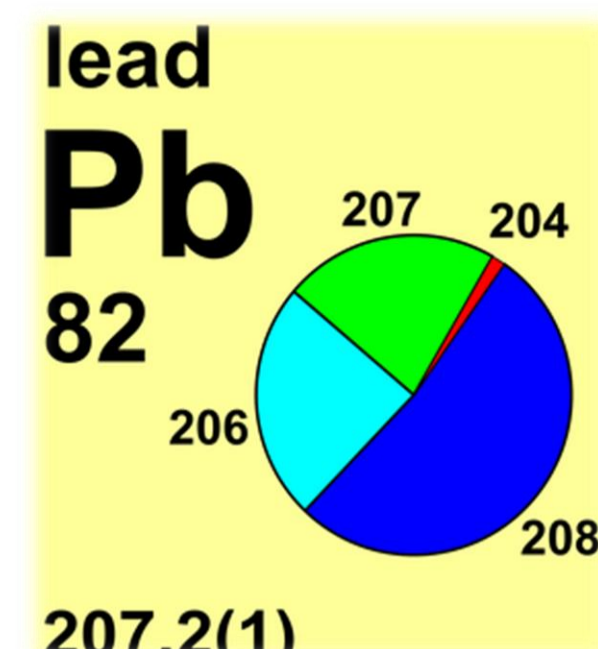


APPLICATION OF Q-ICP-MS FOR SENSITIVE DETERMINATION OF LEAD ISOTOPE RATIOS IN VARIOUS ORGANICALLY BASED MATRIXES



Biljana Balabanova¹, Violeta Ivanova-Petropulos¹, Blazo Boev²

¹Faculty of Agriculture, Goce Delčev University, Krste Misirkov No. 10-A, 2000 Štip, Republic of Macedonia

²Faculty of Natural and Technical Sciences, Goce Delčev University, Krste Misirkov No. 10-A, 2000 Štip, Republic of Macedonia

INTRODUCTION

LEAD ISOTOPE RATIO analysis is important as it is used for Pb-Pb dating in geochronology, and to trace the origin of artifacts, precious metals and even foodstuffs. Lead isotope ratio measurement provide analytical information relating to the source of lead contamination in naturally occurring samples. Concentration measurements cannot provide this information. Studies of the isotopic composition of lead are therefore commonly used in the environmental science as well as geological and anthropological studies. Small Pb abundance variations occurs in nature and the isotopic composition of lead in the environment is dependent on the local pollutant source. IF LEAD IS PRESENT IN THE SOIL, A PLANT WILL TAKE UP SMALL AMOUNTS AND SUBSEQUENT ISOTOPE RATIO STUDIES MIGHT PROVIDE UNIQUE MEANS OF DIFFERENTIATING BETWEEN DIFFERENT PLANT SOURCE OF ORIGIN. Of course, local lead level may become mixed with external source of contamination that vary with time depending on the anthropogenic activity.

