

ANALYTICAL METHODS

Chemical analyses of garnet were performed on polished thin sections with a Cameca SX100 electron microprobe (Microsonde Ouest, Brest, France). Operating conditions for spot analyses were set to 15 kV accelerating voltage, 20 nA sample current and 10 s counting time (spot size = 1). $\varphi(\rho Z)$ matrix correction was applied based on Armstrong (1988, 1991). Natural silicates and oxides were used as standards, and as monitors to check the accuracy of measurements. Standards were albite (Na), orthoclase (K), Al_2O_3 (Al), wollastonite (Ca), albite (Si), forsterite (Mg), MnTiO_3 (Mn, Ti), andradite (Fe). Representative mineral analyses are given in Table DR1.

Back-scattered images and X-ray element maps have been elaborated with the software SX100.

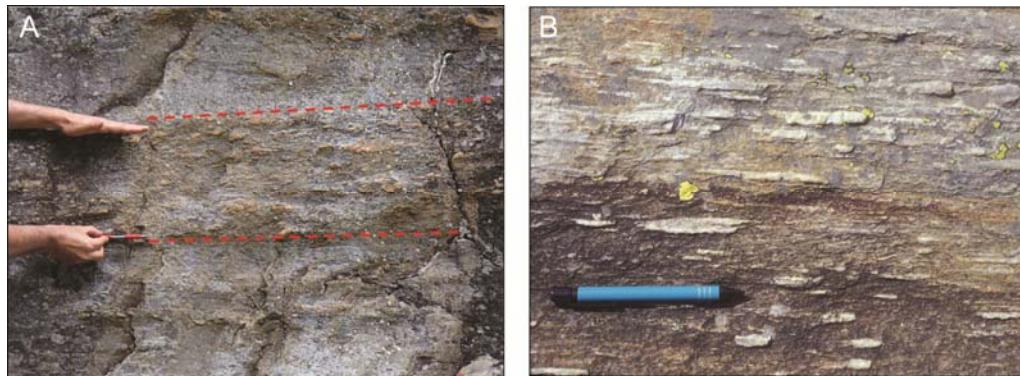


Figure DR1: Matrix-supported quartz-pebble metaconglomerates (A and B) alternate with quartz-micaschist layers. The sedimentary layering is well preserved in some outcrops (A) despite stretching of the former quartz-pebbles that now lie in a micaschist matrix. The multistage garnet crystals studied here come from the matrix.

