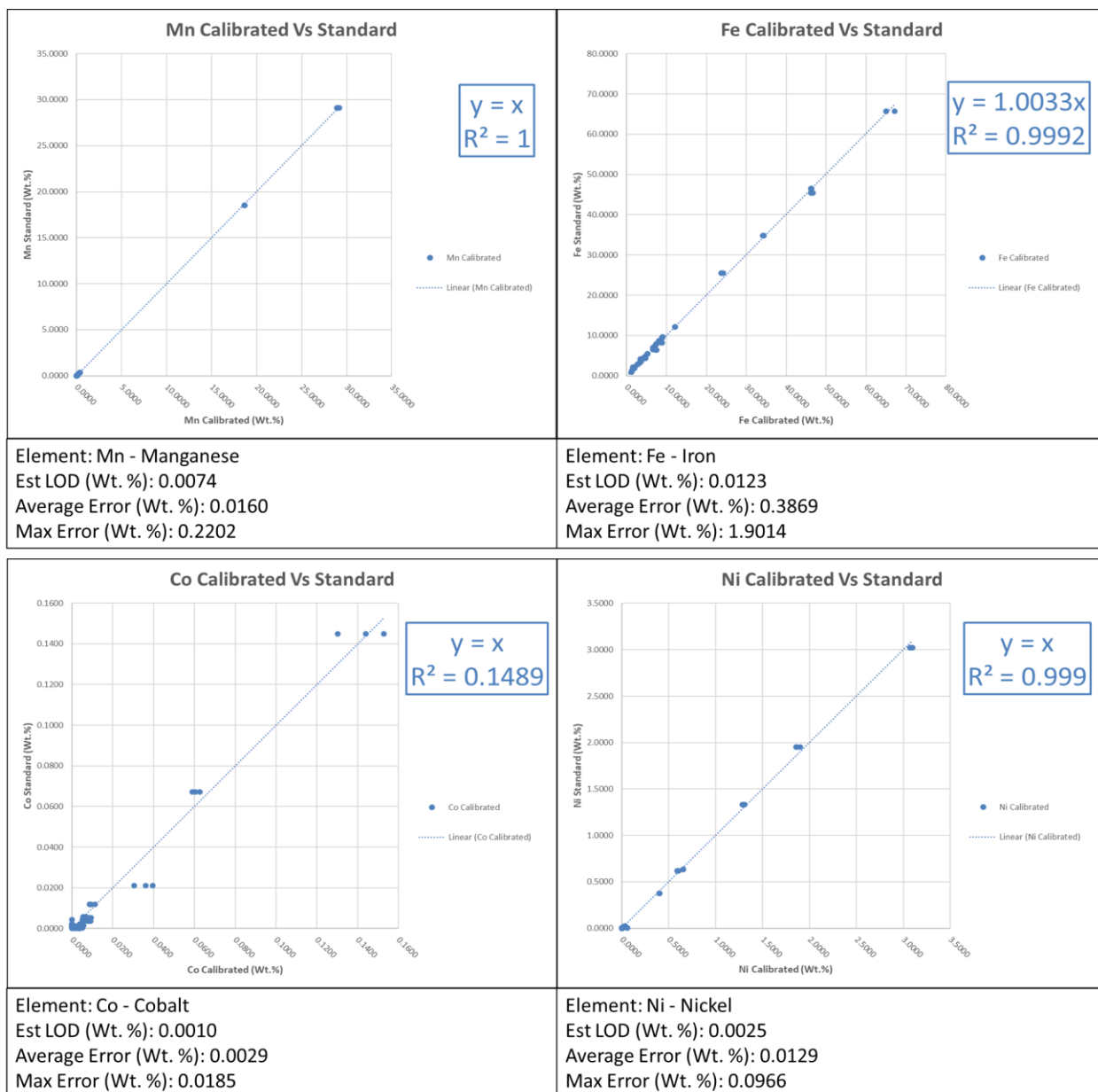
Additional standards may be added as needed to the calibration database. Not every standard has a reported value for each element. If a standard does not have a reported value for a particular element, that standard is eliminated from the calibration for that element. We do this because it is common for an element to be present in relatively small amounts within a standard but not be reported on its certificate. The XRF instrument will detect and report these small concentrations, which can negatively impact the calibrations.

