SLAG FROM EARLY MEDIEVAL GLASS AND IRON PRODUCTION

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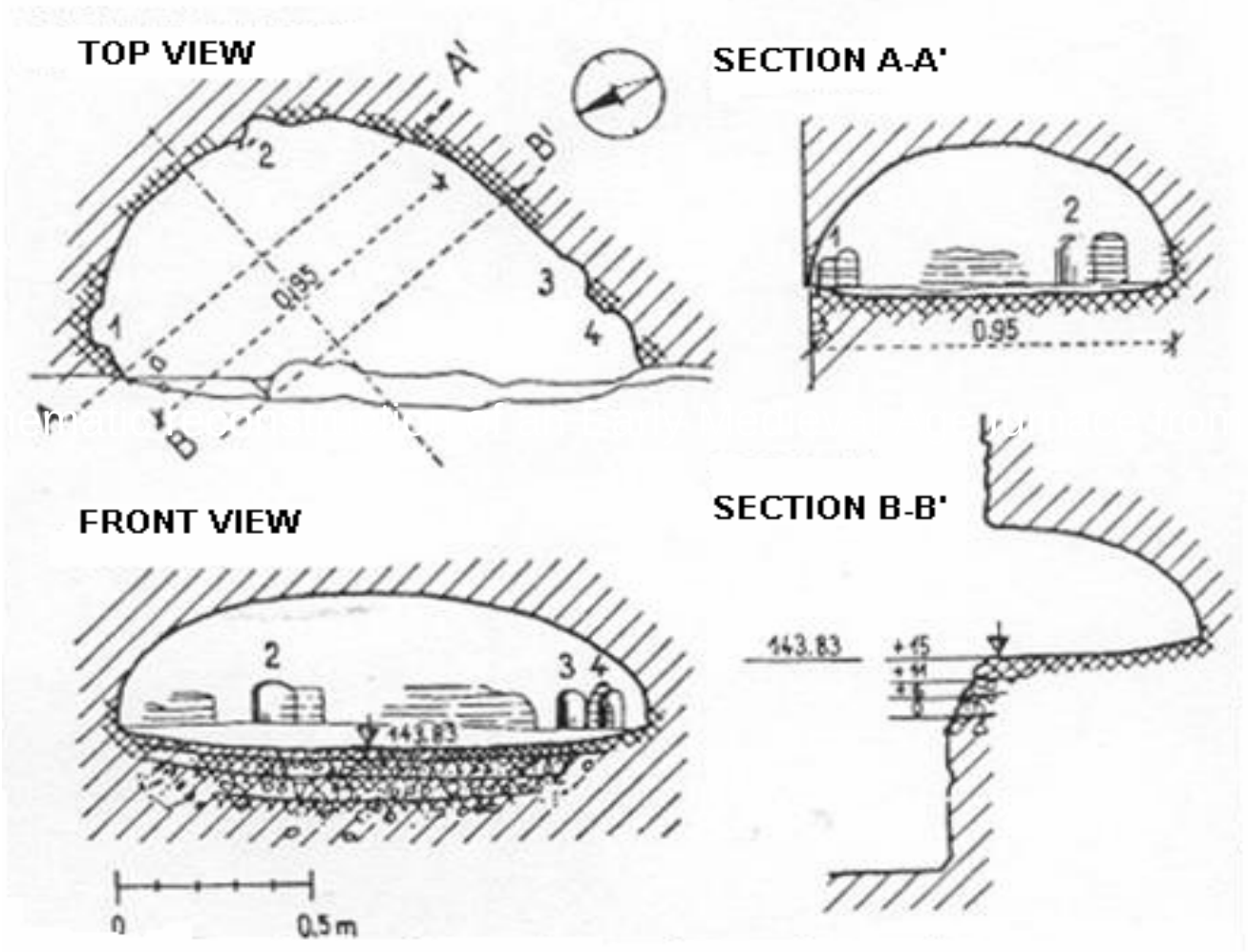