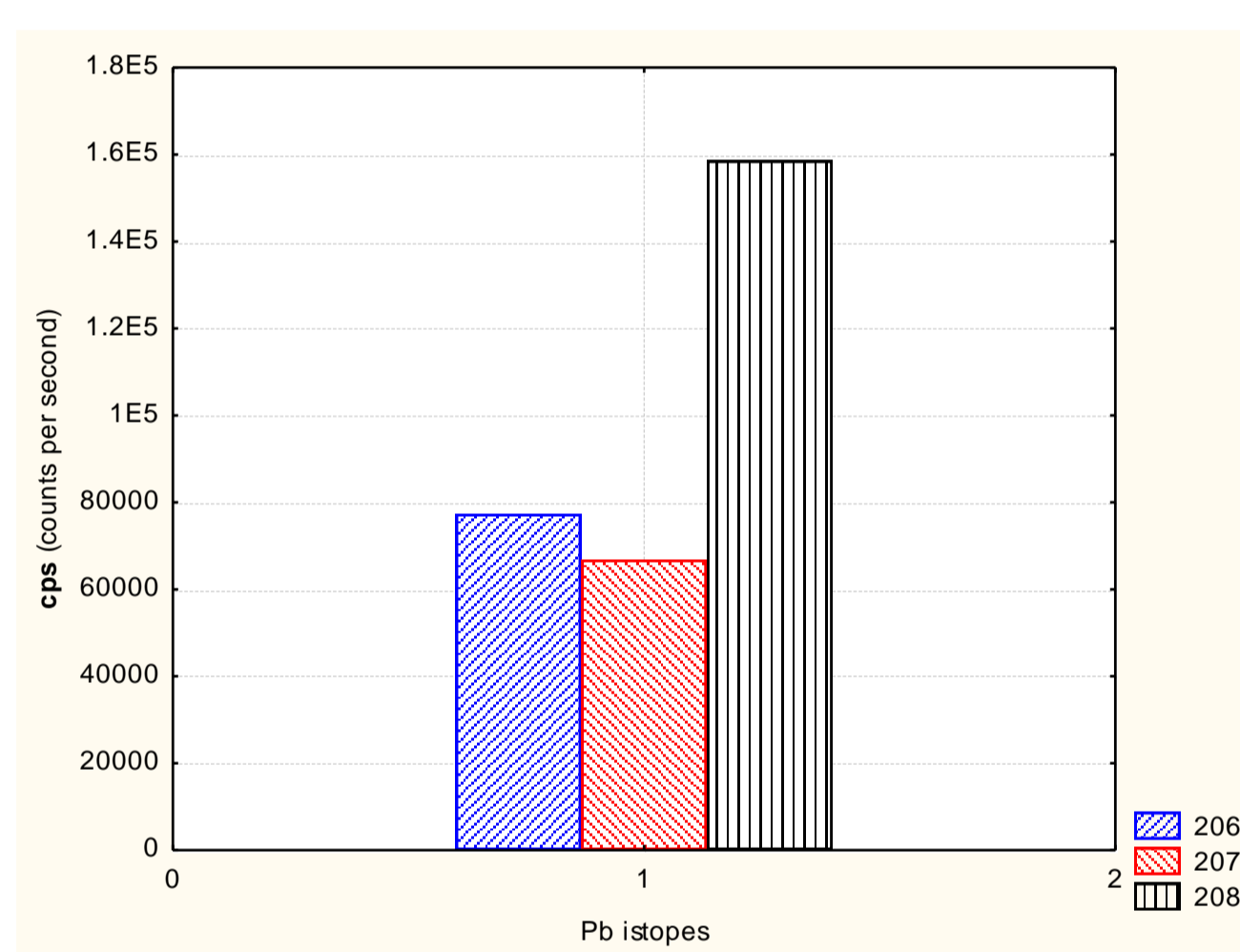
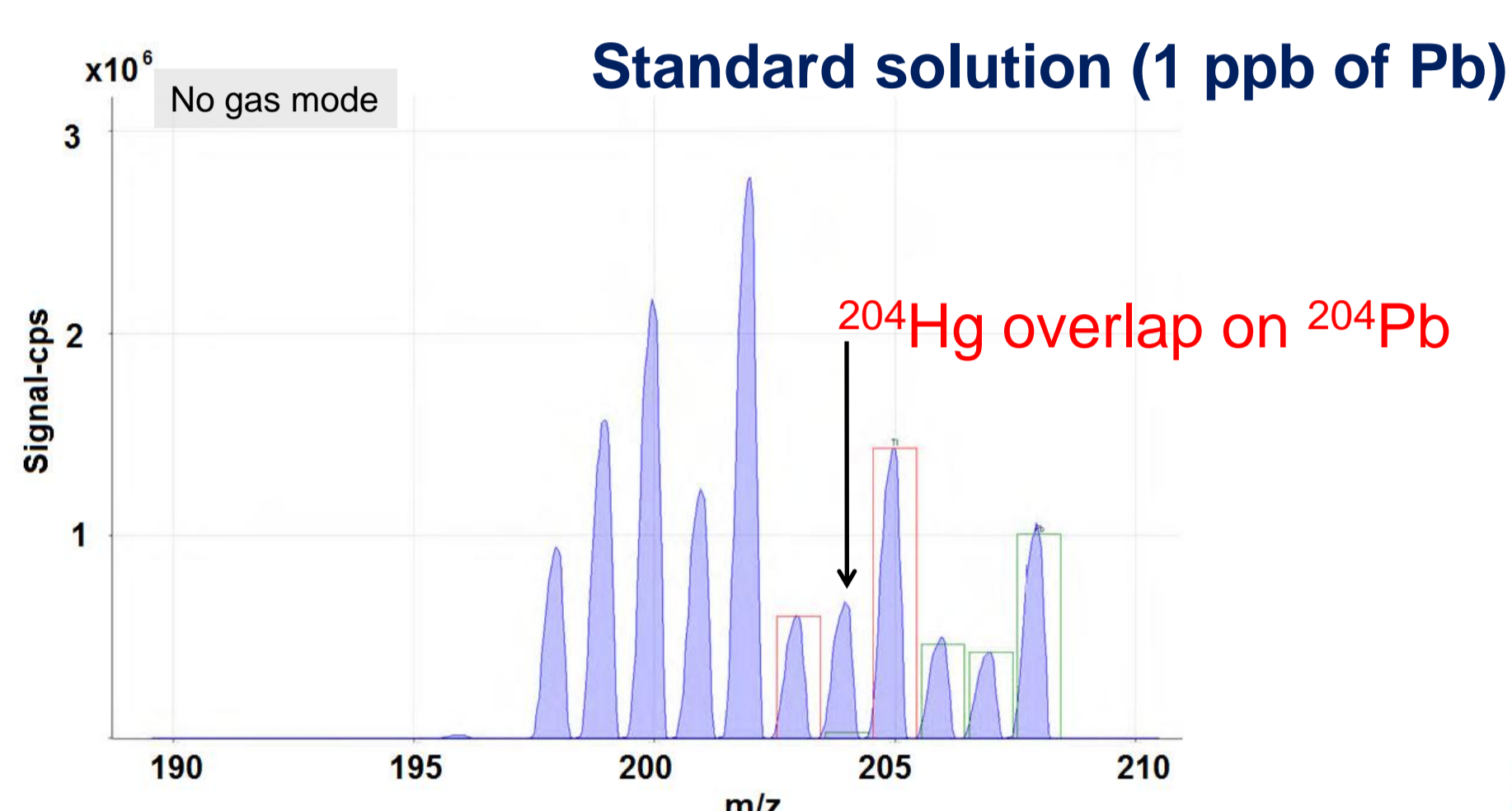
Four stable isotopes of Pb with the following approximate abundances:

