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# Metasomatic effects in the lithospheric mantle beneath the NE Bohemian Massif: a case study of Lutynia (SW Poland) peridotite xenoliths

Magdalena Matusiak-Malek, Jacek Puziewicz, Theodoros Ntaflos, Michel Grégoire, Hilary Downes

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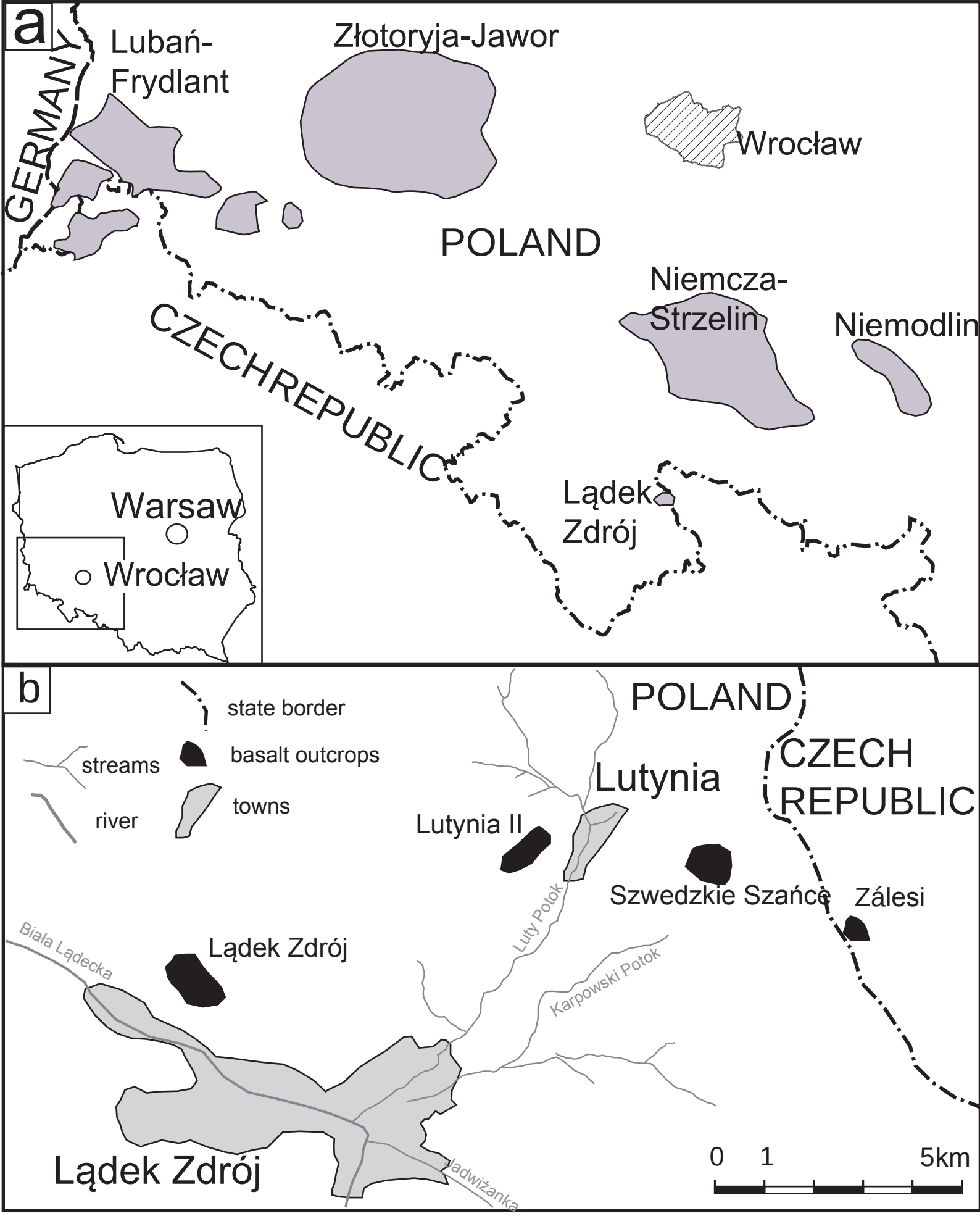
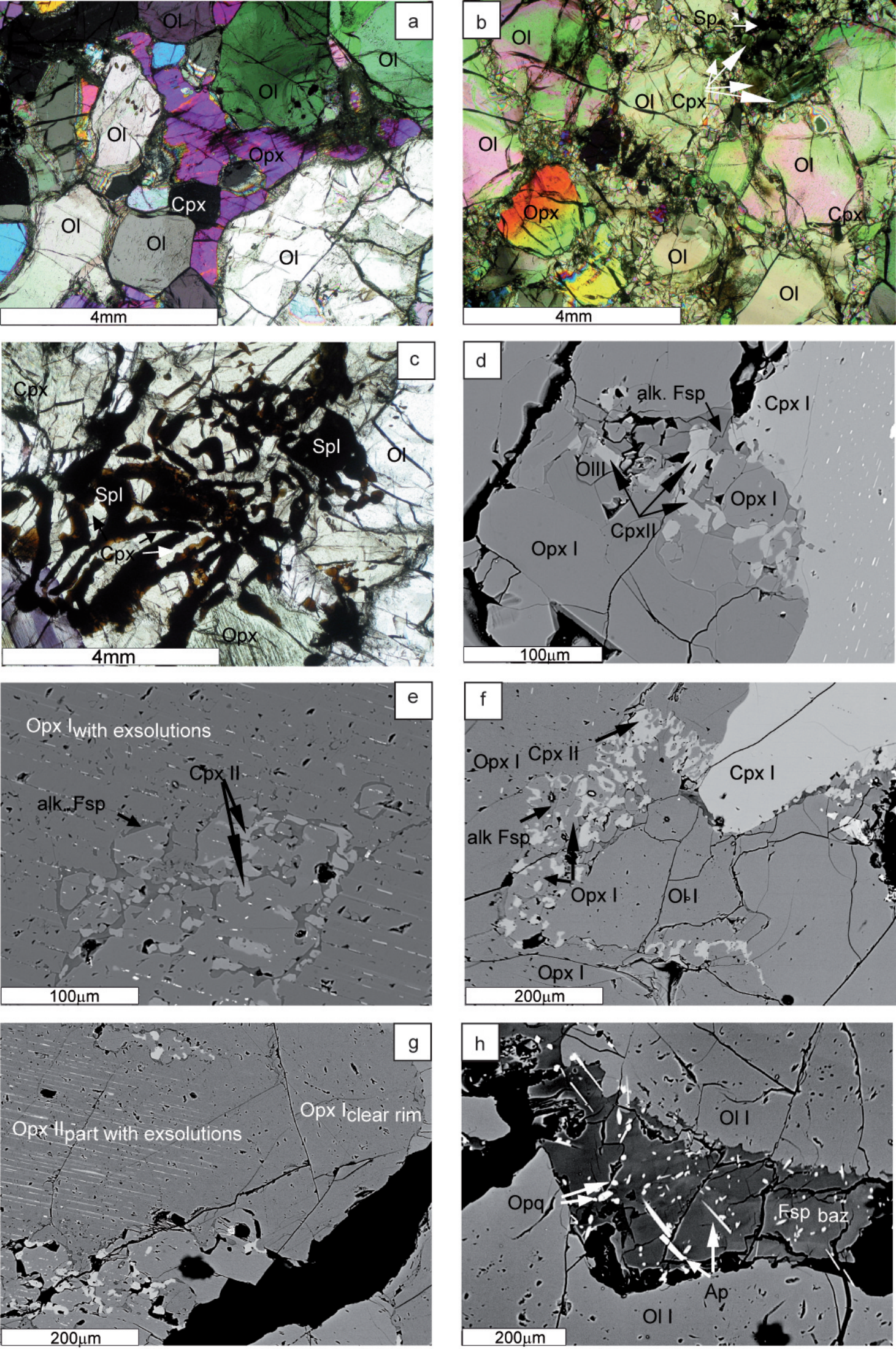