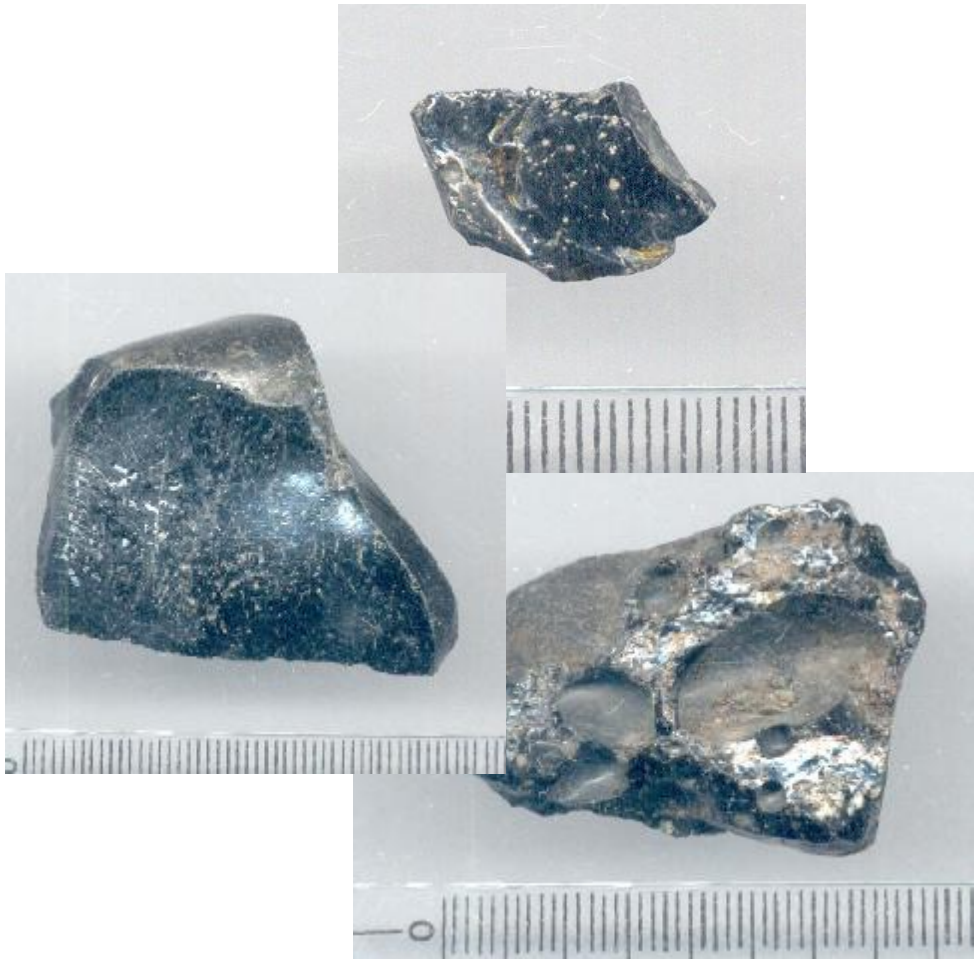
Schematic reconstruction of an Early Medieval Age furnace from Nitra:



