New results from long-term monitoring of Rila mountain region (2000-2006)

Elements content in grass and lichen samples

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The element content measurements are based on EDXRF analyses

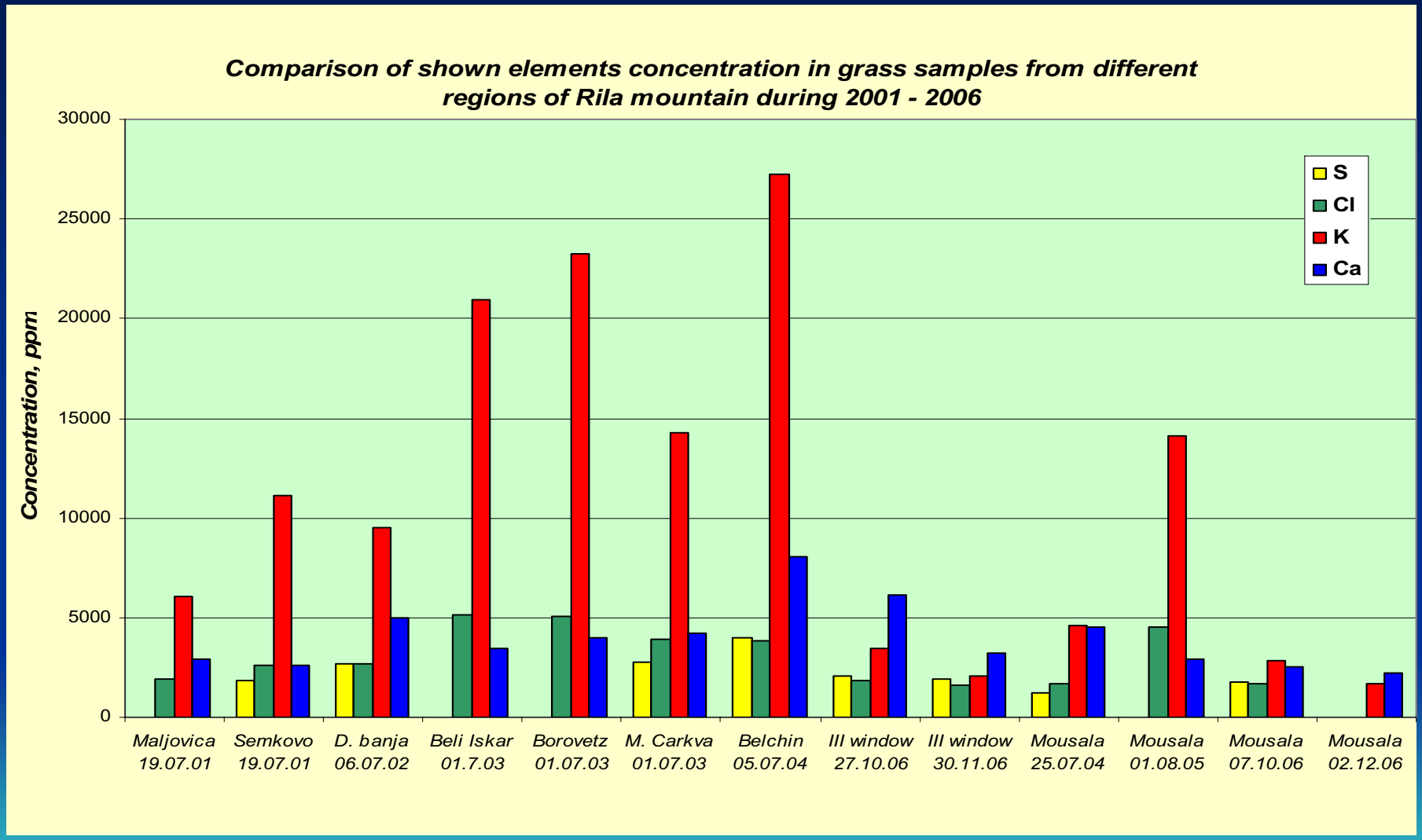
Isotope excitation of characteristics lines is used

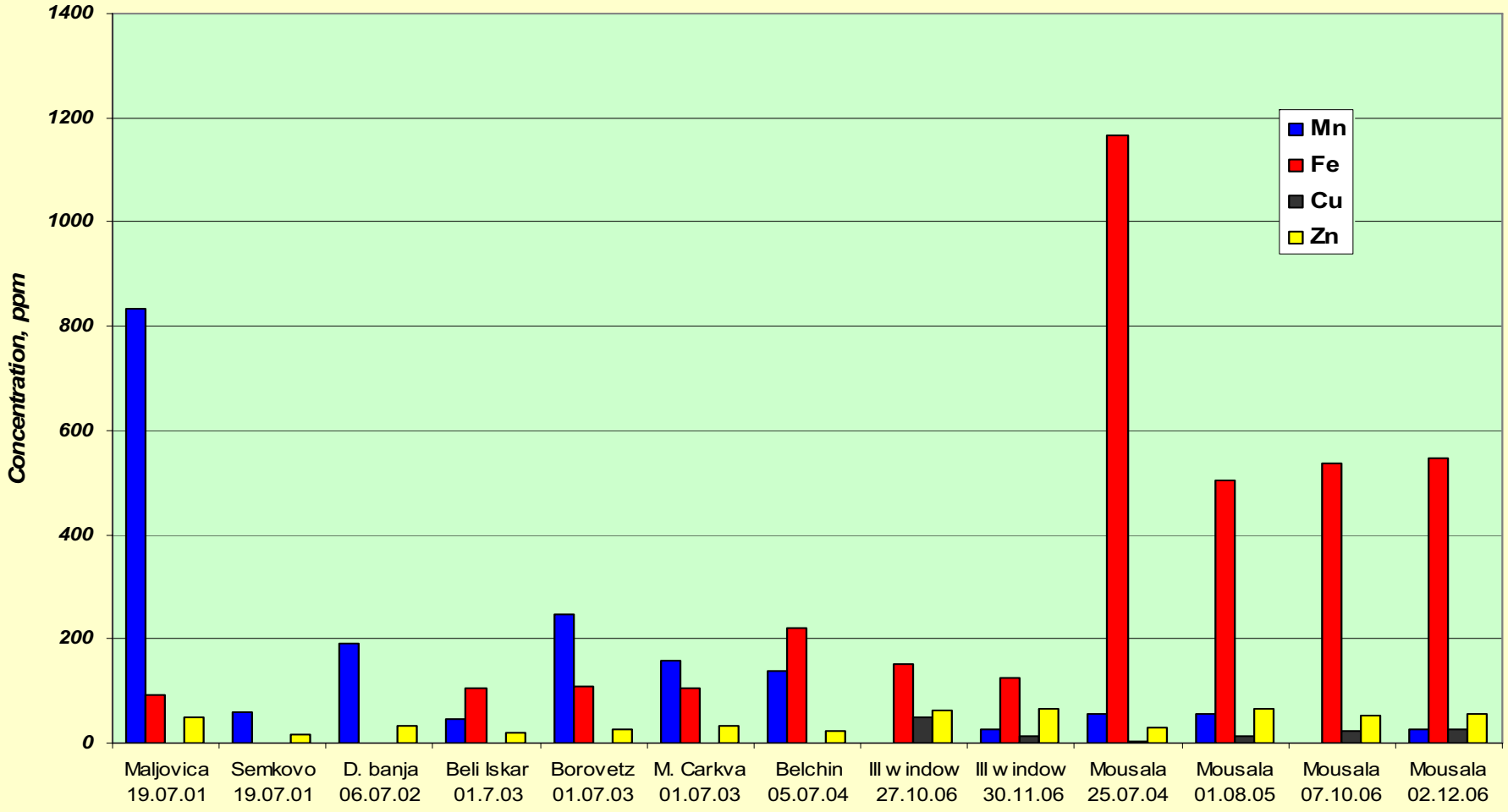
A simple sample preparation procedure is applied

Elements content in grass samples

Why grass?