a
GERMANY
Lubań-
Frydlant
Złotoryja-Jawor
Wrocław
POLAND
Niemcza-
Strzelin
Niemodlin
CZECHREPUBLIC
Lądek-
Zdrój
Warsaw
Wrocław
b
state border
streams
basalt outcrops
river
towns
POLAND
CZECH
REPUBLIC
Lutynia
Lutynia II
Szwedzkie Szańce
Zálesi
Luty Potok
Biała Lądecka
Lądek Zdrój
Karpowski Potok
Lądek Zdrój
Jadwiżanka
0
1
5km

Fig.1


a
Ol
Ol
Ol
Ol
Opx
Cpx
Ol
Ol
Ol
4mm
b
Sp
Ol
Ol
Cpx
Ol
Opx
Ol
Cpx
Ol
Ol
4mm
c
Cpx
Spl
Ol
Spl
Cpx
Opx
4mm
d
alk. Fsp
Cpx I
OlII
Opx I
CpxII
Opx I
100µm
e
Opx I with exsolutions
Cpx II
alk. Fsp
100µm
f
Opx I
Cpx II
Cpx I
alk Fsp
Opx I
Ol I
Opx I
200µm
g
Opx I clear rim
Opx II part with exsolutions
200µm
h
Ol I
Opq
Fsp baz
Ap
Ol I
200µm

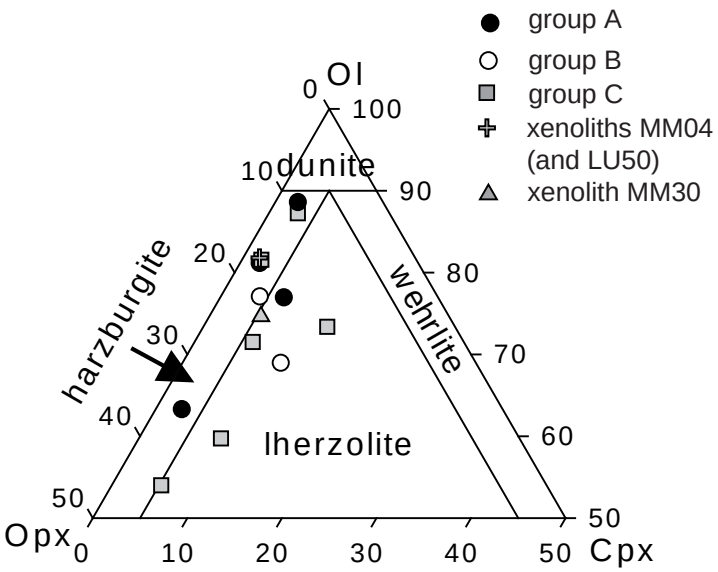

group A
group B
group C
xenoliths MM04
(and LU50)
xenolith MM30
Ol
0
100
10
dunite
90
20
80
harzburgite
wehrlite
30
70
40
lherzolite
60
50
50
Opx
0
10
20
30
40
50
Cpx