- ²⁰⁸Pb (52.4%)
- ²⁰⁷Pb (24.1%)
- ²⁰⁶Pb (22.1%)
- ²⁰⁴Pb (1.4%)

²⁰⁸Pb, ²⁰⁷Pb and ²⁰⁶Pb are formed by the radioactive decay of:

- ²³²Th (half-life = 14 billion years),
- ²³⁵U (half-life = 0.7 billion years),
- ²³⁸U (half-life = 4.5 billion years), respectively.

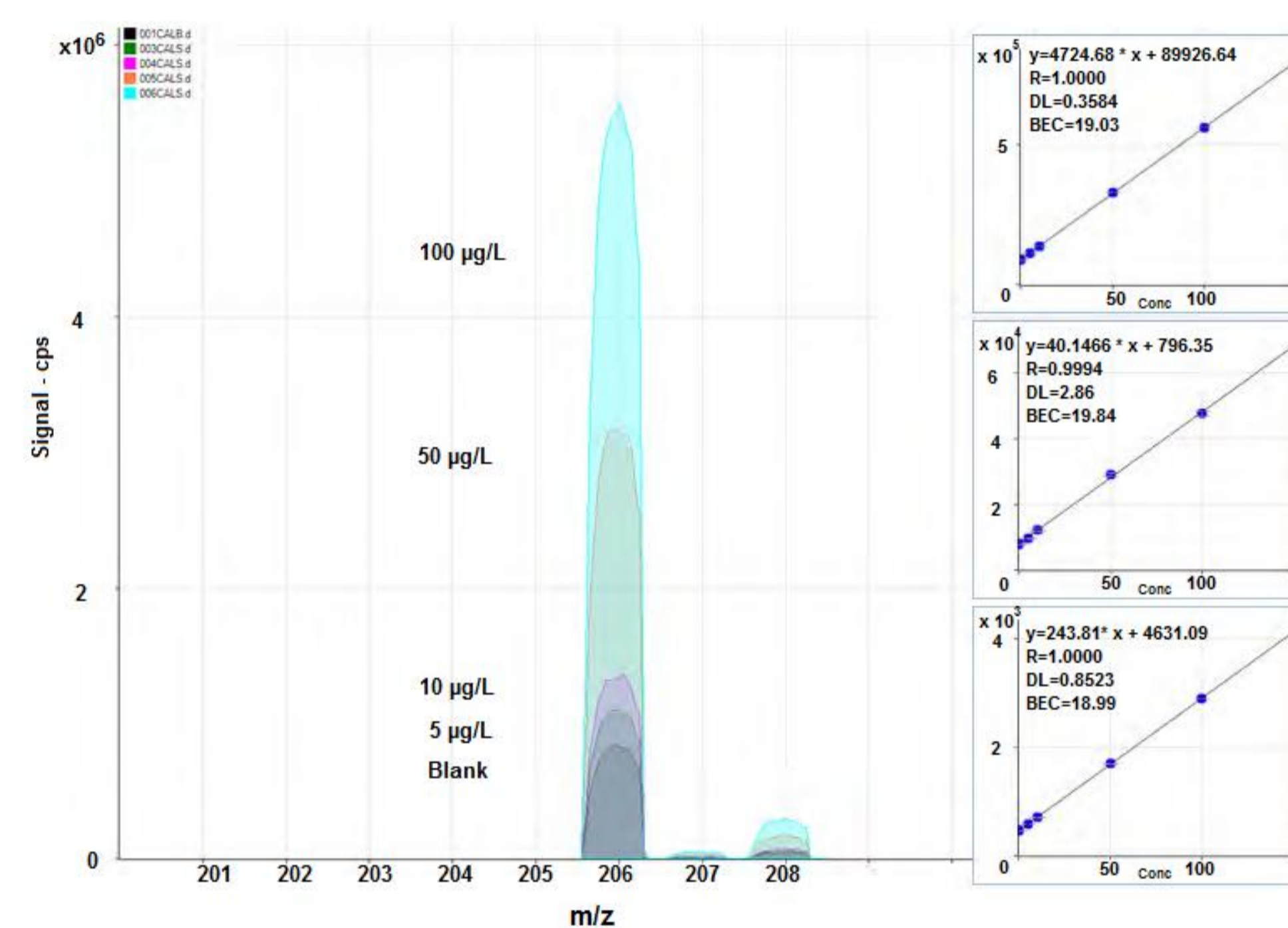
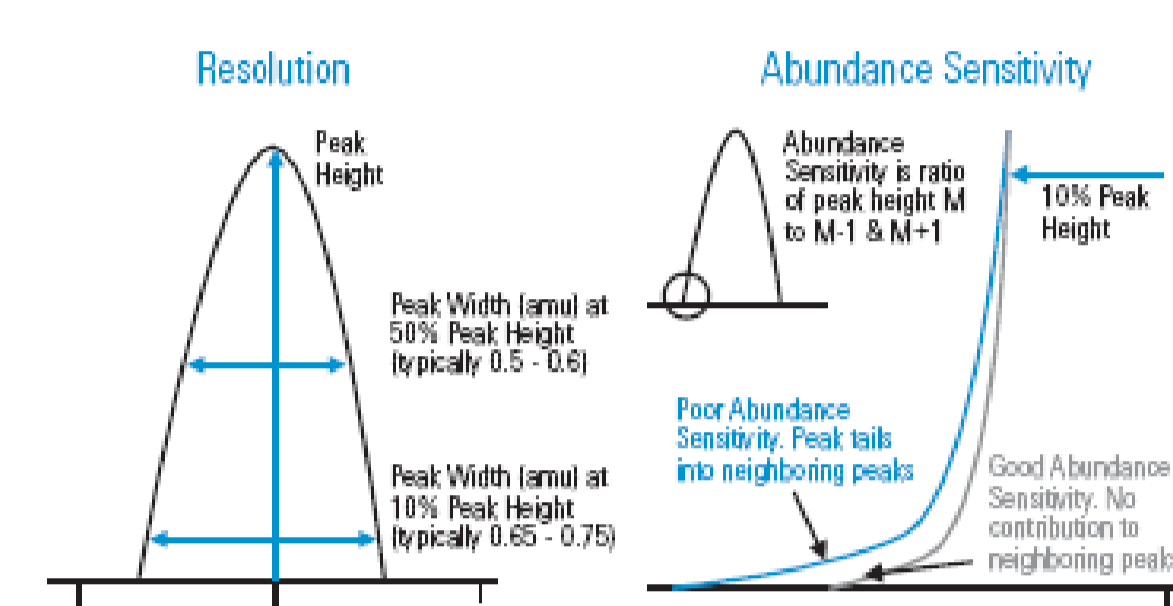
Short-term Stability of Pb isotope ratio determination						
20 ppb	1 rep.	2 rep.	3 rep.	4 rep.	5 rep.	RSD
Acq time	10:22 AM	10:26 AM	10:29 AM	10:31 AM	10:34 AM	
206	0.2413	0.2414	0.214	0.2415	0.2416	0.05
207	0.2211	0.2208	0.2209	0.2209	0.2209	0.05
208	0.5233	0.5235	0.5235	0.5233	0.5232	0.03
207/206	0.9163	0.9146	0.9149	0.9146	0.9144	0.08
208/206	2.169	2.168	2.169	2.167	2.165	0.08



