

Iron, Copper and Zinc Isotope Compositions of Biological Reference Materials Determined by MC-ICP-MS

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The supplementary materials include three figures and one table

FIGURE CAPTIONS

Figure S1. Elution curve of the Cu, Fe and Zn separation procedure for first column using AG MP1 resin.

Figure S2. Doping experiments to test matrix elements interferences on $\delta^{56}\text{Fe}$ (a, b, c, d, e) and $\delta^{66}\text{Zn}$ (f, g, h, i, j, k) analysis. The Fe and Zn concentration for samples and bracketing standards (IRMM 014 for Fe and SRM 683 for Zn) is the same. The errors (2SD) were calculated based on two times replicate measurement.

Figure S3. $\delta^{56}\text{Fe}$, $\delta^{65}\text{Cu}$ and $\delta^{66}\text{Zn}$ values of the in-house standards during the past 12 months, where GSB and USTC-Fe are the internal standards for Fe isotope analysis, NIST 976 and AAS are the internal standards for Cu isotope analysis,

and AAS and IRMM 3702 are the internal standards for Zn isotope analysis. The long-term precision of each reference solution is better than 0.04‰ (2SD) over this period.

Figure S1

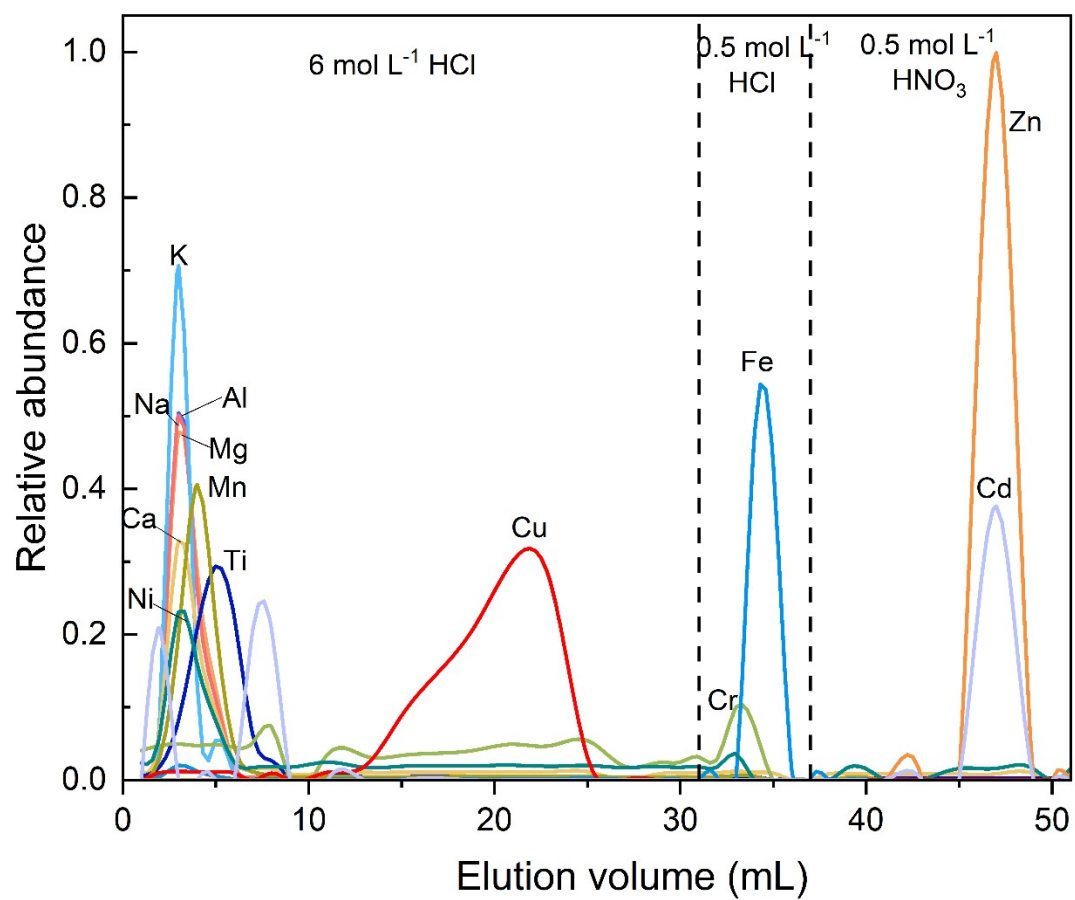


Figure S2

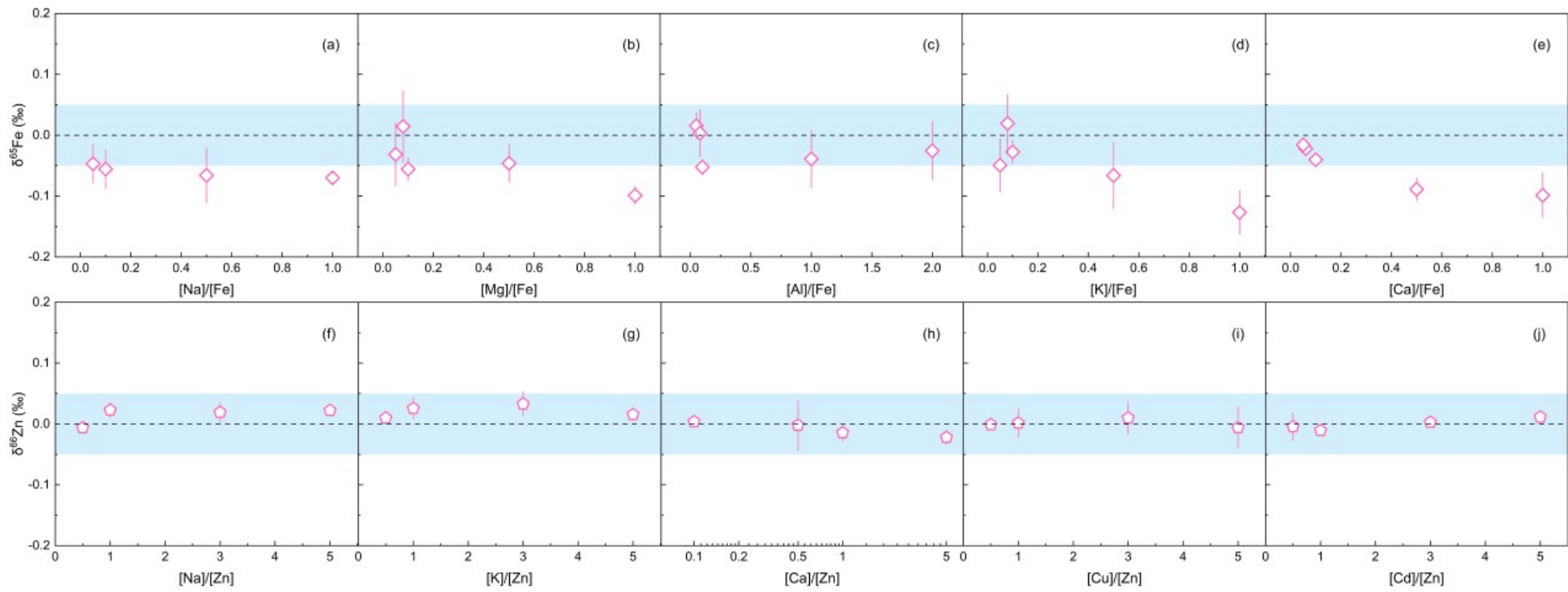


Figure S3

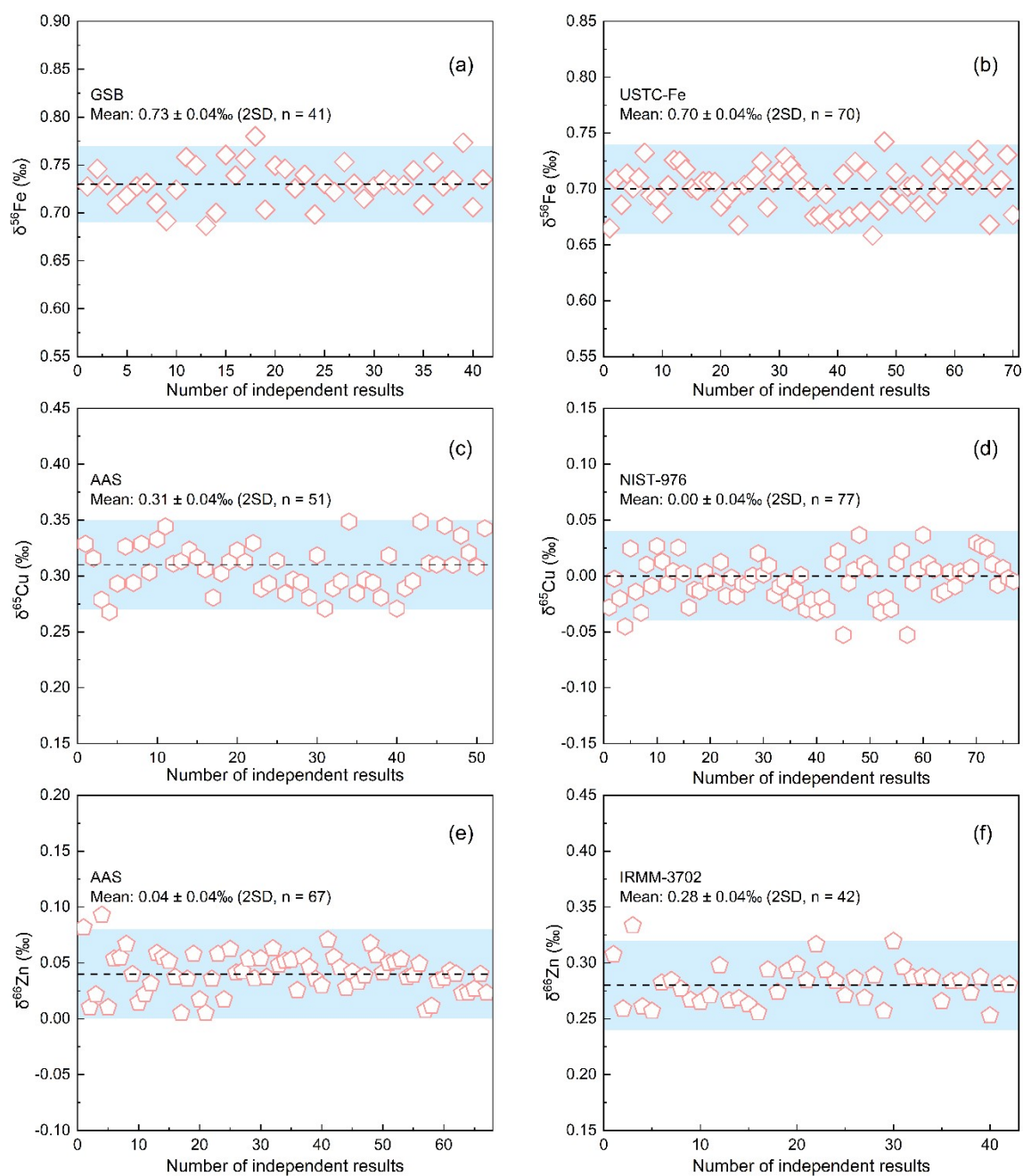


Table S1. Fe, Cu and Zn isotope compositions of biological reference materials from previous studies.