Fig.3

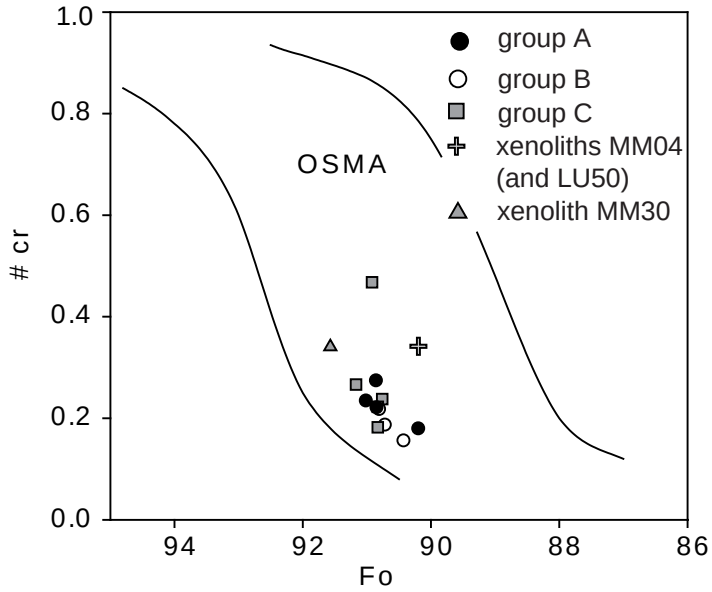

1.0
0.8
0.6
0.4
0.2
0.0
# cr
94
92
90
88
86
Fo
OSMA
group A
group B
group C
xenoliths MM04
(and LU50)
xenolith MM30

Fig.4

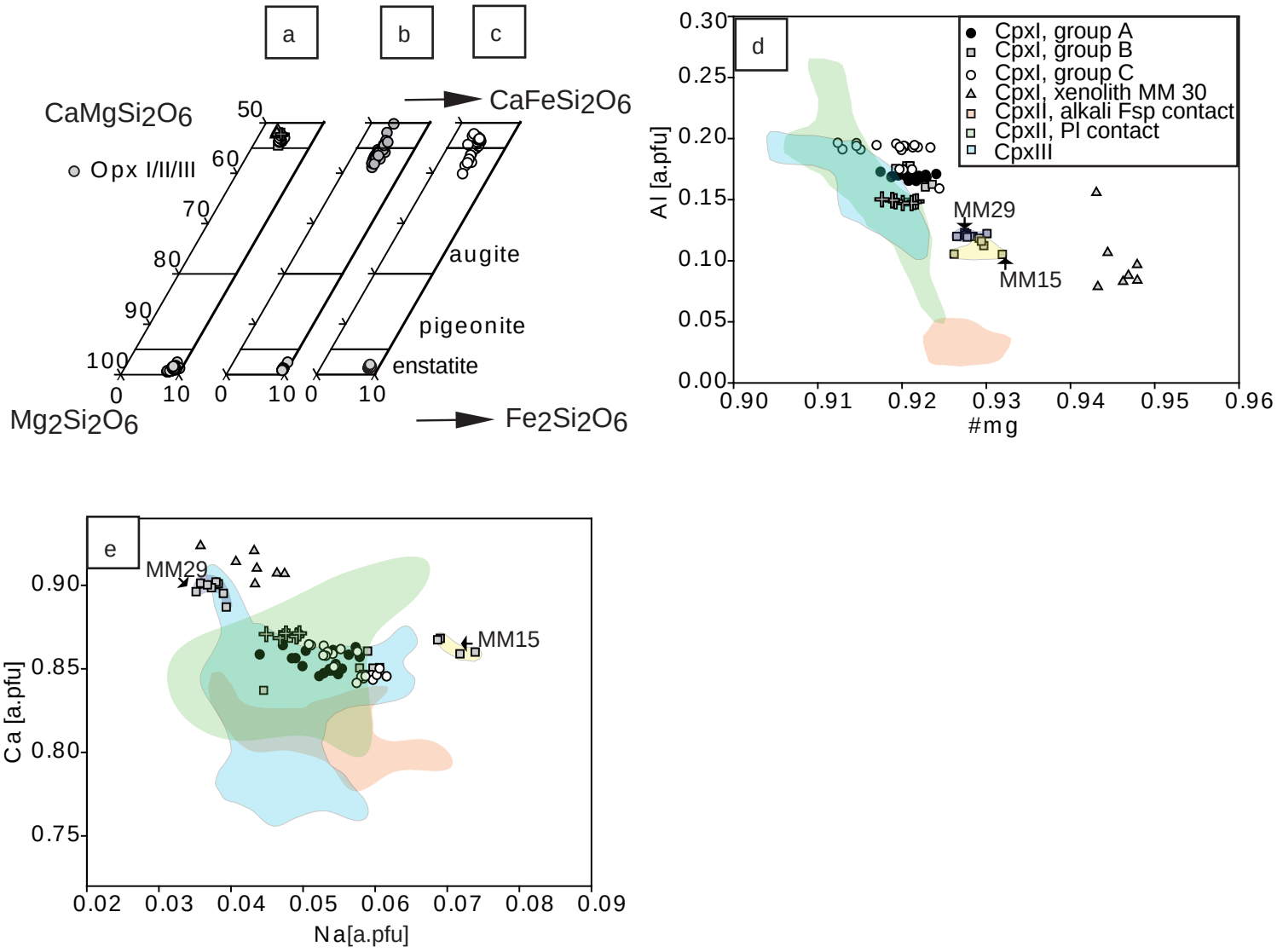

a
b
c
CaMgSi2O6
CaFeSi2O6
Opx I/II/III
50
60
70
80
90
100
0
10
0
10
0
10
augite
pigeonite
enstatite
Mg2Si2O6
Fe2Si2O6
d
Cpxl, group A
Cpxl, group B
Cpxl, group C
Cpxl, xenolith MM 30
CpxII, alkali Fsp contact
CpxII, Pl contact
CpxIII
MM29
MM15
Al [a.pfu]
#mg
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.90
0.91
0.92
0.93
0.94
0.95
0.96
e
MM29
MM15
Ca [a.pfu]
Na[a.pfu]
0.90
0.85
0.80
0.75
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09