- The Grass is wide spread phyto-monitor - from the low valley to the high mountain. It is almost everywhere
- All kinds of grass are used as a feed for many animals Concentrations of trace elements found inside grass are directly correlated with environmental levels of these elements
- All the samples were collected from the open area, far away from local ways, roads and impact terrains
- The grass samples were analyzed for 30 elements


Comparison of shown elements concentration in grass samples from different regions of Rila mountain during 2001 - 2006
Concentration, ppm
30000
25000
20000
15000
10000
5000
0
S
Cl
K
Ca
Maljovica 19.07.01
Semkovo 19.07.01
D. banja 06.07.02
Beli Iskar 01.7.03
Borovetz 01.07.03
M. Carkva 01.07.03
Belchin 05.07.04
III window 27.10.06
III window 30.11.06
Mousala 25.07.04
Mousala 01.08.05
Mousala 07.10.06
Mousala 02.12.06


Comparison of shown elements concentration in grass samples from different regions of Rila mountain during 2001 - 2006
Concentration, ppm
1400
1200
1000
800
600
400
200
0
Mn
Fe
Cu
Zn
Maljovica 19.07.01
Semkovo 19.07.01
D. banja 06.07.02
Beli Iskar 01.7.03
Borovetz 01.07.03
M. Carkva 01.07.03
Belchin 05.07.04
III w indow 27.10.06
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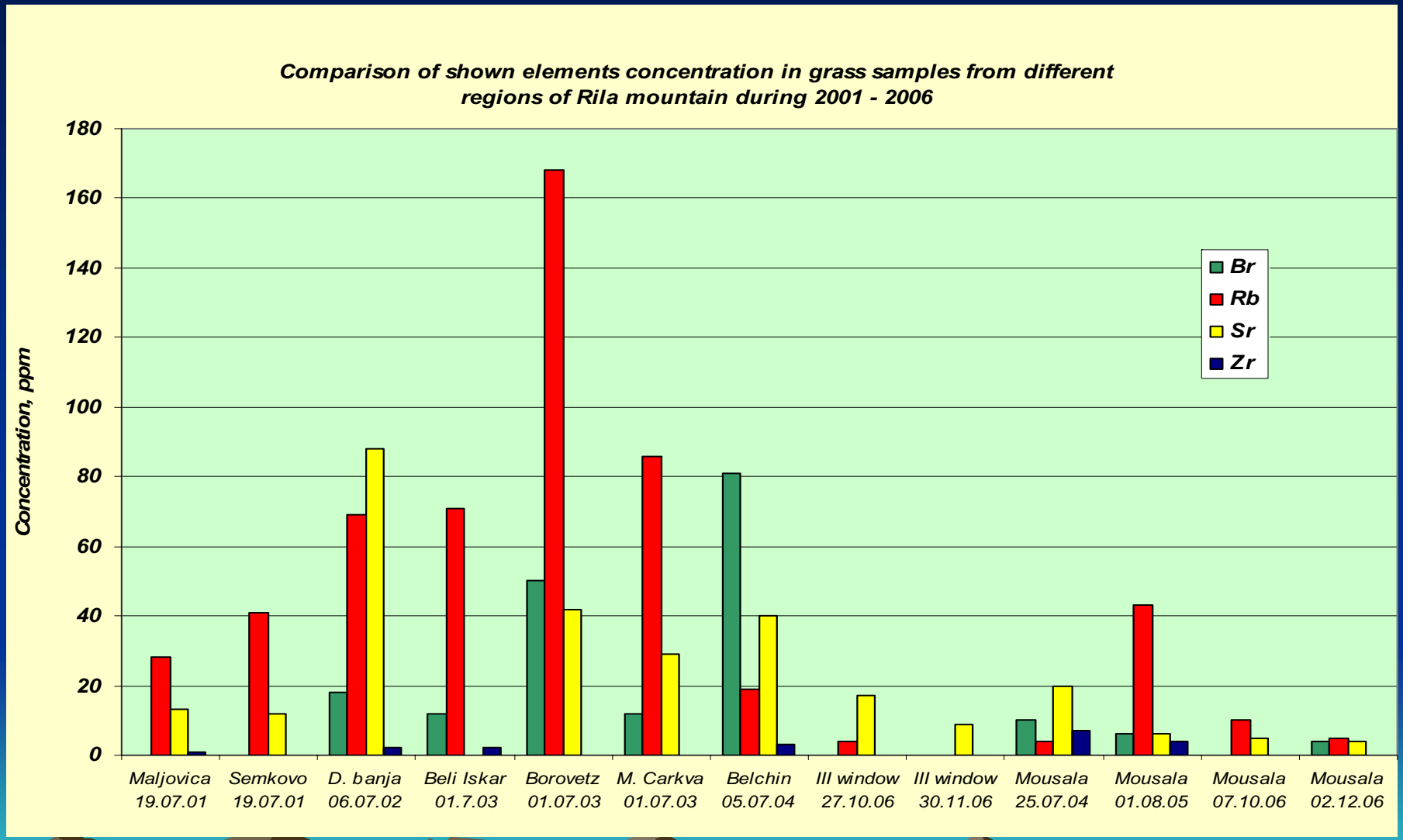
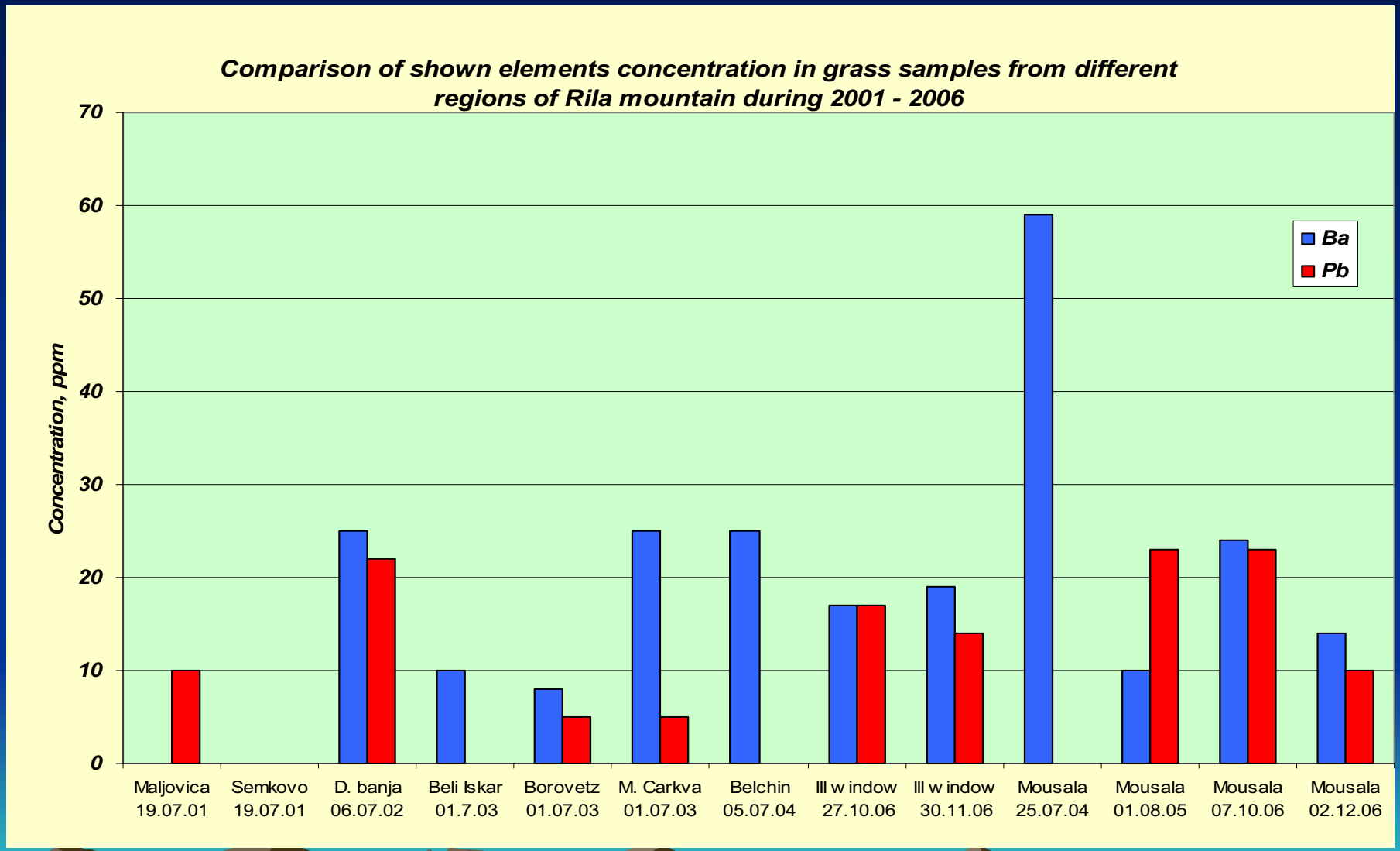
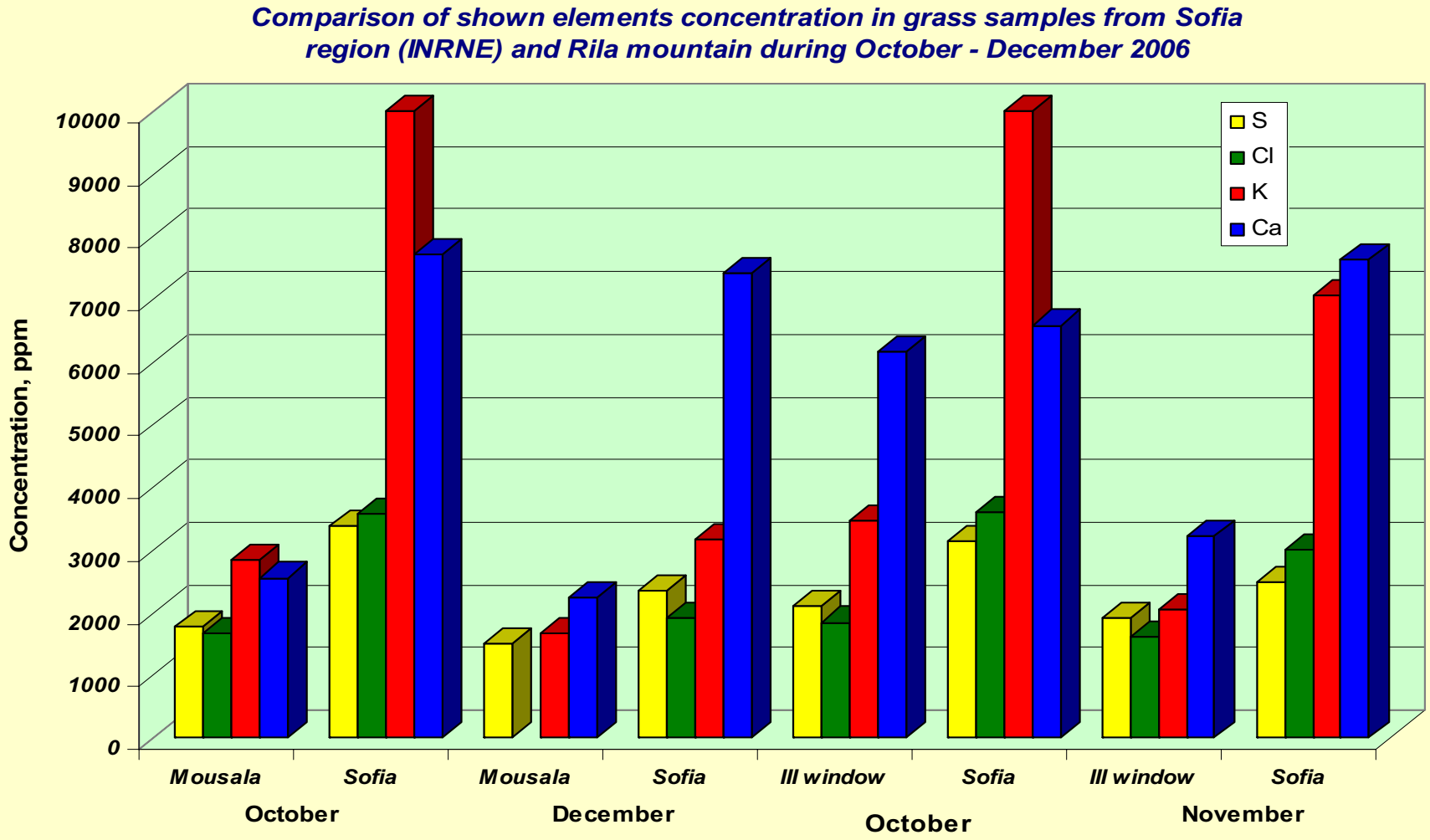
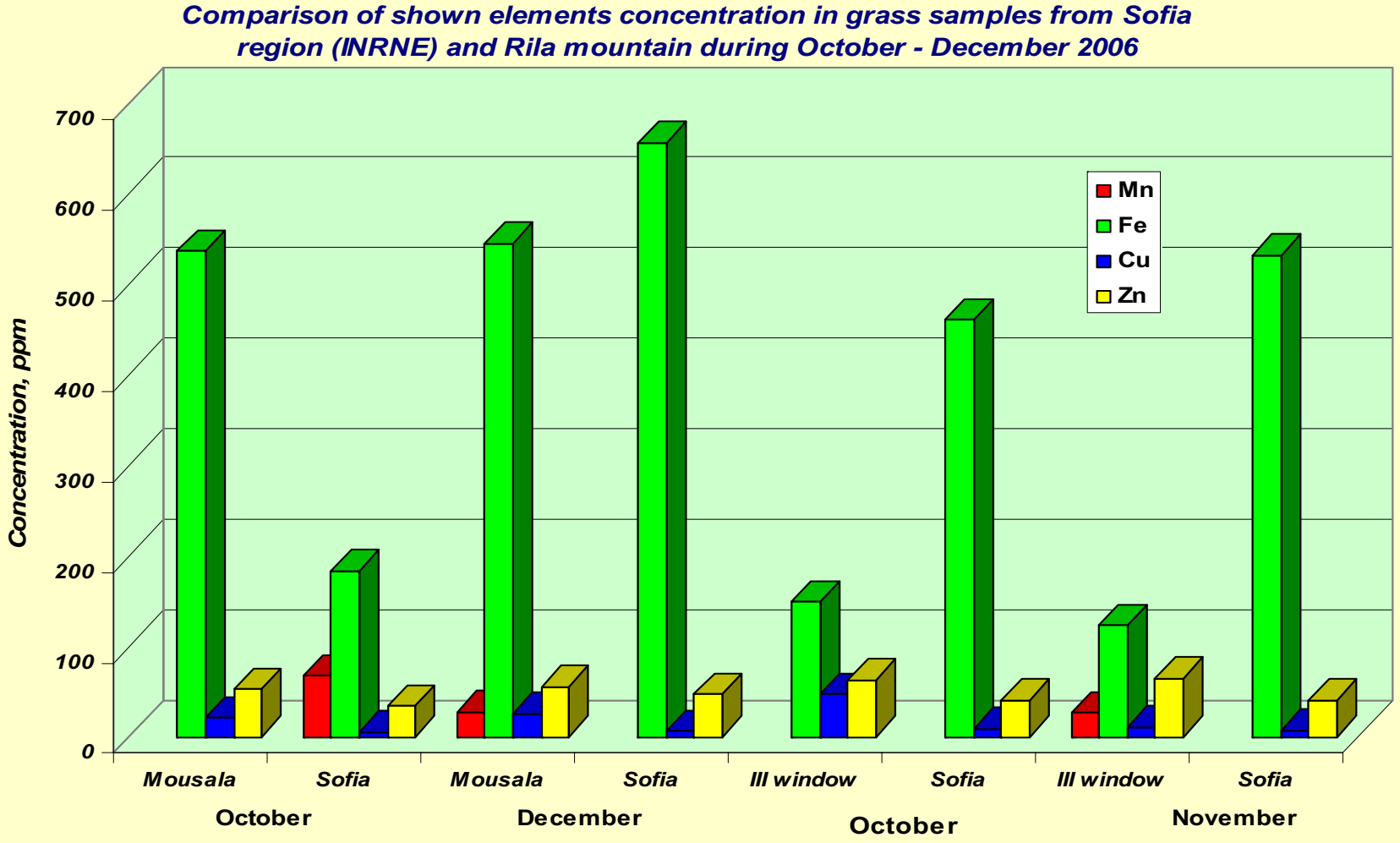
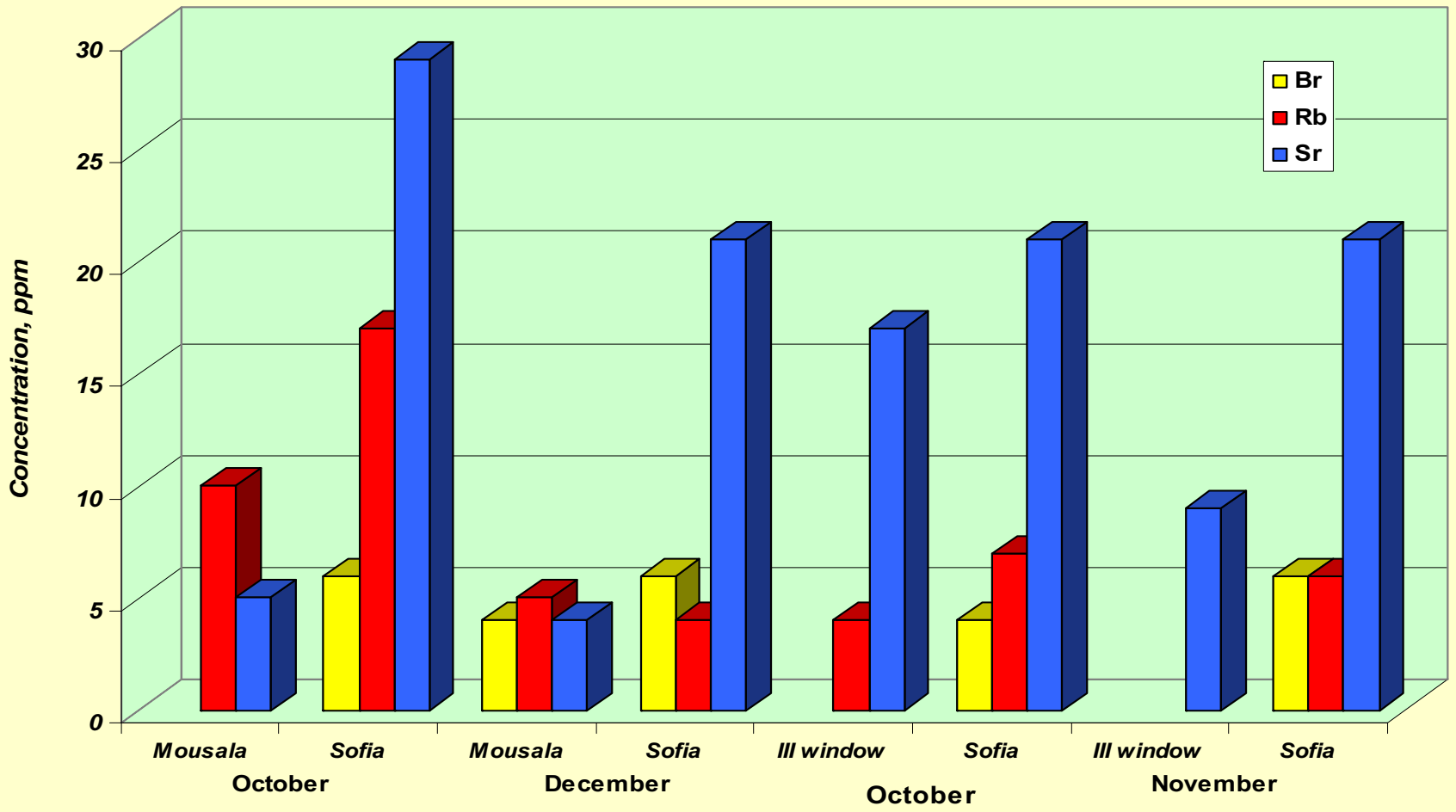
Mousala 25.07.04
Mousala 01.08.05
Mousala 07.10.06
Mousala 02.12.06