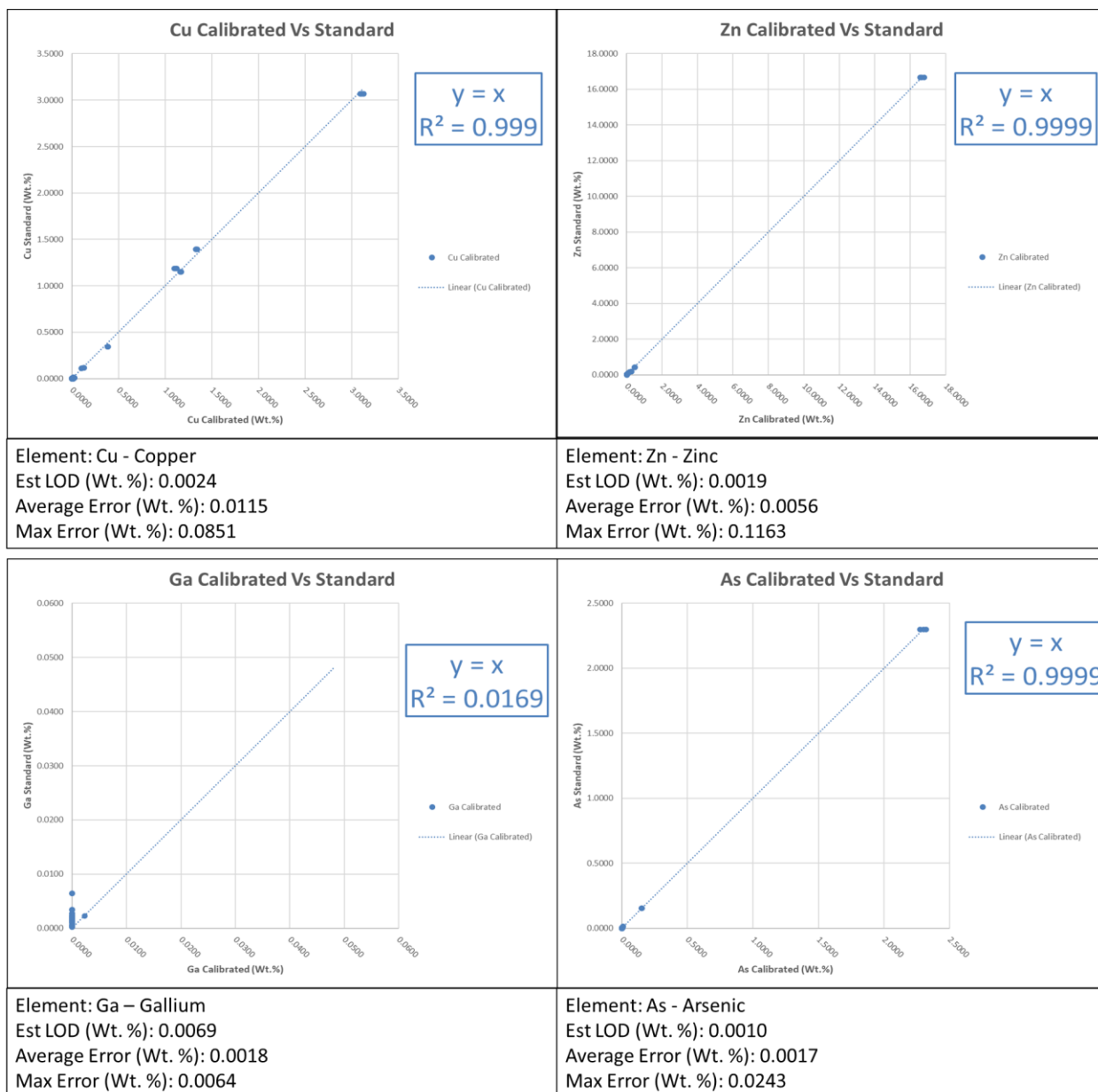
Calibrated XRF data on the 41 standards are displayed below for each element with estimated LOD, maximum error, and standard error. Maximum and standard error calculations only include data for each element that have a certified reported concentration. LOD is estimated at 3x the lowest possible detected value in any standard based on the calibration curve for each element.