Type	CRM	$\delta^{56}\text{Fe}$ (‰)	2SD	$\delta^{65}\text{Cu}$ (‰)	2SD	$\delta^{66}\text{Zn}$ (‰)	2SD	Purchase situation	Reference
Spinach	NIST SRM1570	□	□	□	□	0.69	0.03	On sale	Costas-Rodriguez et al. [56]
Rice flour	NIST SRM1568a	□	□	□	□	0.39	0.01	On sale	Costas-Rodriguez et al. [56]
Wheat flour	NIST SRM1567a	□	□	□	□	1.17	0.08	On sale	Costas-Rodriguez et al. [56]
Whole meal flour	BCR CRM 189	□	□	□	□	0.61	0.05	Sell out	Costas-Rodriguez et al. [56]
Ryegrass	BCR CRM 281	□	□	□	□	0.40	0.09	Sell out	Arnold et al. [52]
						0.81	0.10		Weiss et al. [57]
						0.38	0.04		Smolders et al. [58]
						0.50	0.10		Caldelas et al. [59]
Lichen	BCR CRM 482	□	□	□	□	0.14	0.03	Sell out	Viers et al. [60]
						0.07	0.10		Cloquet et al. [61]
						0.07	0.10		Dinis et al. [62]
						0.09	0.04		Sonke et al. [63]
Sea lettuce	BCR-279	□	□	0.26	0.02	0.52	0.03	Sell out	Druce et al. [41]
						0.55	0.04		Druce et al. [41]
						0.51	0.06		Jeong et al. [32]
Plankton	BCR-414	□	□	□	□	0.42		On sale	Maréchal et al. [64]
						-0.19	0.04		Jeong et al. [32]
						-0.27	0.04		Takano et al. [65]
						-0.29	0.10		Yang et al. [66]
						0.31	0.10		Druce et al. [41]
Aquatic plant	BCR-670	□	□	0.26	0.02	0.32	0.06	On sale	Druce et al. [41]
						0.23	0.02		Jeong et al. [32]

Haricots vert	BCR-383	-0.33	0.09	-0.05	0.05	0.44	0.04	Sell out	Sauzéat et al. [67]
Apple leaves	NIST 1515	-0.71	0.06					On sale	Kubik et al. [5]
		-0.71	0.04	□	□	□	□		Kubik et al. [5]
Tomato leaves	NIST SRM 1573a					0.79	0.09	On sale	Araújo et al. [68]
		□	□	0.70	0.02	0.78	0.06		Jeong et al. [32]
Peach leaves	NIST SRM 1547	-0.30	0.05	0.43	0.21	-0.06	0.14	On sale	Rodushkin et al. [44]
Olive leaves	BCR-62	□	□	□	□	0.43	0.02	Sell out	Tang et al. [69]
Wood fuel	NJV 94-5	-0.16	0.08	-0.40	0.27	-0.21	0.10	Sell out	Rodushkin et al. [44]
Oak leaves	V464	□	□	□	□	-0.43	0.02	Sell out	Tang et al. [69]
Human hair	ERM DB001	-0.35	0.24			-0.05	0.07	On sale	Kubik et al. [5]
						-0.05	0.07		Moore et al. [25]
						-0.04	0.07		Moore et al. [25]
						-0.04	0.07		Moore et al. [25]
		□	□	□	□	0.00	0.07		Moore et al. [25]
Human Serum	BCR-639					-2.97	0.08	On sale	Moore et al. [25]
						-3.06	0.08		Moore et al. [25]
						-3.11	0.08		Moore et al. [25]
						-2.99	0.08		Moore et al. [25]
						-2.94	0.08		Moore et al. [25]
						-2.96	0.08		Moore et al. [25]
						-3.05	0.10		Moore et al. [25]
						-3.04	0.10		Moore et al. [25]
		□	□	-0.53	0.06	-2.78	0.20		Larner et al. [23]
Fish muscle	ERM BB422					-0.09	0.08	On sale	Moore et al. [25]
						-0.04	0.08		Moore et al. [25]
						-0.05	0.07		Moore et al. [25]