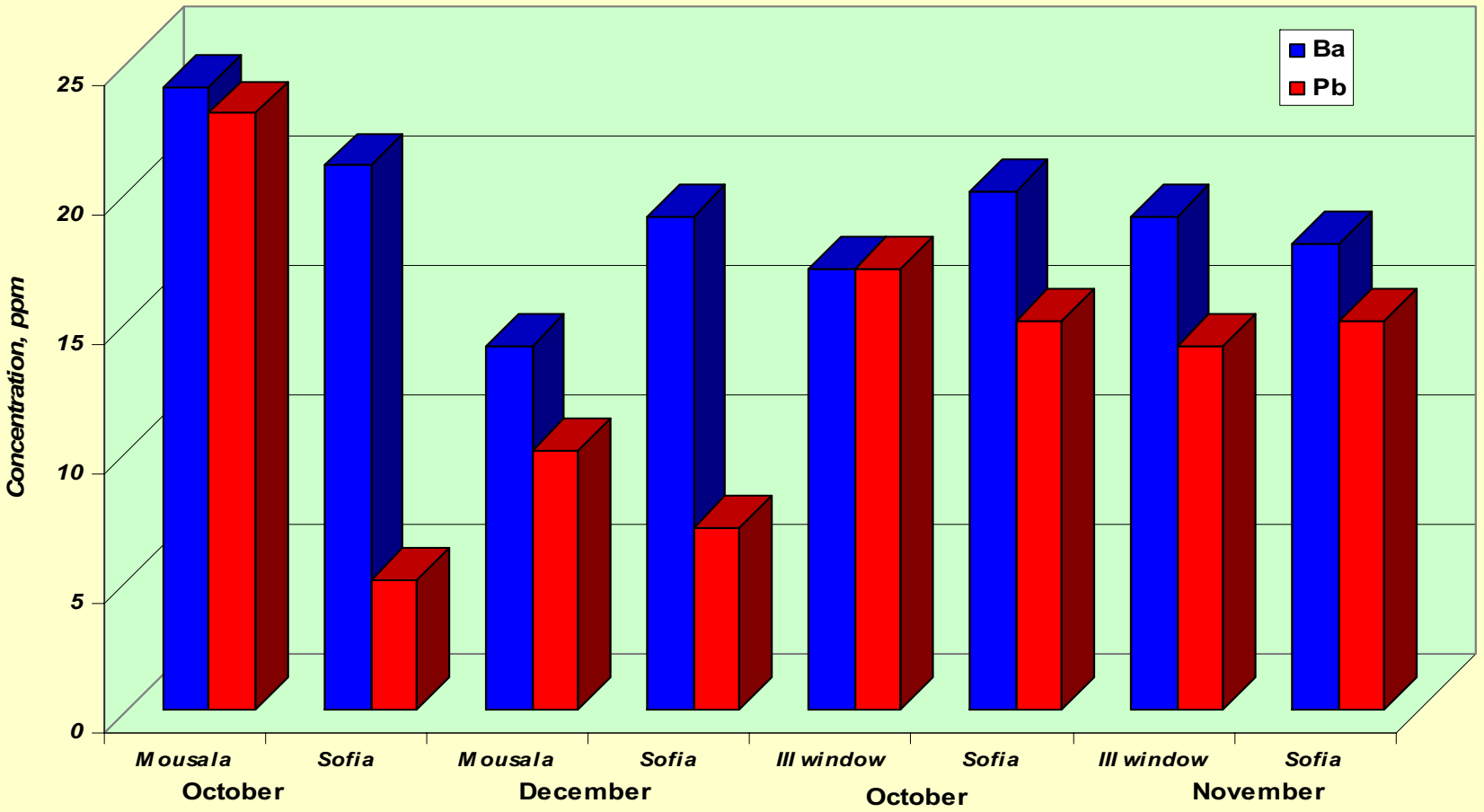

Comparison of shown elements concentration in grass samples from different regions of Rila mountain during 2001 - 2006
Concentration, ppm
180
160
140
120
100
80
60
40
20
0
Br
Rb
Sr
Zr
Maljovica 19.07.01
Semkovo 19.07.01
D. banja 06.07.02
Beli Iskar 01.7.03
Borovetz 01.07.03
M. Carkva 01.07.03
Belchin 05.07.04
III window 27.10.06
III window 30.11.06
Mousala 25.07.04
Mousala 01.08.05
Mousala 07.10.06
Mousala 02.12.06


Comparison of shown elements concentration in grass samples from different regions of Rila mountain during 2001 - 2006
Concentration, ppm
0
10
20
30
40
50
60
70
Ba
Pb
Maljovica 19.07.01
Semkovo 19.07.01
D. banja 06.07.02
Beli Iskar 01.7.03
Borovetz 01.07.03
M. Carkva 01.07.03
Belchin 05.07.04
III window 27.10.06
III window 30.11.06
Mousala 25.07.04
Mousala 01.08.05
Mousala 07.10.06
Mousala 02.12.06


Comparison of shown elements concentration in grass samples from Sofia region (INRNE) and Rila mountain during October - December 2006
Concentration, ppm
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
S
Cl
K
Ca
Mousala
Sofia
Mousala
Sofia
Ill window
Sofia
Ill window
Sofia
October
December
October
November


Comparison of shown elements concentration in grass samples from Sofia region (INRNE) and Rila mountain during October - December 2006
Concentration, ppm
0
100
200
300
400
500
600
700
Mn
Fe
Cu
Zn
Mousala
Sofia
Mousala
Sofia
III window
Sofia
III window
Sofia
October
December
October
November


Comparison of shown elements concentration in grass samples from Sofia region (INRNE) and Rila mountain during October - December 2006
Concentration, ppm
0
5
10
15
20
25
30
Br
Rb
Sr
Mousala
Sofia
Mousala
Sofia
Ill window
Sofia
Ill window
Sofia
October
December
October
November


Comparison of shown elements concentration in grass samples from Sofia region (INRNE) and Rila mountain during October - December 2006
Ba
Pb
Concentration, ppm
25
20
15
10
5
0
Mousala
Sofia
Mousala
Sofia
III window
Sofia
III window
Sofia
October
December
October
November