Samples:

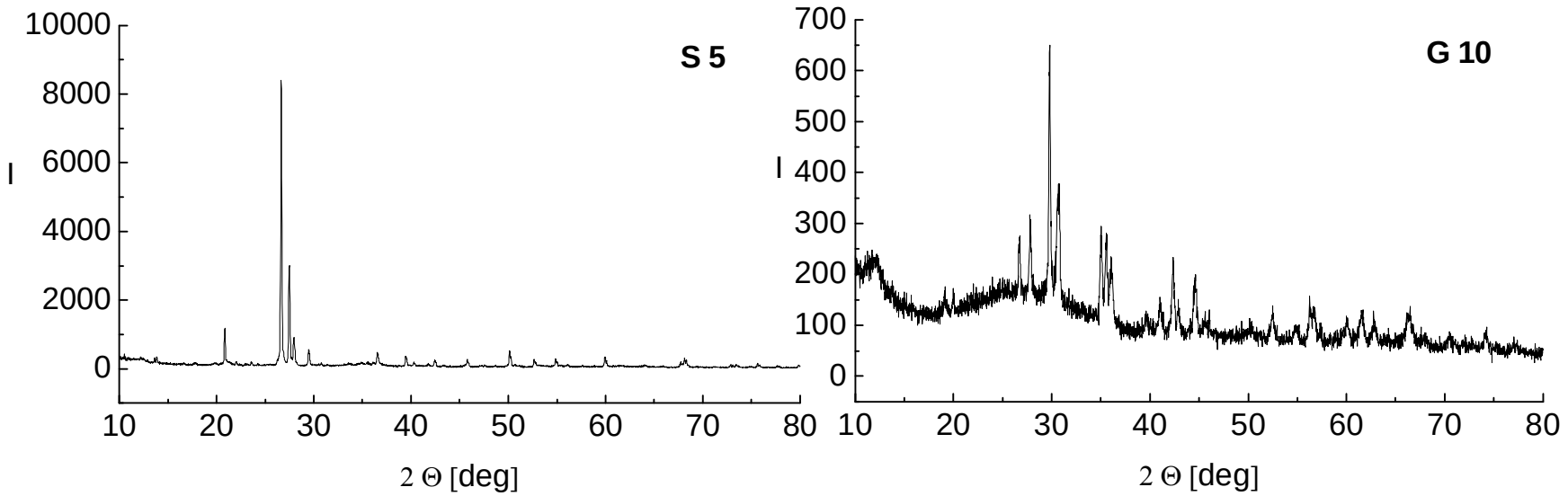
glass-like slag



iron slag

X–ray diffraction

Measured samples: S 3, S 5 , S 7 and G 10.
In all of them **fayalite** (Fe_2SiO_4) and **quartz** (SiO_2) were identified.



X–ray fluorescence

Measured samples: S 3, S 5 , S 7 and G 10.

sample	Fe	Si	Ca	Al	P	K	Mg	Mn	Na	Ti	SUM [%]
S 3	28.92	18.01	4.28	2.92	1.45	1.52	0.84	0.53	0.48	0.16	59.11
S 5	19.27	25.22	3.22	4.18	0.59	1.47	0.70	0.07	0.72	0.23	55.67
S 7	24.27	18.19	7.71	3.48	1.05	2.57	0.80	0.45	0.52	0.19	59.23
G 10	7.73	22.13	8.76	6.33	0.14	0.85	4.22	4.55	0.61	0.93	56.25

Neutron Activation Analysis

Measured samples: S 3, S 5 , S 7, G 9, G 10, G 11.

	^{56}Mn	^{27}Mg	^{24}Na	^{42}K	^{28}Al	^{48}Ca
S 3	x		x		x	
S 5	x		x		x	
S 7	X	x	x	x	x	x

G 9	x		x
G 10	x		x
G 11	X	x	x

Mössbauer spectrometry experimental details:

Samples for Mössbauer effect experiments were prepared by crushing to powder

^{57}Fe Mössbauer spectra were taken at 300 K (RT) with ^{57}Co /Rh source in transmission geometry.

Calibration was perfomed with α-Fe foil, and isomer shifts are given relative to α-Fe.

Spectral parameters were refined by the help of CONFIT fitting software.