Fig.5

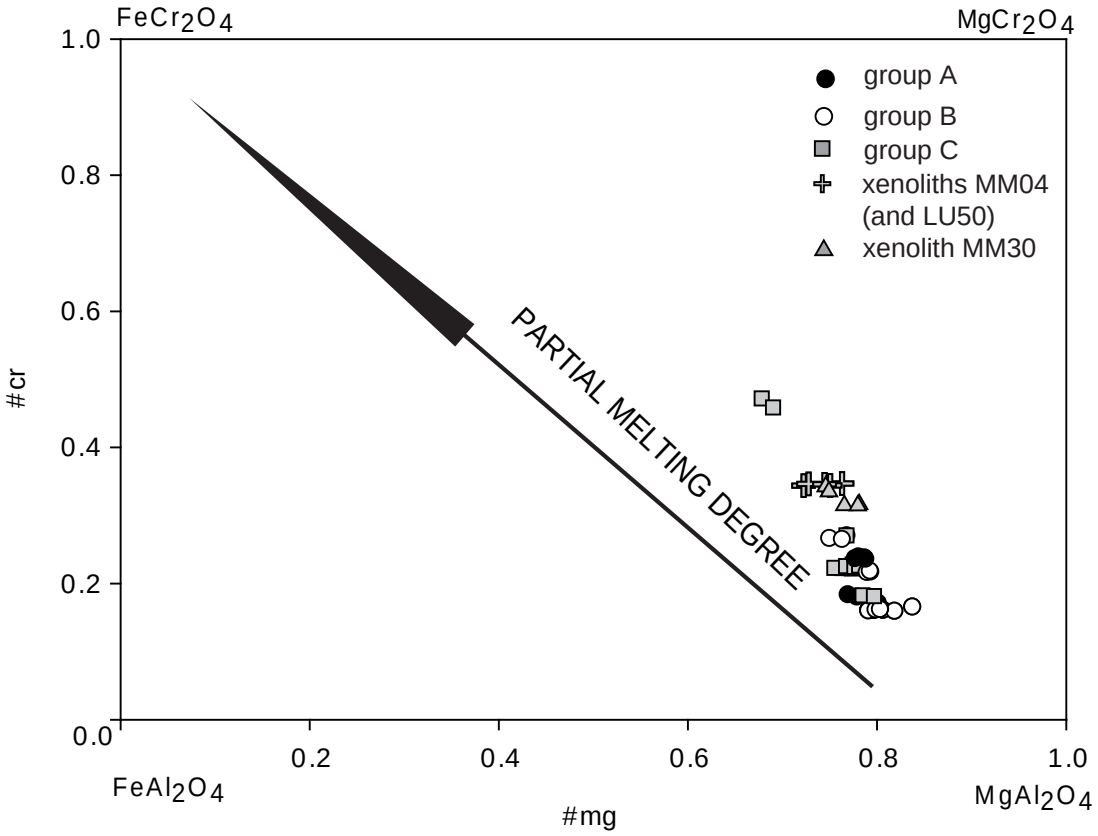

FeCr2O4
MgCr2O4
1.0
0.8
0.6
0.4
0.2
0.0
#cr
group A
group B
group C
xenoliths MM04
(and LU50)
xenolith MM30
PARTIAL MELTING DEGREE
0.2
0.4
0.6
0.8
1.0
FeAl2O4
MgAl2O4
#mg