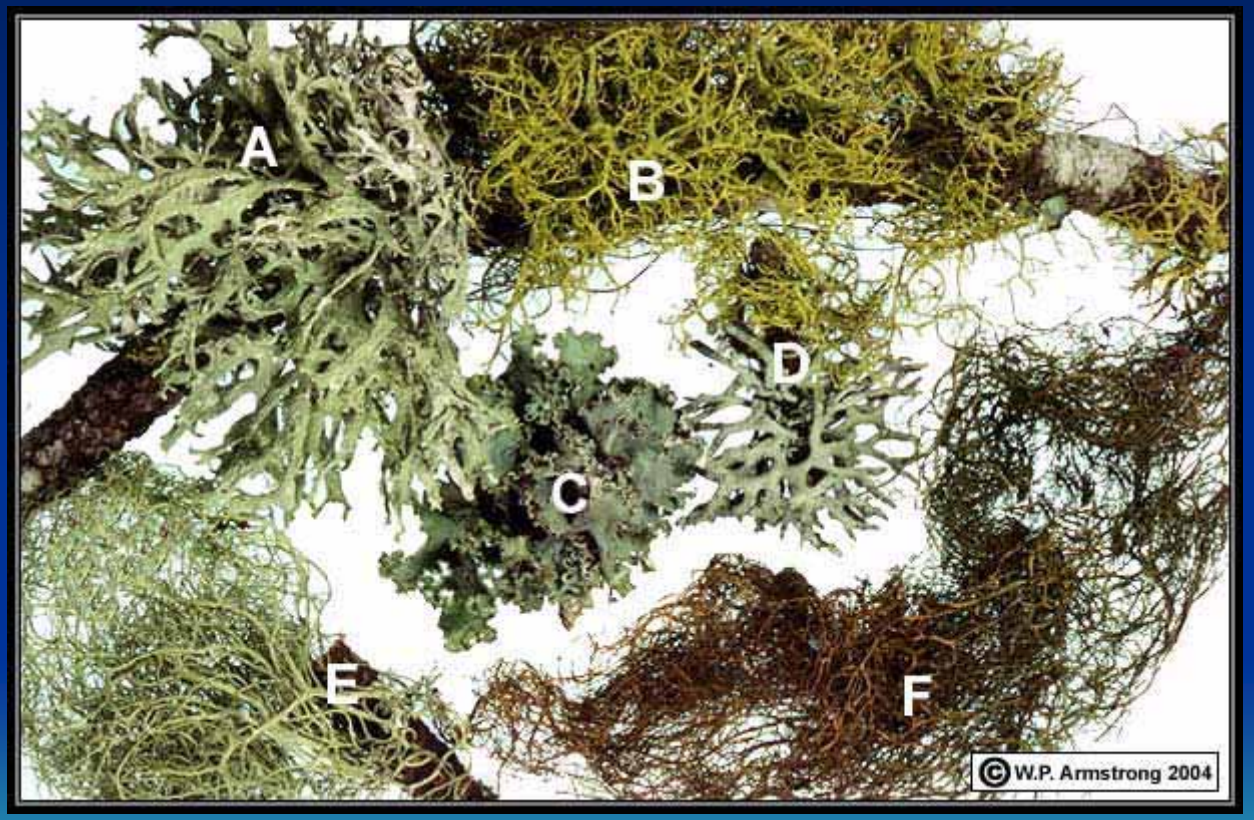
Elements content in lichen samples

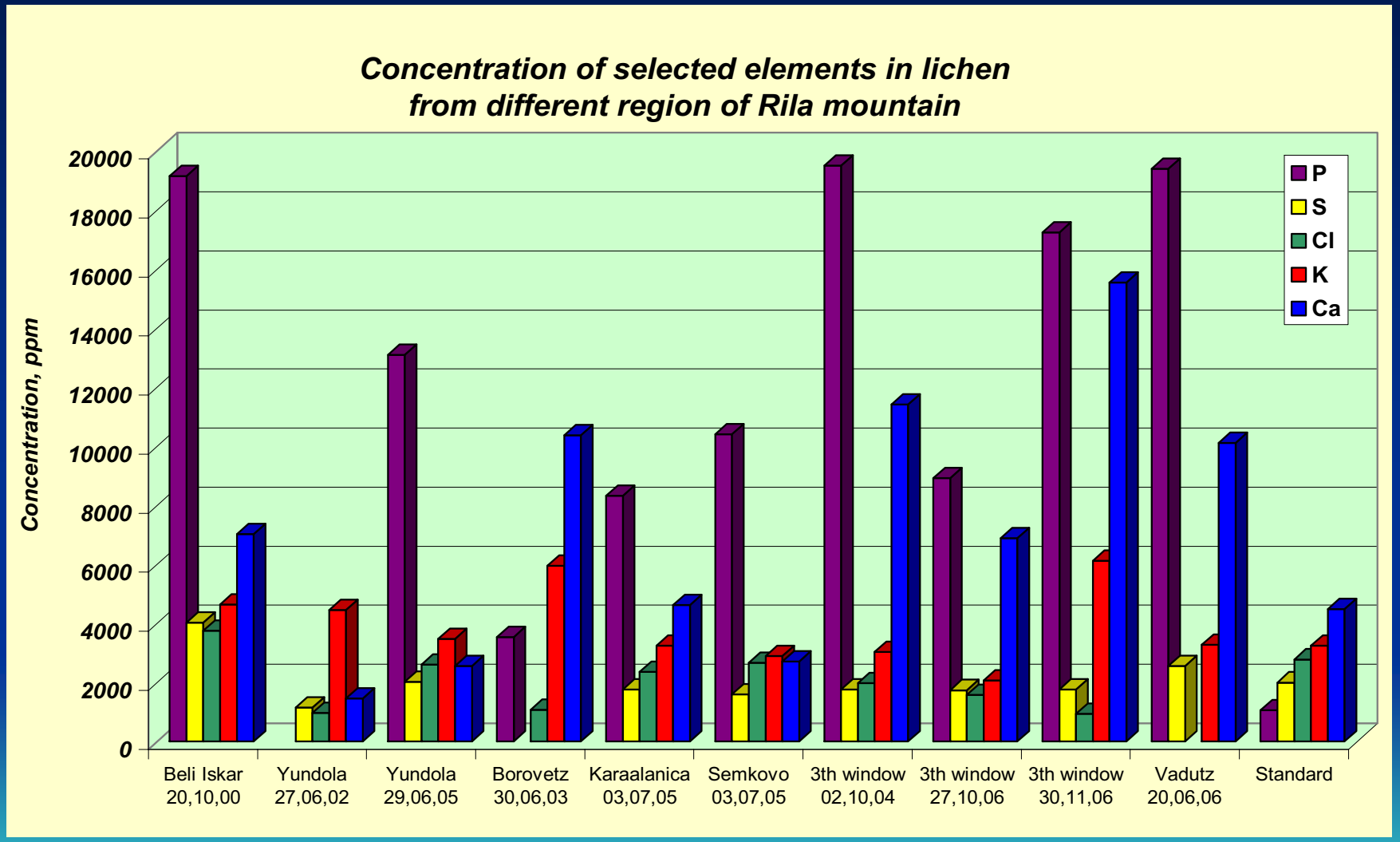
Why lichen?

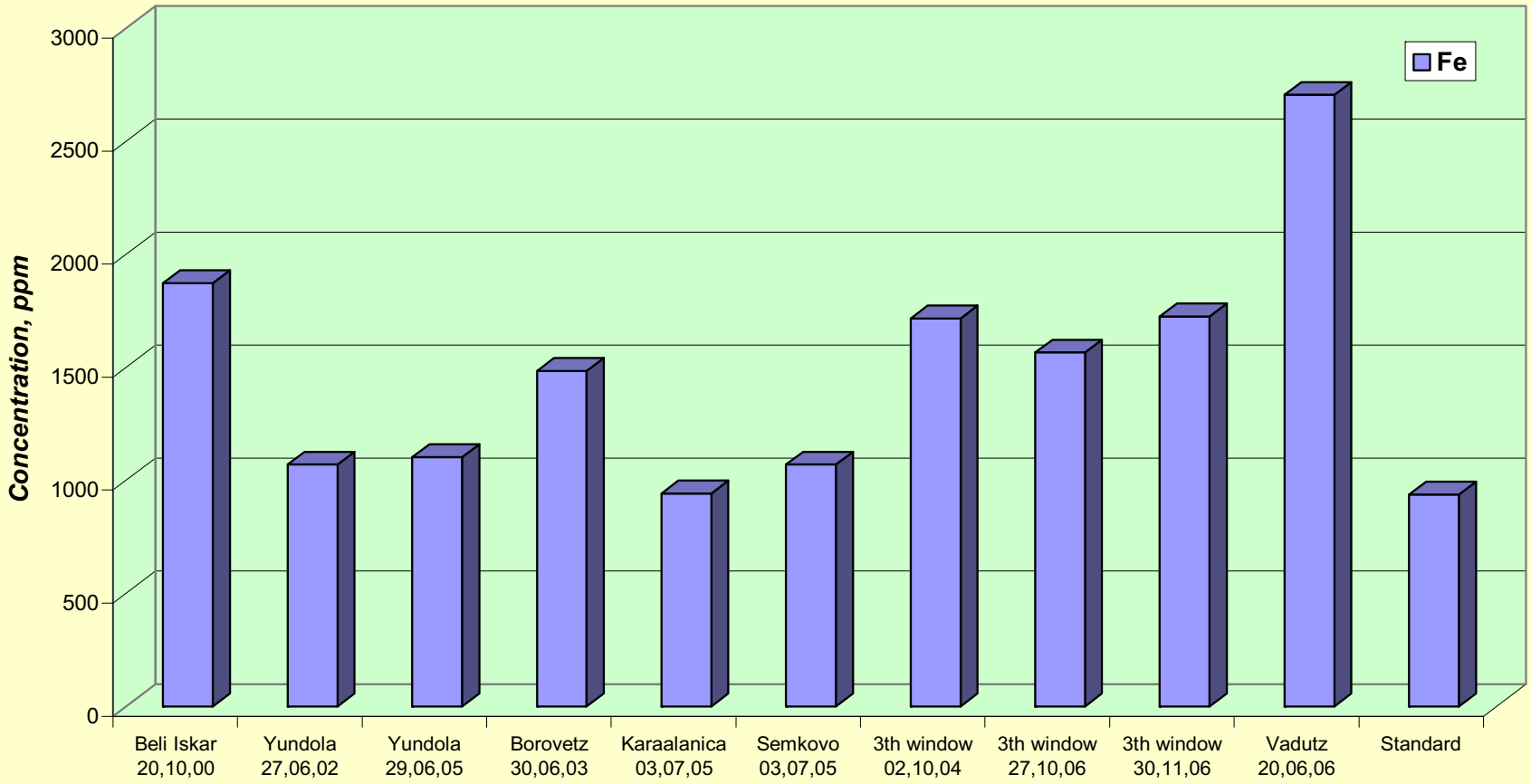
- Lichen are at a lower level of the biological system growth. Lichens are dependent almost exclusively on the atmosphere for nutrients, absorbing and retaining captions from very dilute solutions like rain-water. It is well known that they have the ability to accumulate many airborne substances to concentrations above those in the environment.
- Some authors showed that the concentrations of trace elements found inside lichen are directly correlated with environmental levels of these elements.
- All the samples were collected from spruce tree (*Picea*) at the height 1,5 - 2 m and analyzed for 30 elements.