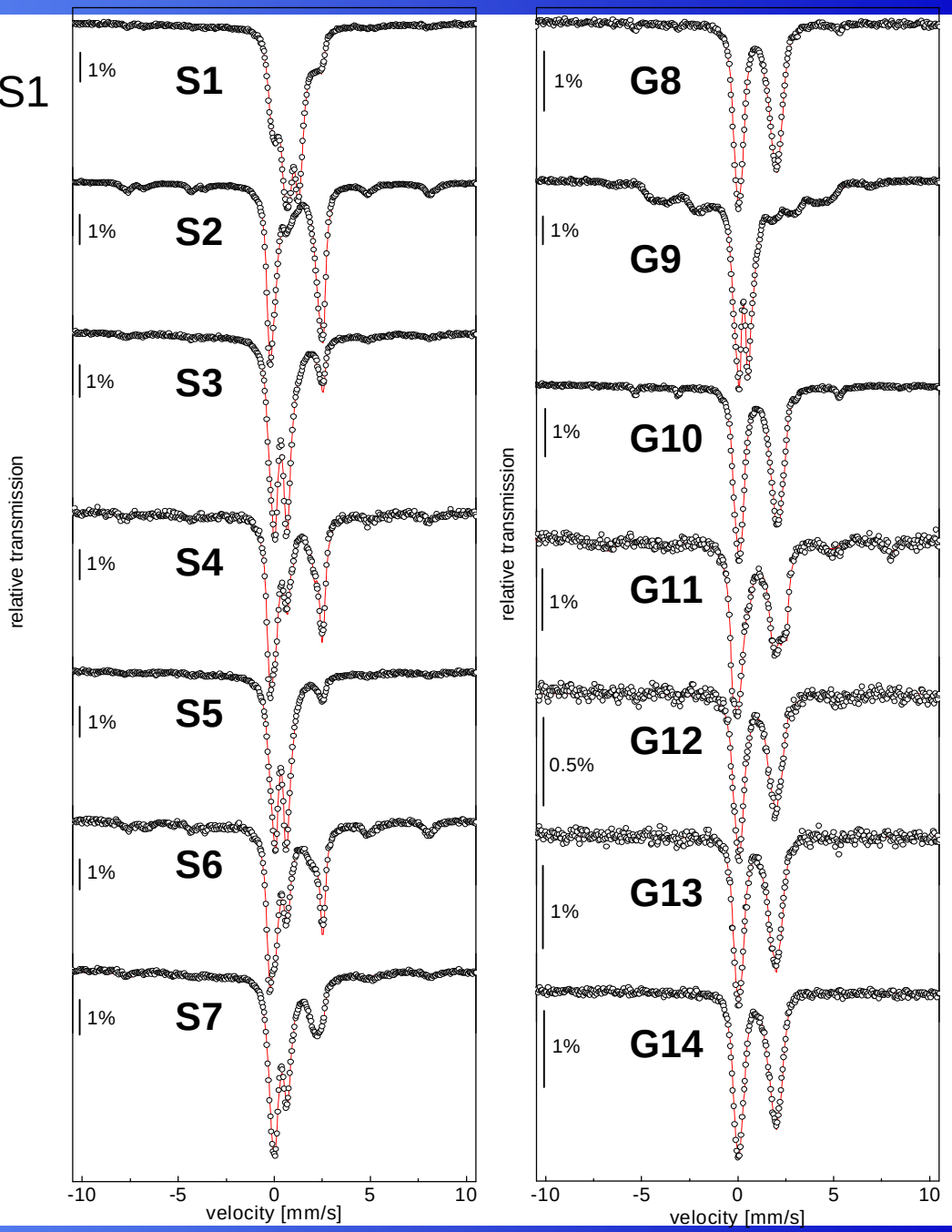
Mössbauer spectra - All samples

S1

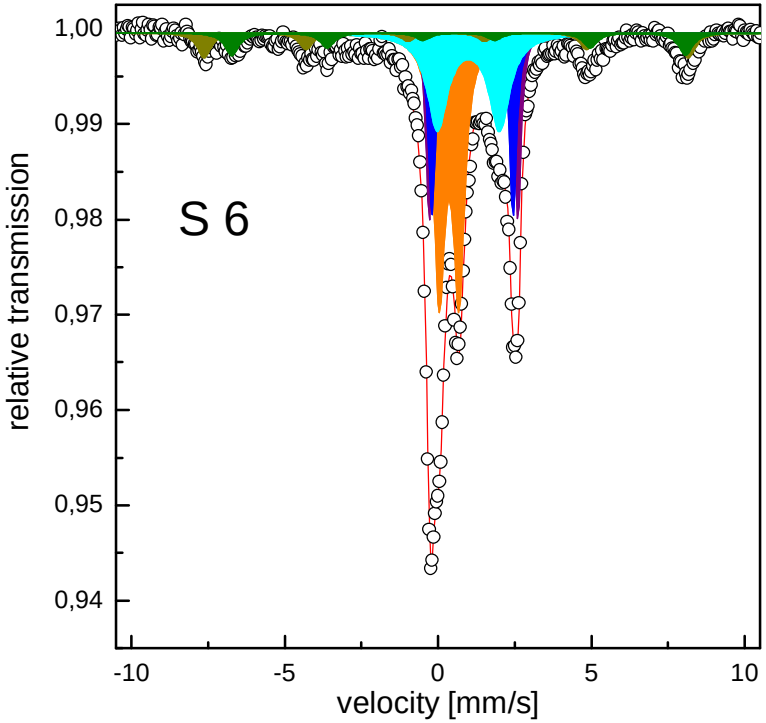
Samples measured by XRD:
S 3, S 5 , S 7, G 10