Fig.6

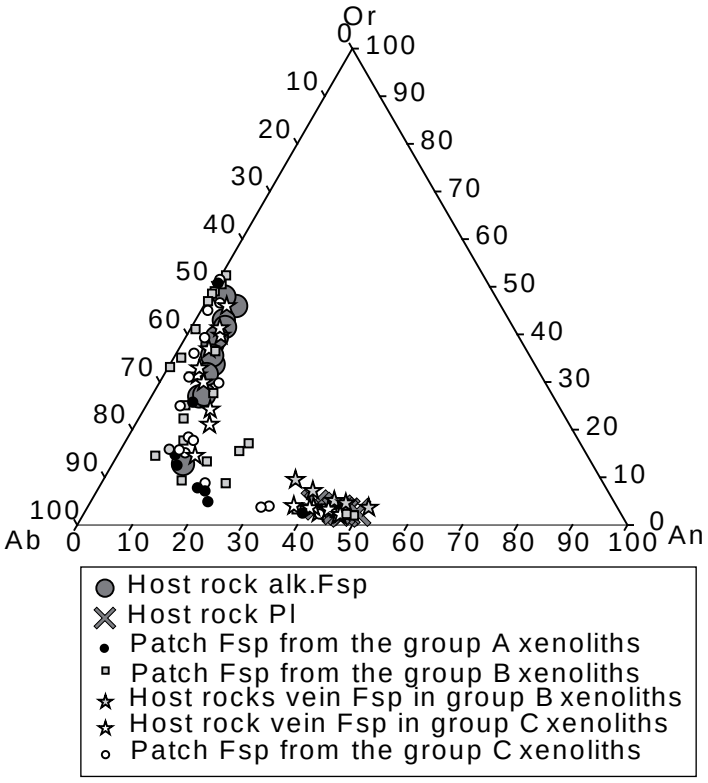
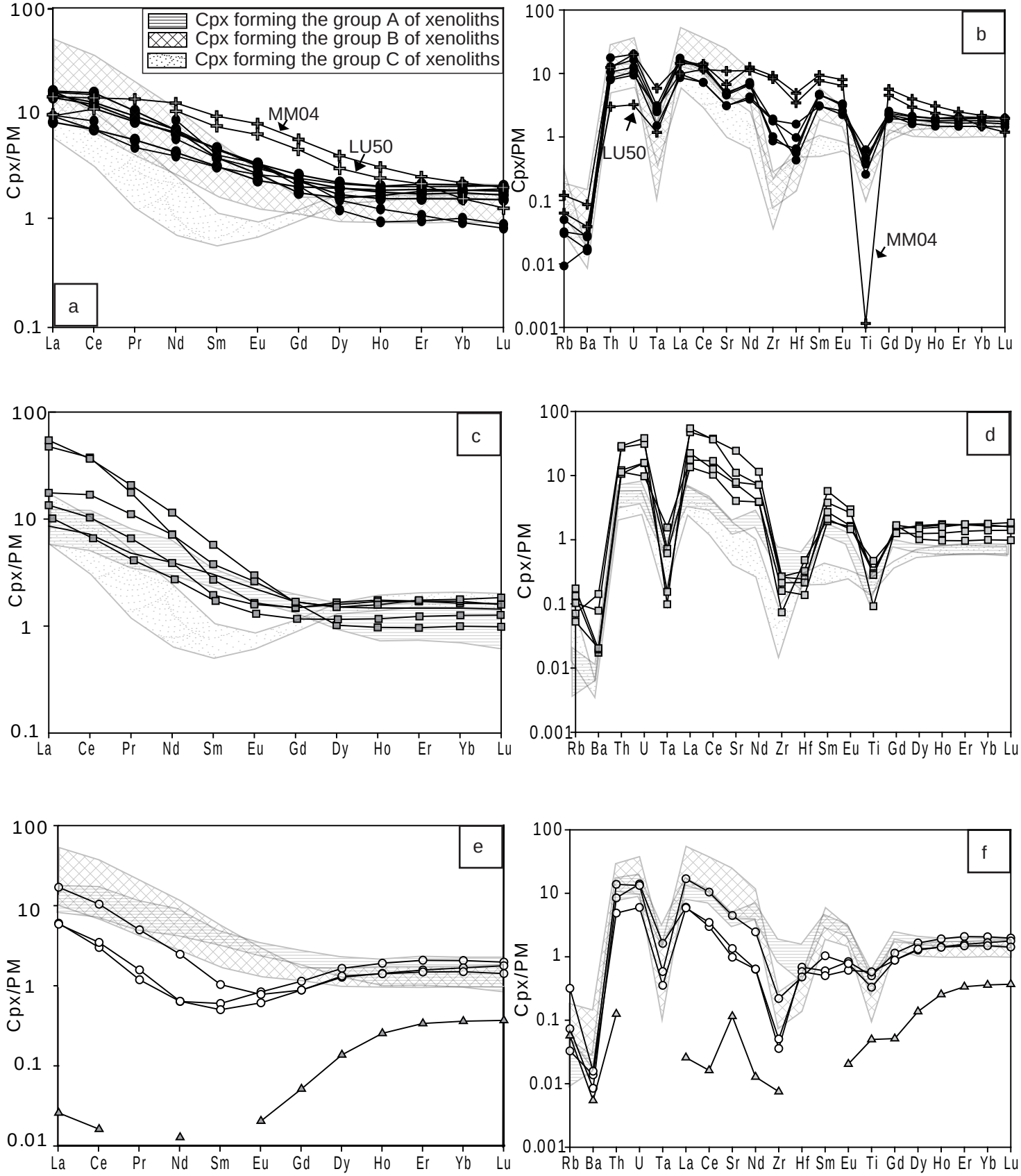

Or
0
100
10
90
20
80
30
70
40
60
50
50
60
40
70
30
80
20
90
10
100
0
Ab
0 10 20 30 40 50 60 70 80 90 100
An
Host rock alk.Fsp
Host rock Pl
Patch Fsp from the group A xenoliths
Patch Fsp from the group B xenoliths
Host rocks vein Fsp in group B xenoliths
Host rock vein Fsp in group C xenoliths
Patch Fsp from the group C xenoliths

Fig.7


Cpx forming the group A of xenoliths
Cpx forming the group B of xenoliths
Cpx forming the group C of xenoliths
MM04
LU50
a
b
c
d
e
f
Cpx/PM
La Ce Pr Nd Sm Eu Gd Dy Ho Er Yb Lu
Rb Ba Th U Ta La Ce Sr Nd Zr Hf Sm Eu Ti Gd Dy Ho Er Yb Lu
100
10
1
0.1
0.01
0.001