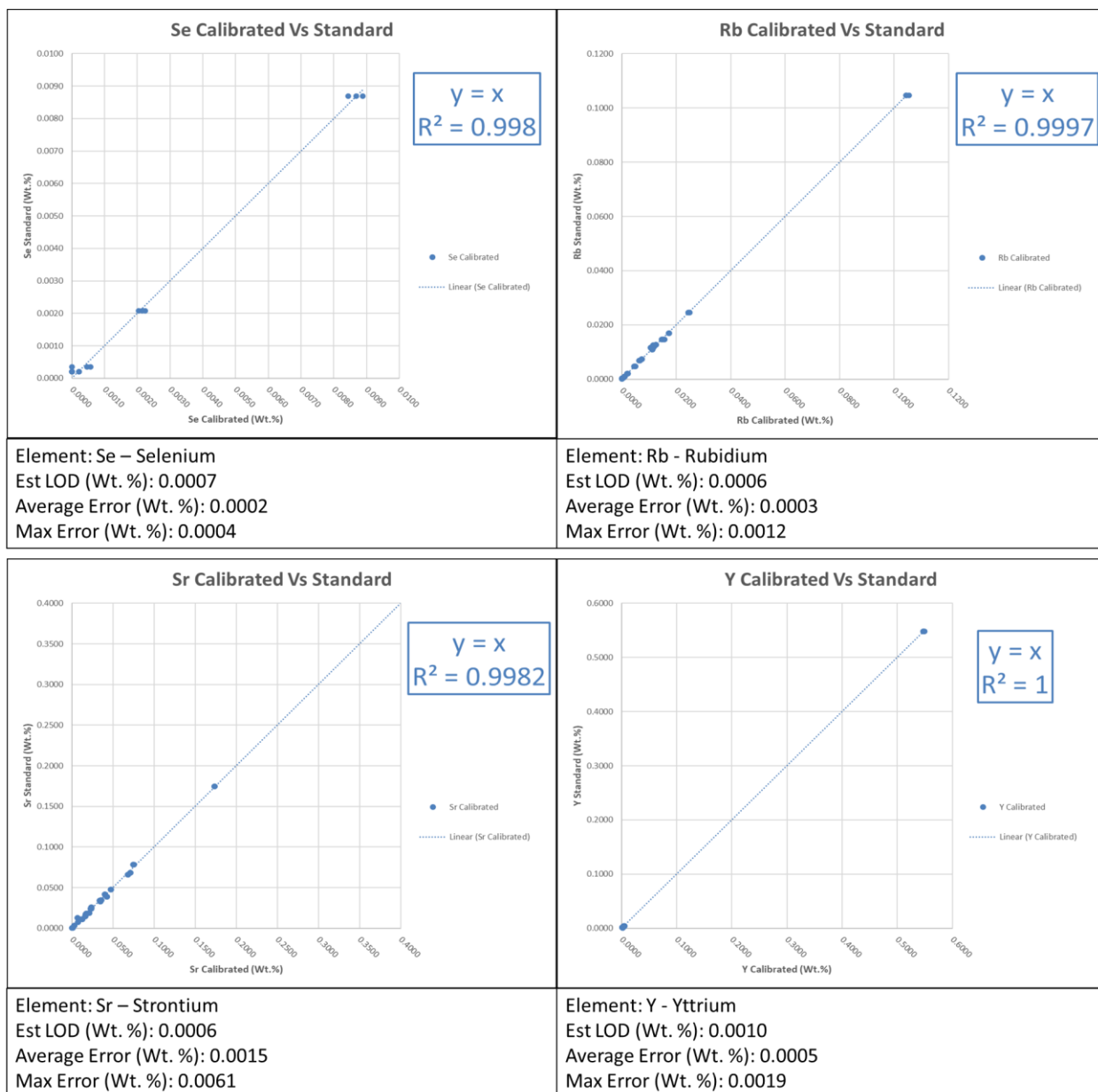


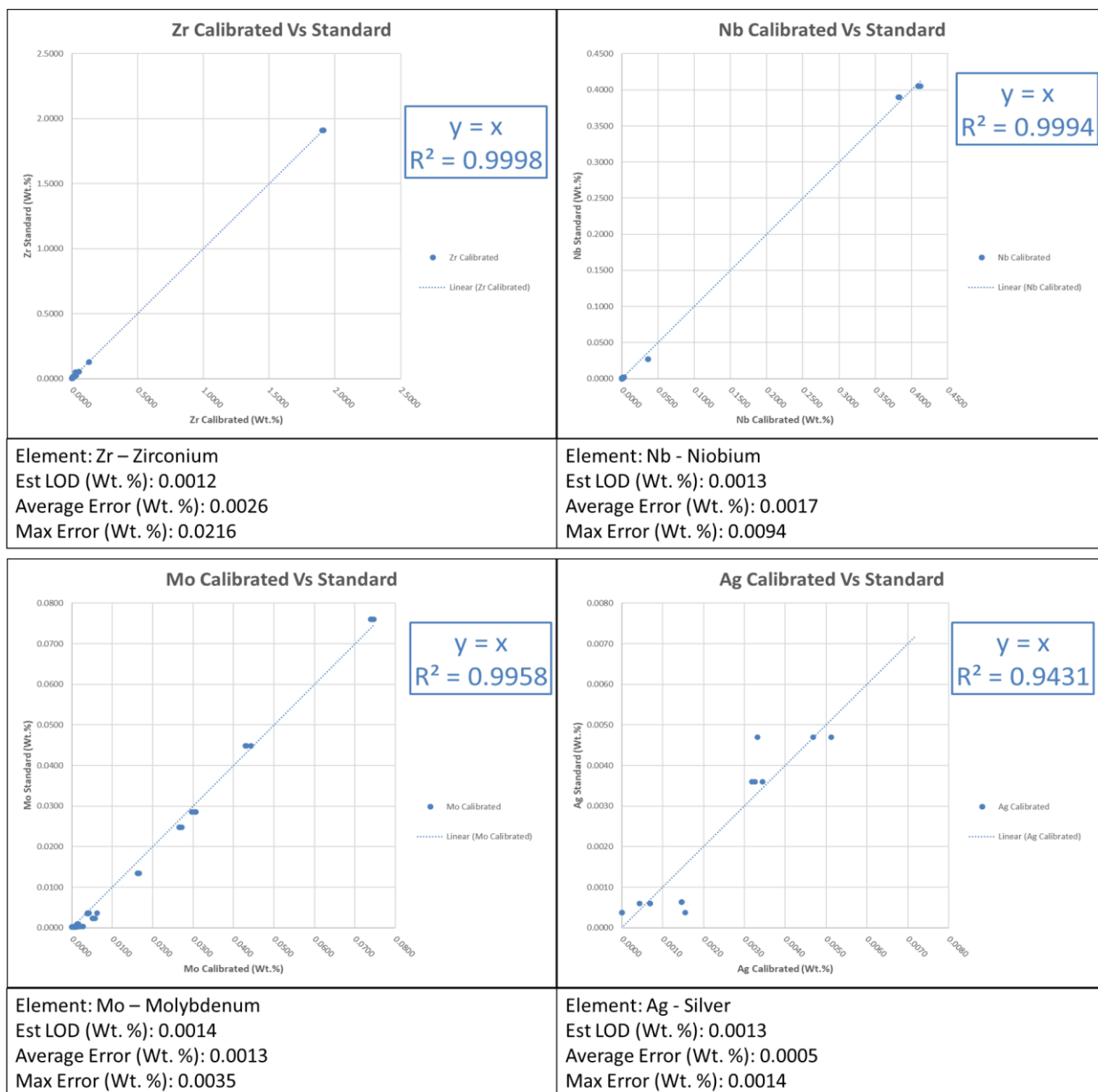