Analytical procedures



QUADROPOLE INDUCTIVELY COUPLED PLASMA WITH MASS SPECTROMETRY (Q-ICP-MS)

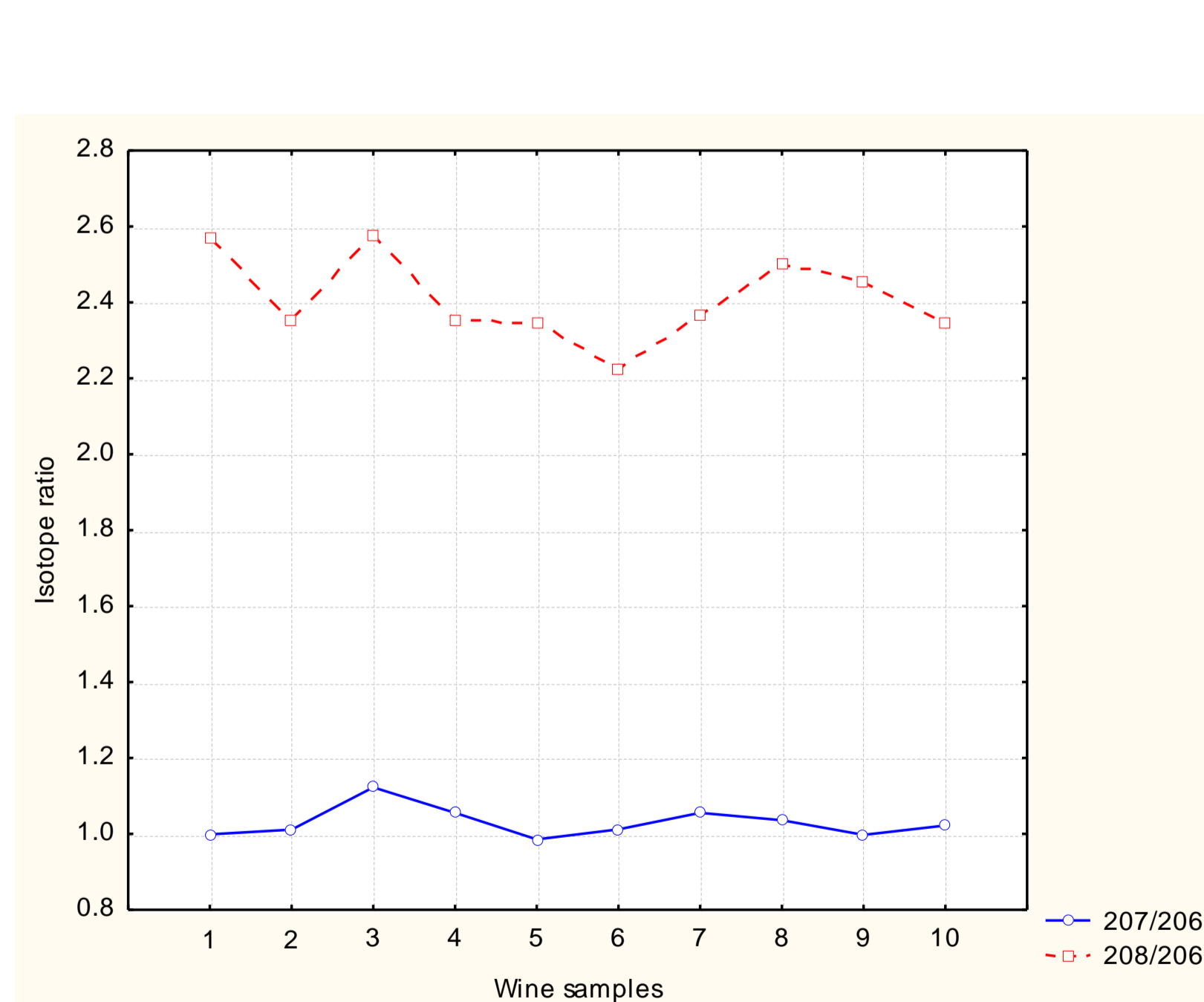


DATA SUMMARY/RESULTS



Lead isotopes measurements for wine samples

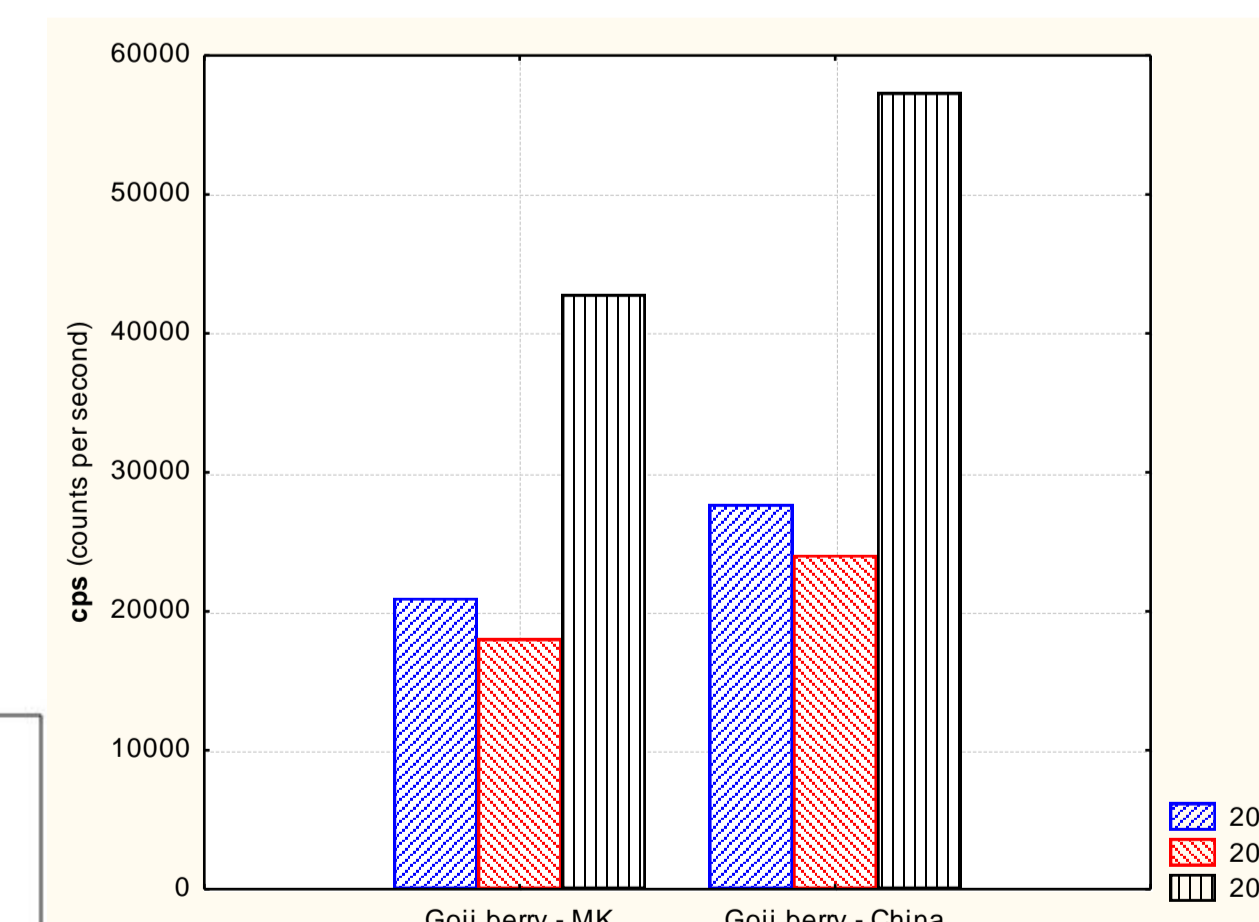
Wine code	²⁰⁷ Pb/ ²⁰⁶ Pb	²⁰⁸ Pb/ ²⁰⁶ Pb	Total Pb content (µg/L)
1	0.998	2.569	6.35
2	1.011	2.356	8.79
3	1.122	2.578	3.74
4	1.055	2.356	3.81
5	0.985	2.345	9.75
6	1.012	2.221	11.2
7	1.055	2.365	10.2
8	1.036	2.998	16.3
9	0.997	2.457	9.58
10	1.022	2.345	10.4



Lead isotopes measurements in Goji berries

Total	Varieties from R. China (in mg/kg)				Varieties from R. Macedonia (in mg/kg)				t	P*
	min	max	Mean	SD	min	max	Mean	SD		
Pb	0.015	0.096	0.054	0.028	0.008	0.028	0.022	0.01	3.08	0.03

Sample	N	²⁰⁷ Pb/ ²⁰⁶ Pb	²⁰⁸ Pb/ ²⁰⁶ Pb
Goji berries - MK	5	0.859 ± 0.15	2.041 ± 0.09
Goji berries - Ch	5	0.868 ± 0.10	2.070 ± 0.08



CONCLUSIONS

- > Q-ICP-MS – sensitive method for simultaneous ²⁰⁶Pb, ²⁰⁷Pb and ²⁰⁸Pb measurements using single tune mode
- > Various samples with different and complex matrix can be analyzed
- > ²⁰⁷Pb/²⁰⁶Pb and ²⁰⁸Pb/²⁰⁷Pb ratios can be very useful for improving isotopic characterization of environmental isotope studies
- > Isotopic data often do not provide a simple tracer to identify and distinguish source emissions.
- > Improved characterization of point source emissions could be achieved with additional isotopic ratios, such as isotopes of Sr and Hg.