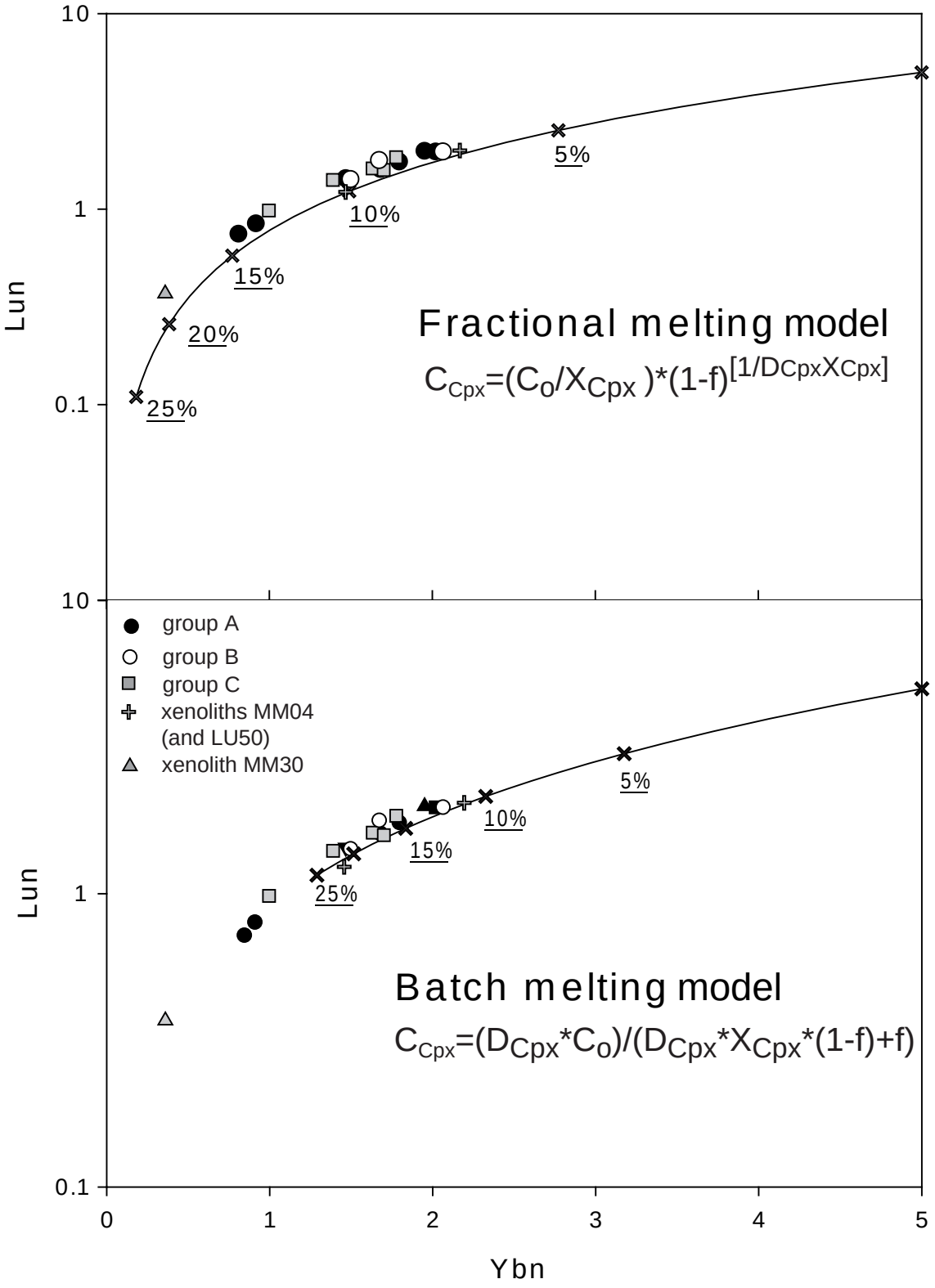

10
1
0.1
Lun
5%
10%
15%
20%
25%
Fractional melting model
$C_{Cpx}=(C_o/X_{Cpx})*(1-f)^{[1/D_{Cpx}X_{Cpx}]}$
group A
group B
group C
xenoliths MM04
(and LU50)
xenolith MM30
Batch melting model
$C_{Cpx}=(D_{Cpx}*C_o)/(D_{Cpx}*X_{Cpx}*(1-f)+f)$
0
1
2
3
4
5
Ybn

Fig.9

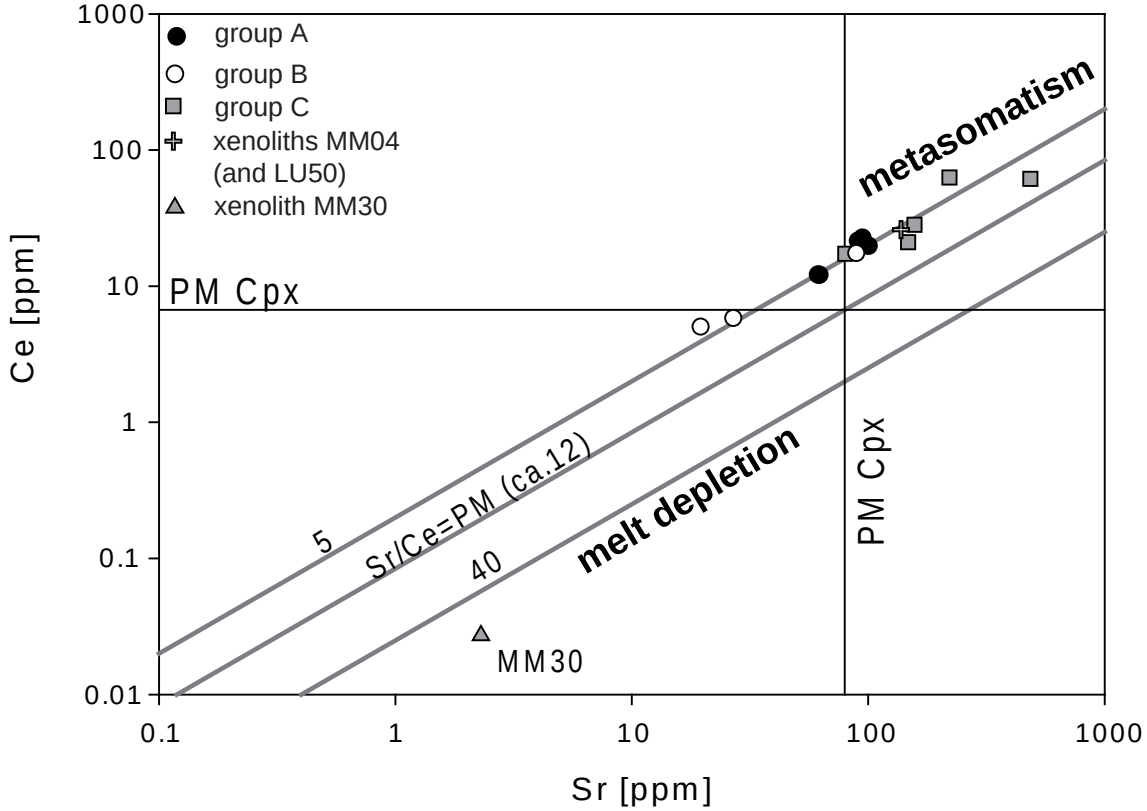
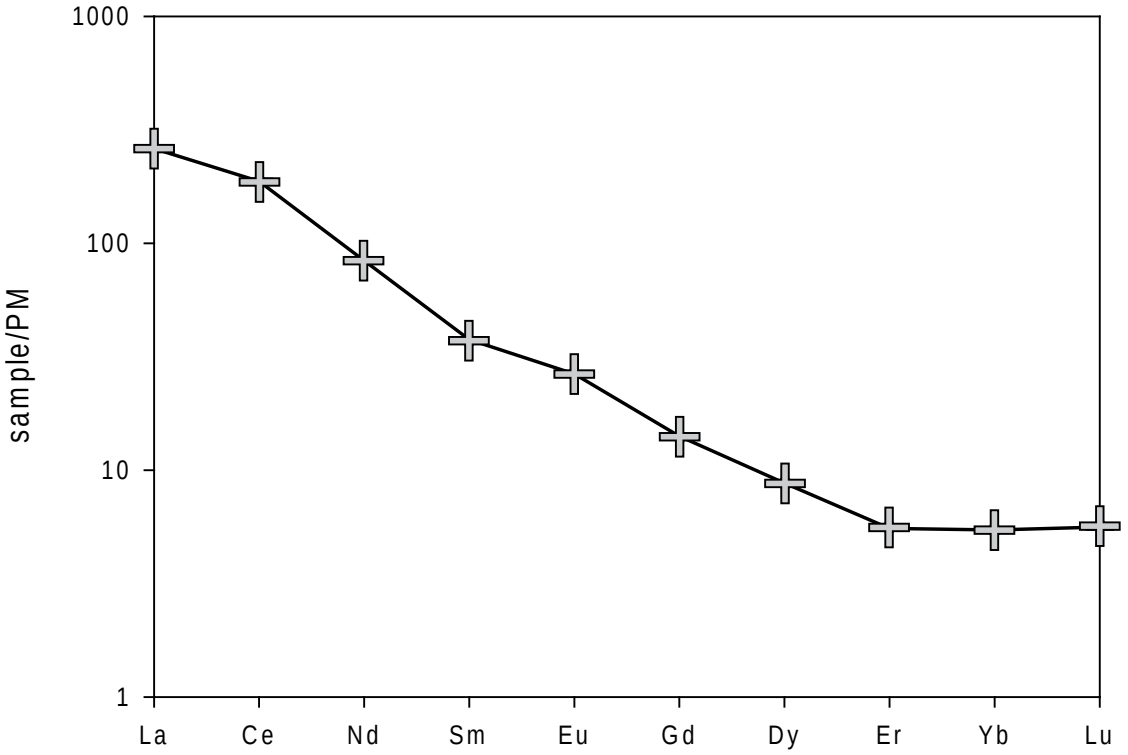