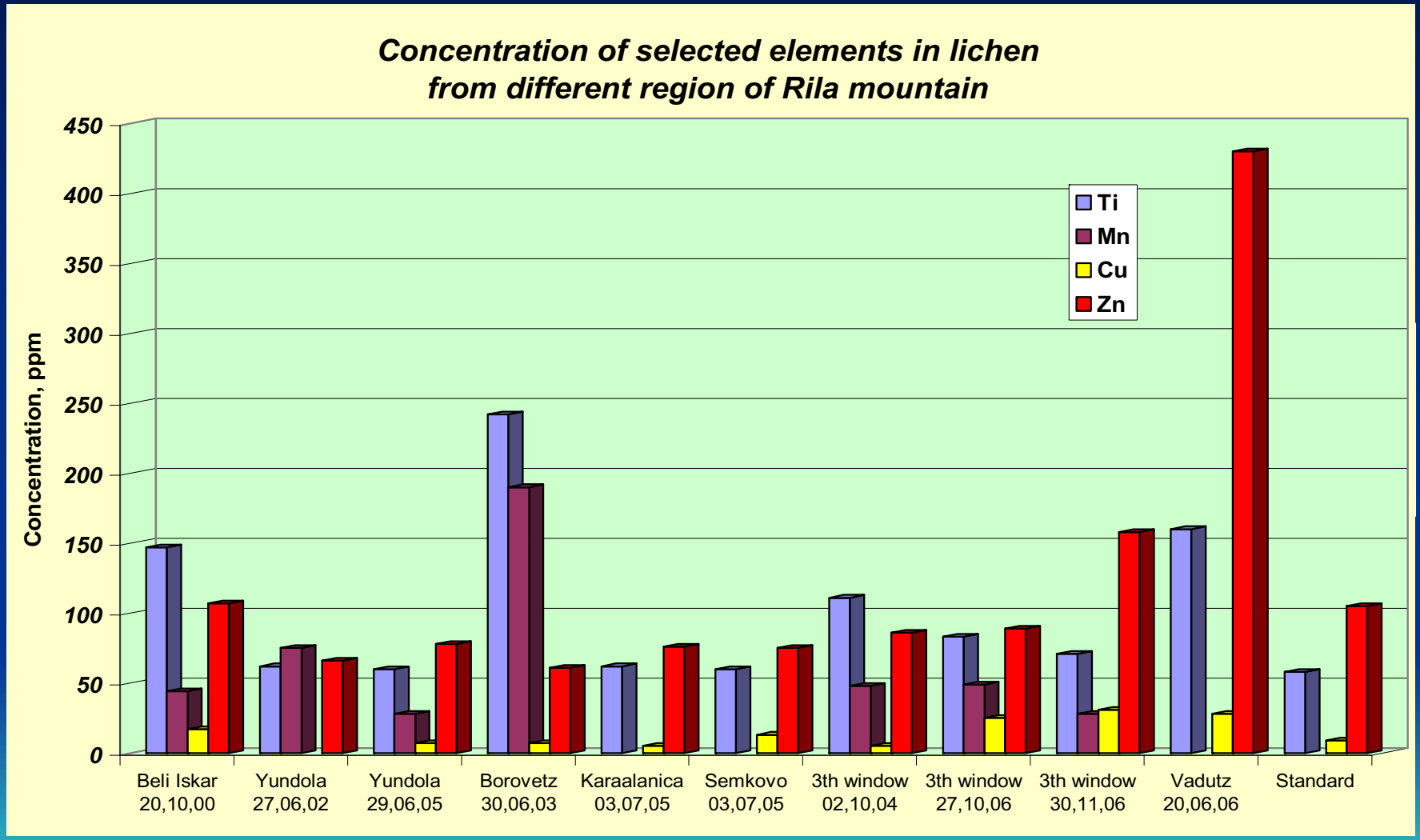
Pine lichen (Letharia vulpina)

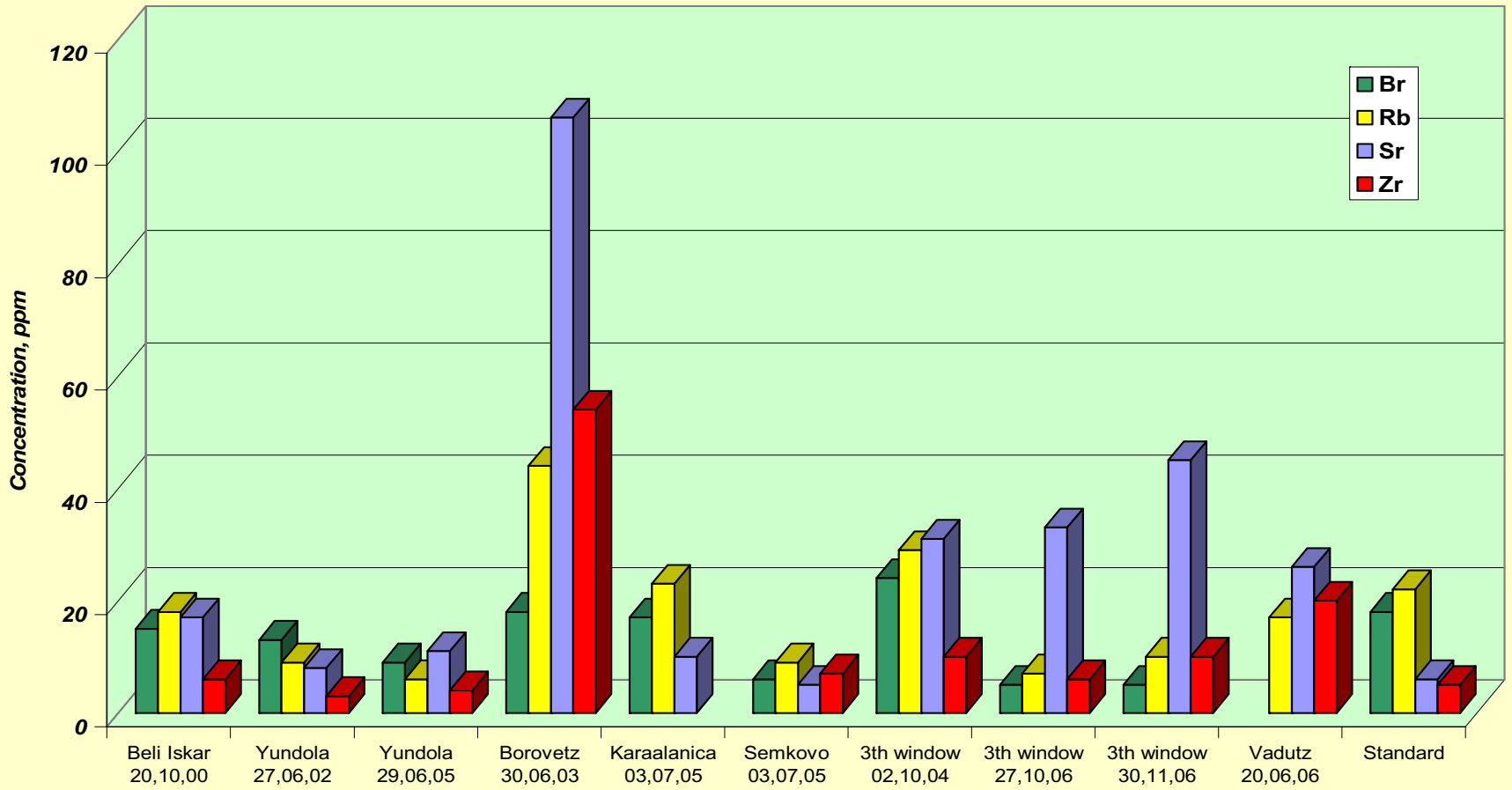
An assortment of fruticose and foliose bark lichens