		□	□	□	□	-0.05	0.07		Moore et al. [25]
Tuna fish	ERM-CE464	-0.65	0.10						Kubik et al. [5]
		-0.60	0.09	0.11	0.05	-0.42	0.04	Sell out	Sauzéat et al. [67]
		□	□	□	□	-0.34	0.04		Sauzéat et al. [67]
Fish protein	DORM-4			0.52	0.08				Sullivan et al. [70]
						0.09	0.02	Sell out	Jeong et al. [32]
		-0.26	0.07	0.48	0.06	0.07	0.04		Sauzéat et al. [67]
Mussel tissue	NIST SRM 2976			0.25	0.04	0.56	0.04	On sale	Jeong et al. [32]
	BCR CRM 278					0.73	0.01	Sell out	Costas-Rodriguez et al. [56]
						0.82	0.04		Maréchal et al. [64]
	ERM-CE278	□	□	0.27	0.06	0.72	0.02	On sale	Jeong et al. [32]
Oyster	NIST SRM1566b	□	□	0.30	0.02	0.71	0.02	On sale	Jeong et al. [32]
Lobster liver	BCR CRM TORT-1	-0.20	0.09	-0.08	0.10	0.65	0.10	Sell out	Rodushkin et al. [44]
	BCR CRM TORT-2					0.51	0.04	Sell out	Maréchal et al. [64]
				0.52	0.08	0.51	0.02		Jeong et al. [32]
	BCR CRM TORT-3			0.36	0.05			On sale	Sullivan et al. [70]
		-1.41	0.10	0.35	0.05	0.23	0.04		Sauzéat et al. [67]
Dogfish liver	DOLT-4					-0.98	0.05	Sell out	Druce et al. [41]
				-0.19	0.02	-0.96	0.04		Jeong et al. [32]
	DOLT-5			-0.02	0.08			On sale	Sullivan et al. [70]
		□	□	□	□	-1.02	0.03		Druce et al. [41]
Skimmed milk	BCR CRM 063R	□	□	□	□	0.52	0.04	Sell out	Costas-Rodriguez et al. [56]
Whole milk	BCR CRM 380R			-0.13	0.06			Sell out	Sauzéat et al. [67]
		-1.55	0.05	0.12	0.06	0.53	0.06		Sauzéat et al. [67]
Bovine muscle	BCR CRM 184					0.02	0.02	Sell out	Costas-Rodriguez et al. [56]
	ERM-BB184	-1.97	0.07			-0.08	0.08	On sale	Kubik et al. [5]

						-0.08	0.08		Moore et al. [25]
						-0.03	0.07		Moore et al. [25]
						0.05	0.08		Moore et al. [25]
						-0.01	0.06		Moore et al. [25]
		□	□	□	□	-0.01	0.12		Schilling et al. [45]
Bovine liver	ERM-BB185	-1.48	0.07			-0.08	0.08	On sale	Kubik et al. [5]
	NIST SRM1577a					0.24	0.02	Sell out	Costas-Rodriguez et al. [56]
	NIST SRM1577c	-1.33	0.07	0.37	0.05	-0.19	0.05	On sale	Sauzéat et al. [67]
		-1.34	0.03	□	□	□	□		Craddock et al. [71]
Bovine blood	ERM-CE196	-2.27	0.12	□	□	□	□	On sale	Kubik et al. [5]
Pork muscle	ERM-BB124	-1.92	0.02	□	□	□	□	On sale	Kubik et al. [5]
Pig kidney	ERM BB186	-2.16	0.04						Kubik et al. [5]
		-2.07	0.14	2.70	0.25	-0.33	0.15		Rodushkin et al. [44]
						-0.40	0.14		Schilling et al. [45]
						-0.45	0.07	On sale	Moore et al. [25]
						-0.41	0.08		Moore et al. [25]
						-0.35	0.08		Moore et al. [25]
						-0.38	0.08		Moore et al. [25]
		□	□	□	□	-0.27	0.08		Moore et al. [25]