1000
100
10
1
0.1
0.01
0.1
1
10
100
1000
Ce [ppm]
Sr [ppm]
group A
group B
group C
xenoliths MM04
(and LU50)
xenolith MM30
PM Cpx
PM Cpx
metasomatism
melt depletion
Sr/Ce=PM (ca.12)
5
40
MM30

Fig.10


1000
100
10
1
sample/PM
La
Ce
Nd
Sm
Eu
Gd
Dy
Er
Yb
Lu

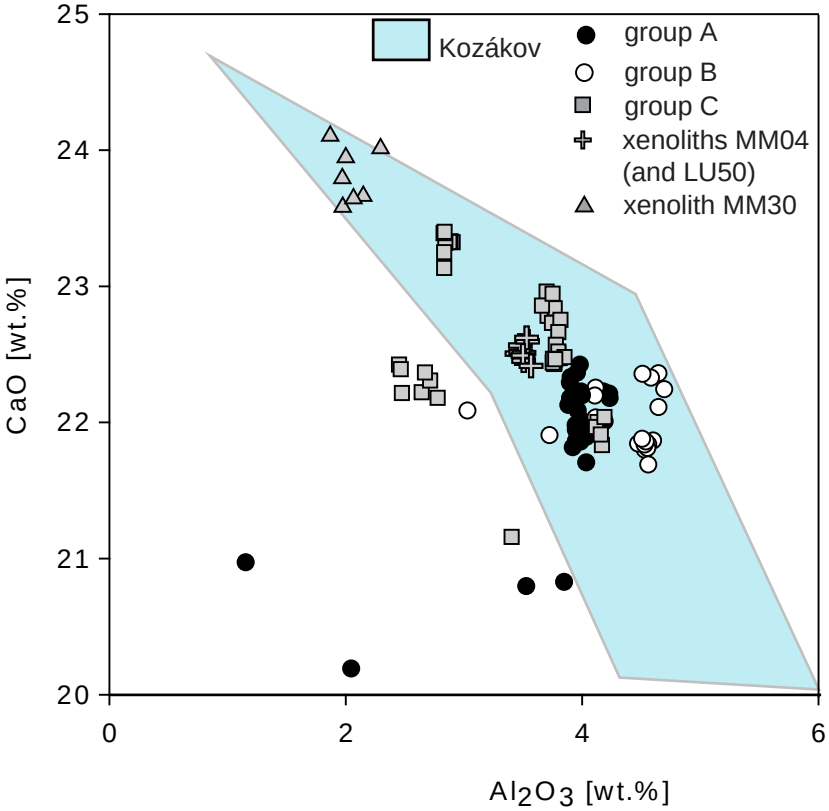

Kozákov
group A
group B
group C
xenoliths MM04
(and LU50)
xenolith MM30
CaO [wt.%]
Al2O3 [wt.%]
25
24
23
22
21
20
0
2
4
6