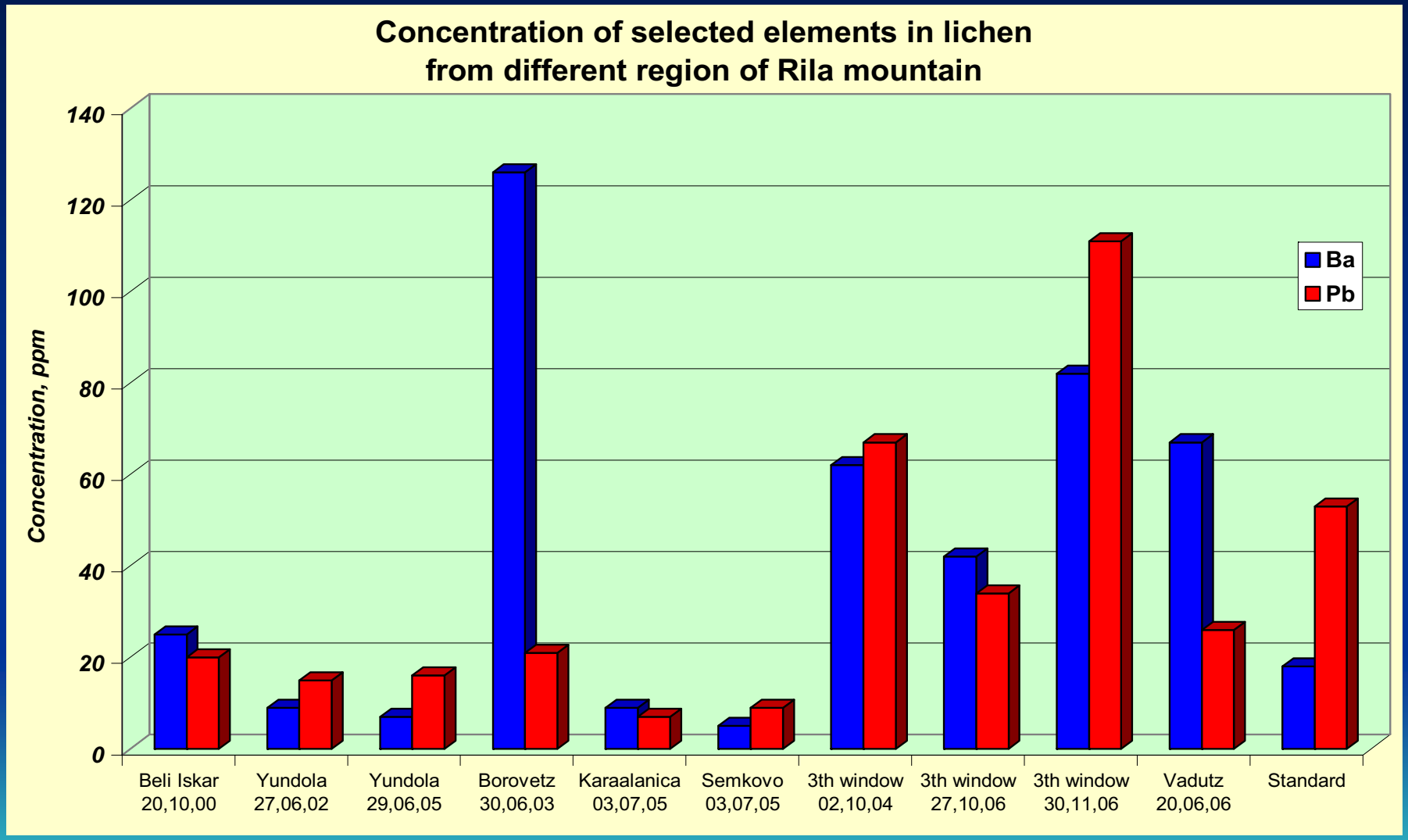



Concentration of selected elements in lichen
from different region of Rila mountain
Concentration, ppm
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
P
S
Cl
K
Ca
Beli Iskar
20,10,00
Yundola
27,06,02
Yundola
29,06,05
Borovetz
30,06,03
Karaalanica
03,07,05
Semkovo
03,07,05
3th window
02,10,04
3th window
27,10,06
3th window
30,11,06
Vadutz
20,06,06
Standard


Concentration of Fe in lichen from different region of Rila mountain Fe
Concentration, ppm
3000
2500
2000
1500
1000
500
0
Fe
Beli Iskar 20,10,00
Yundola 27,06,02
Yundola 29,06,05
Borovetz 30,06,03
Karaalanica 03,07,05
Semkovo 03,07,05
3th window 02,10,04
3th window 27,10,06
3th window 30,11,06
Vadutz 20,06,06
Standard


Concentration of selected elements in lichen
from different region of Rila mountain
Concentration, ppm
450
400
350
300
250
200
150
100
50
0
Ti
Mn
Cu
Zn
Beli Iskar
20,10,00
Yundola
27,06,02
Yundola
29,06,05
Borovetz
30,06,03
Karaalanica
03,07,05
Semkovo
03,07,05
3th window
02,10,04
3th window
27,10,06
3th window
30,11,06
Vadutz
20,06,06
Standard


Concentration of selected elements in lichen
from different region of Rila mountain
Concentration, ppm
120
100
80
60
40
20
0
Br
Rb
Sr
Zr
Beli Iskar
20,10,00
Yundola
27,06,02
Yundola
29,06,05
Borovetz
30,06,03
Karaalanica
03,07,05
Semkovo
03,07,05
3th window
02,10,04
3th window
27,10,06
3th window
30,11,06
Vadutz
20,06,06
Standard


Concentration of selected elements in lichen
from different region of Rila mountain
Concentration, ppm
140
120
100
80
60
40
20
0
Ba
Pb
Beli Iskar 20,10,00
Yundola 27,06,02
Yundola 29,06,05
Borovetz 30,06,03
Karaalanica 03,07,05
Semkovo 03,07,05
3th window 02,10,04
3th window 27,10,06
3th window 30,11,06
Vadutz 20,06,06
Standard

CONCLUSIONS

- There are No significant changes in elements content in the investigated monitors during the period
- More regularly sampling is necessary in order to provide statistically reliable estimations
- The EDXRF is one of the analytical methods proved for long-term investigation of great amounts of environment oriented samples