Samples measured by XRF
S 3, S 5 , S 7, G 10.

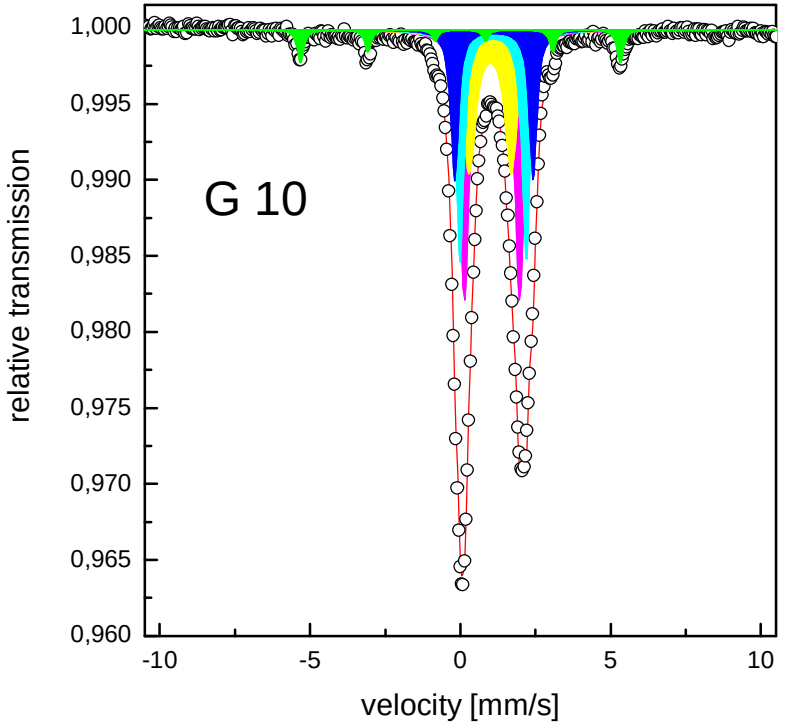
Samples measured by NAA
S3, S5, S 7, G9, G10, G11



One spectra from each group



Component	A [%]	IS [mm/s]	QS [mm/s]	B [T]
Fe_3O_4 A-site	7	0.27	0	49.1
Fe_3O_4 B-site	7	0.67	0	46
Fe_2SiO_4	14	1.16	2.9	
$(Fe,Mg)_2SiO_4$	16	1.12	2.65	
Fe^{2+} 4	23	0.99	2.02	
Fe^{3+} 4	33	0.36	0.64	



Component	A [%]	IS [mm/s]	QS [mm/s]	B [T]
α-Fe	6	0	0	33.04
$(Fe,Mg)_2SiO_4$	15	1.11	2.61	
Fe^{2+} 4	24	1.09	2.21	
Fe^{2+} 4	32	1.06	1.82	
Fe^{2+} 4	23	0.99	1.41	

Conclusions

In all samples, Fe2+ and Fe3+ structural positions were revealed. In addition, some of the archaeological artefacts that are presumably coming from glass production show traces of metallic iron. On the other hand, slag from iron production exhibit minute contribution of iron oxides in several instances. Based on the results obtained from room temperature as well as low temperature Mössbauer spectra we were able to identify possible iron sites in the samples studied. Among them the contribution of fayalite plays a dominant role. It partial substitution presumably with Mg is also revealed. The obtained results are supported by findings from XRD, NAA and XRF analyses.