Fig.12

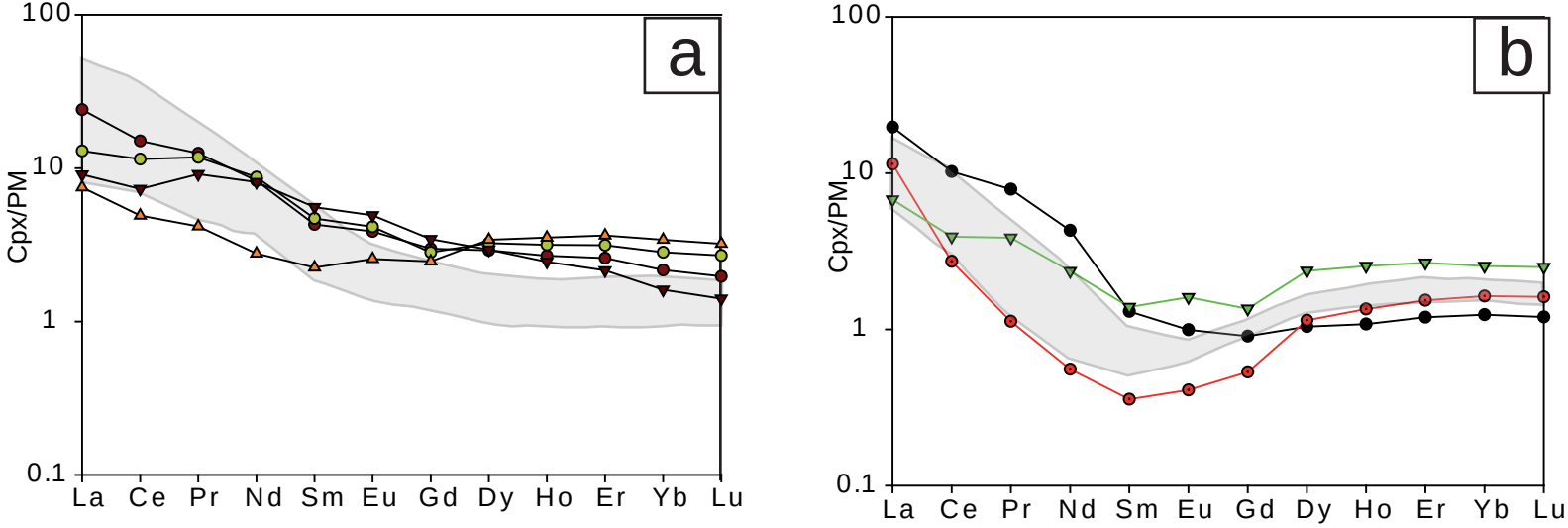



Fig.13

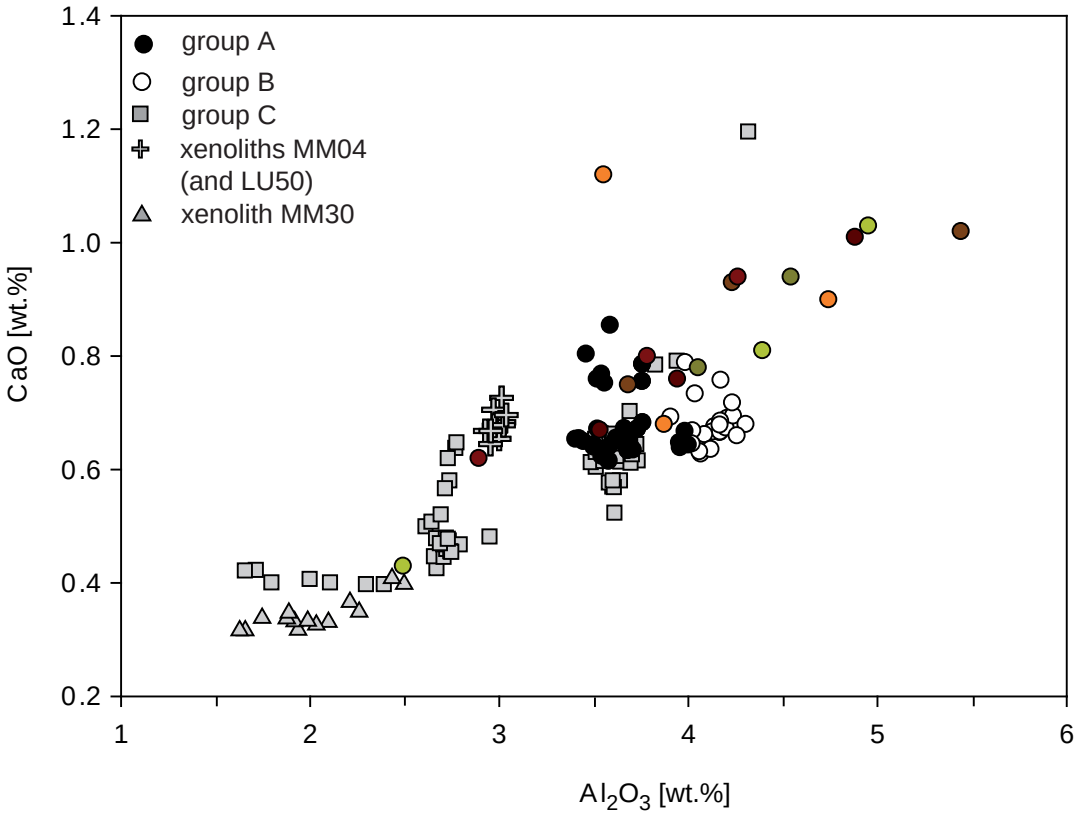

group A
group B
group C
xenoliths MM04
(and LU50)
xenolith MM30
CaO [wt.%]
$Al_2O_3$ [wt.%]
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
2
3
4
5
6

Fig.14