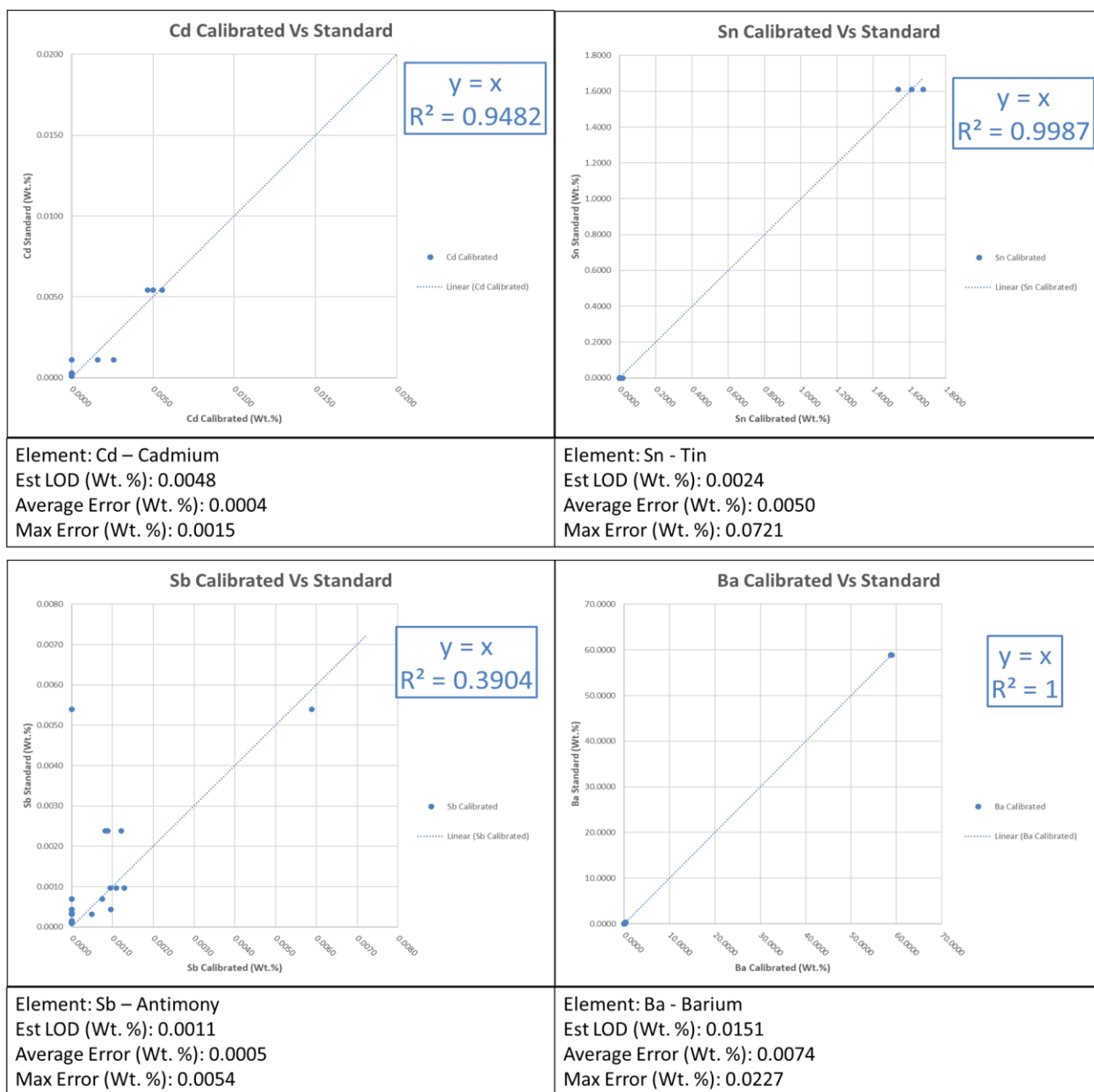


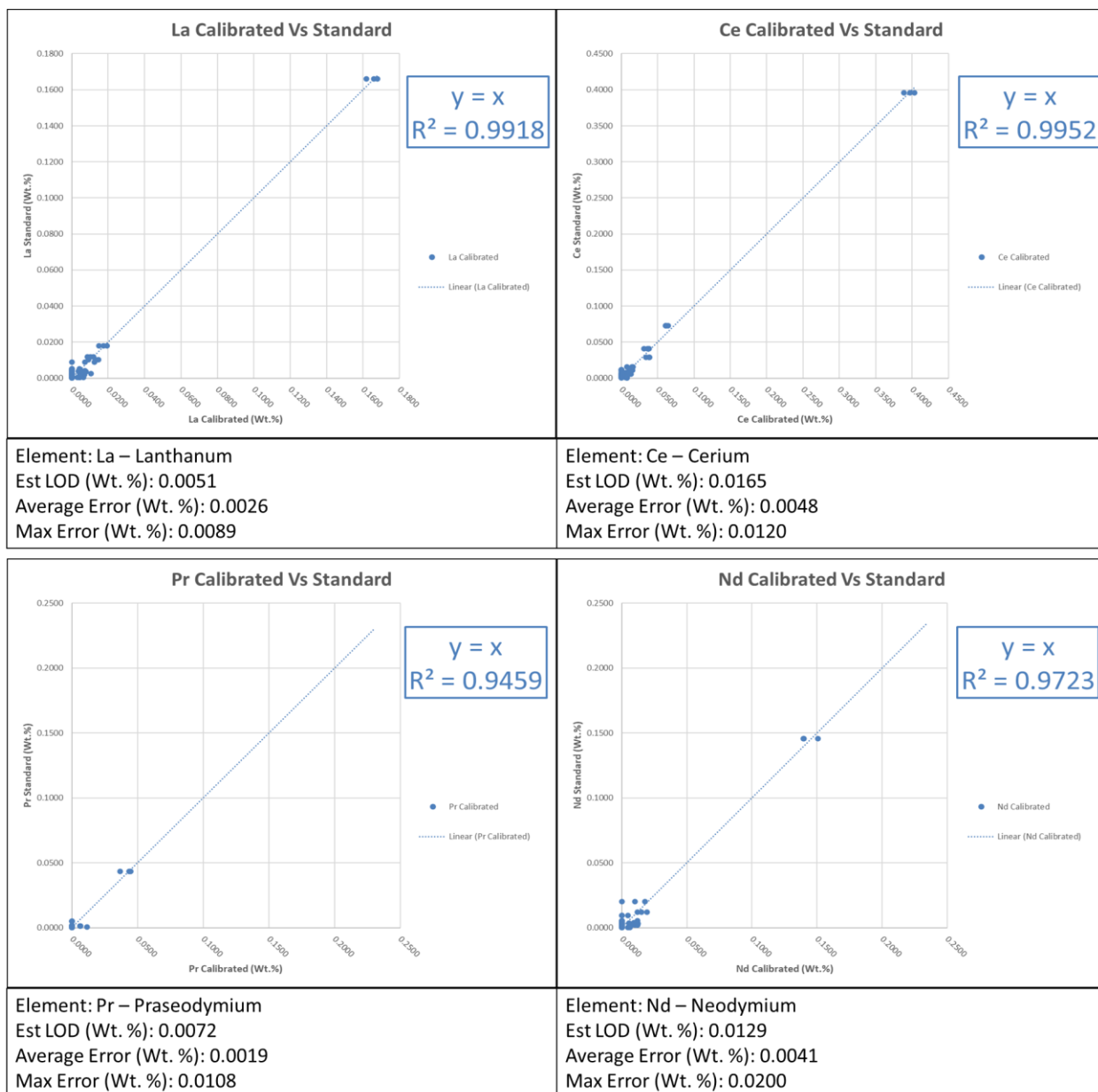


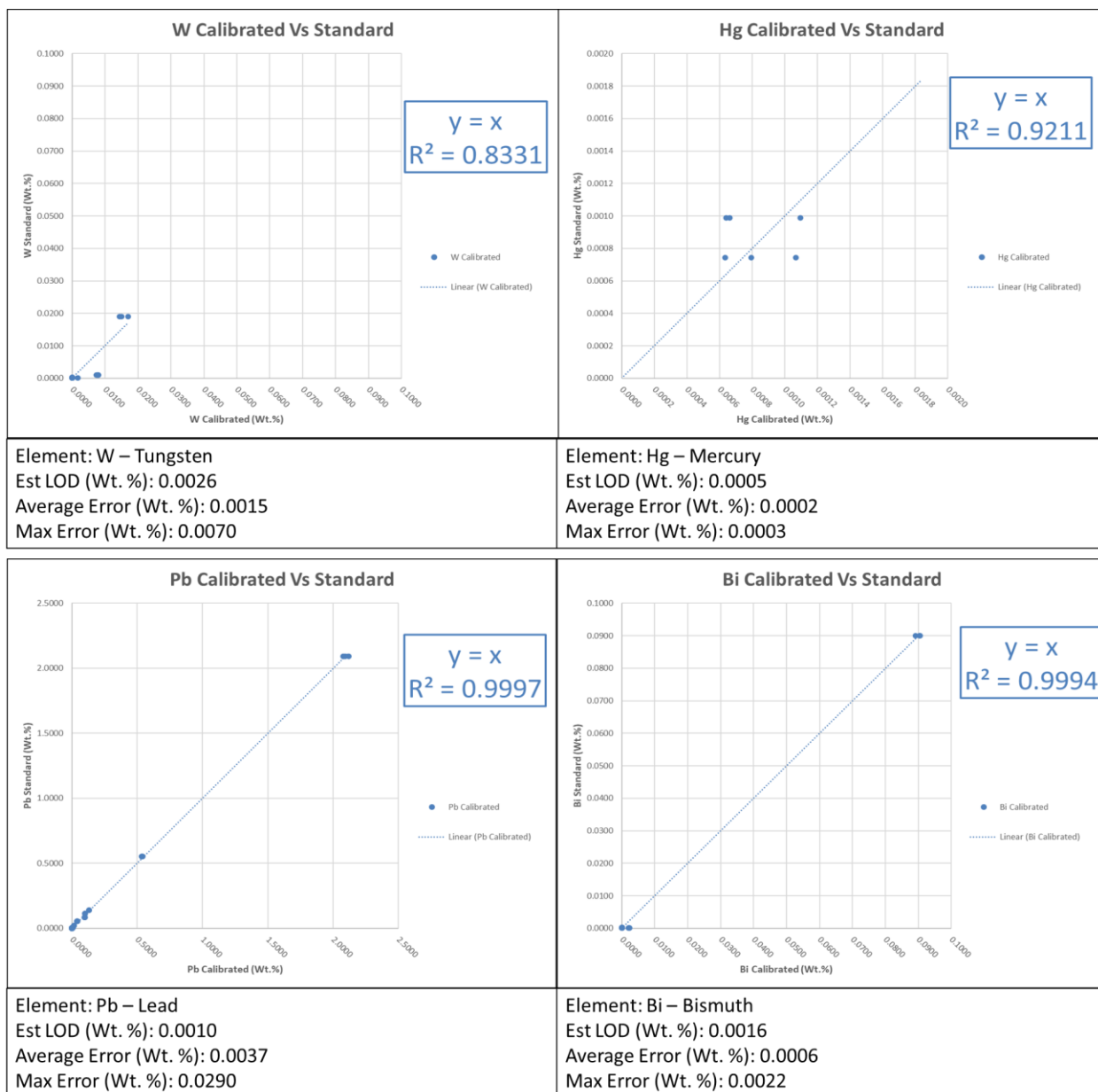


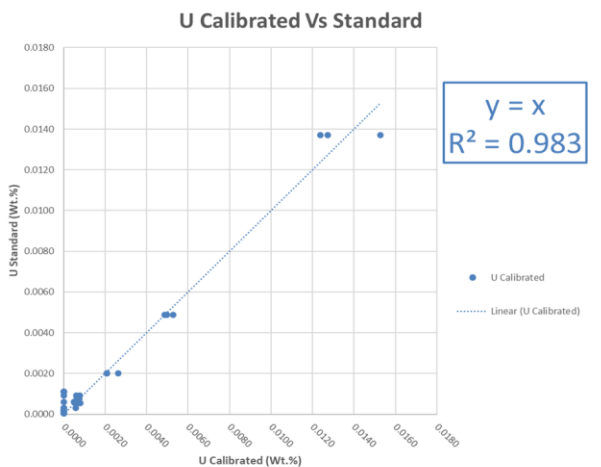












Element: U – Uranium
Est LOD (Wt. %): 0.0015
Average Error (Wt. %): 0.0004
Max Error (Wt. %): 0.0016