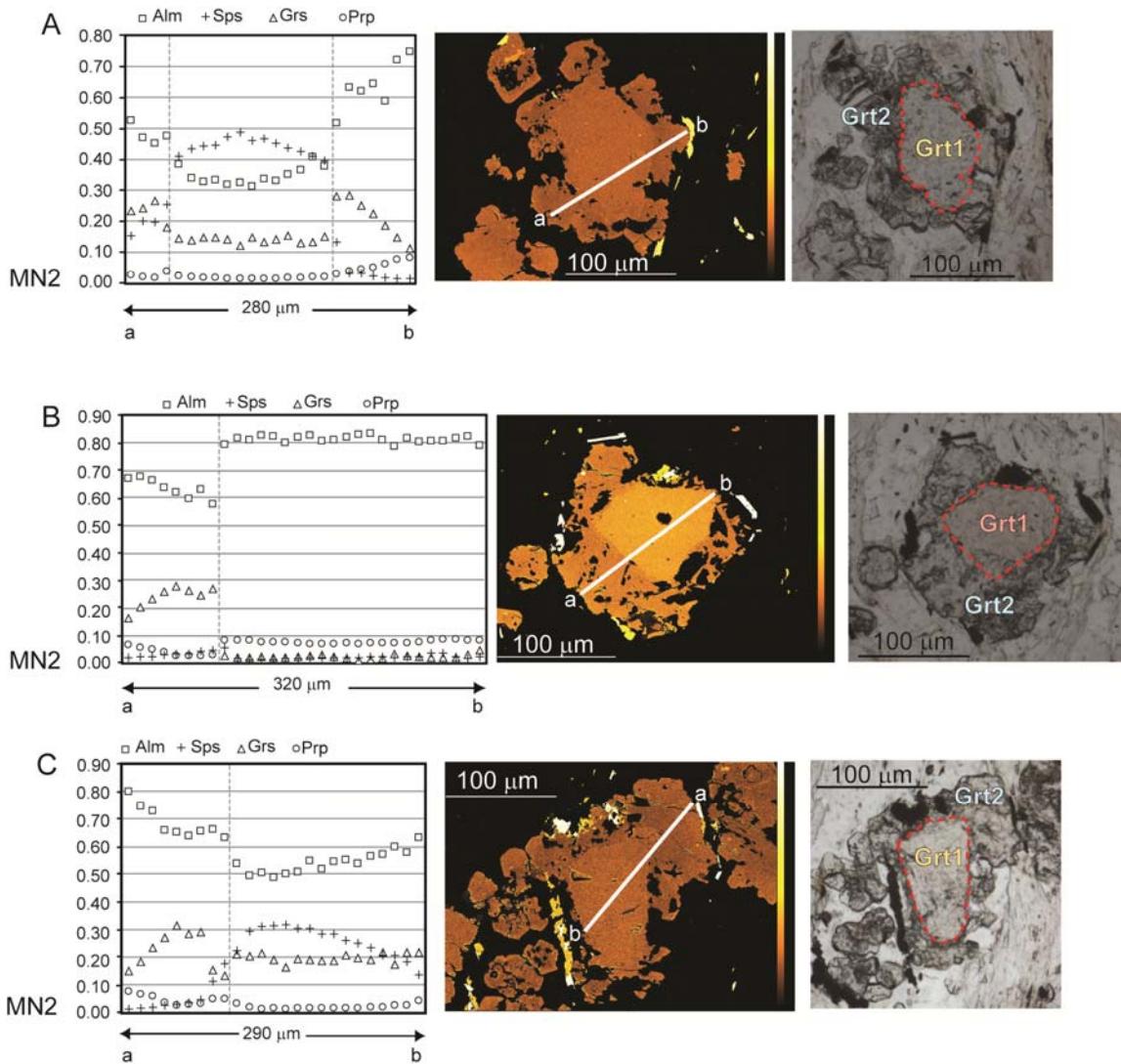


Figure DR2: Chemical profiles, back-scattered images and micro-photographs (plane-polarized light) of multistage garnet crystals showing the metamorphic overgrowths on detrital garnet grains (a-c, sample MN2). (Alm = almandine, Sps = spessartine, Grs = grossular, Prp = pyrope). Lines indicate the position of the chemical profiles. Garnet 1 is interpreted as a detrital grain, garnet 2 as a metamorphic overgrowth.

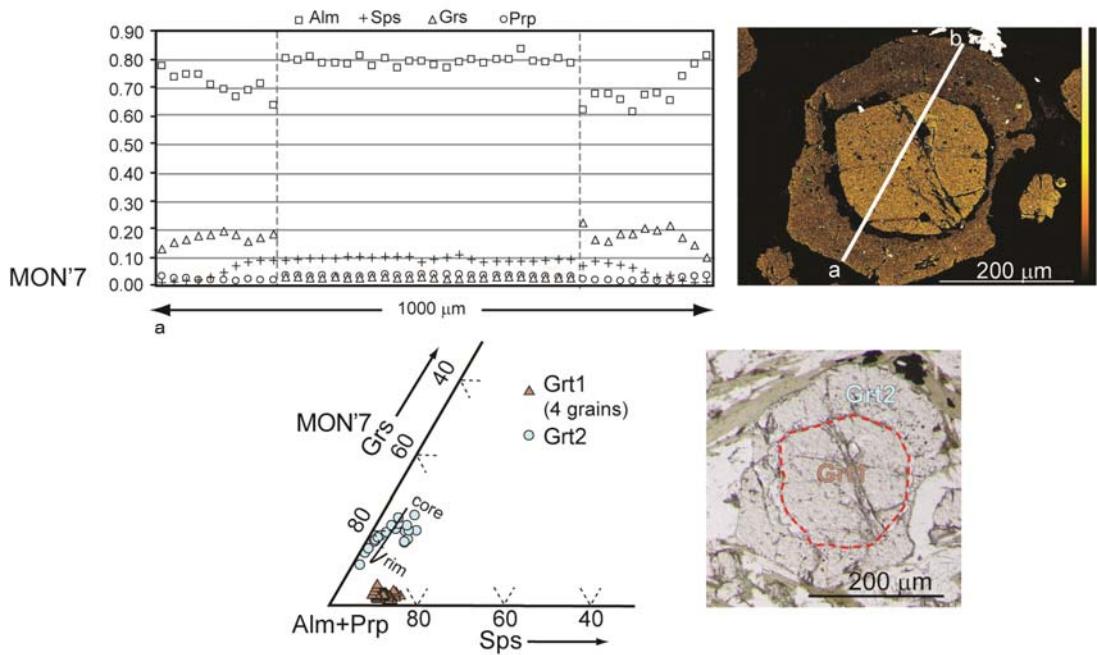


Figure DR3: Chemical profiles, ternary plot, back-scattered image and micro-photograph (plane-polarized light) of multistage garnet crystal showing the contact metamorphism garnet (new analyses from sample MON'7, already studied by Le Bayon and Ballèvre (2004). (Alm = almandine, Sps = spessartine, Grs = grossular, Prp = pyrope). Lines indicate the position of the chemical profiles. Garnet 1 is interpreted as resulting from a pre-Alpine contact metamorphism, whereas growth of garnet 2 took place during the Alpine regional metamorphism.

Table DR1. Representative analyses of garnet (Grt) from metaconglomerate samples MN2 (this study).

Mineral/ Zone	Grt1 (grain A)	Grt1 (grain A)	Grt1 core (grain B)	Grt1 rim (grain B)	Grt1 (grain C)	Grt1 (grain C)	Grt2 core	Grt2 rim
Sample	MN2	MN2	MN2	MN2	MN2	MN2	MN2	MN2
SiO ₂	36.48	36.94	36.78	36.59	37.19	36.87	37.75	37.09
TiO ₂	0.00	0.05	0.07	0.14	0.04	0.05	0.00	0.00
Al ₂ O ₃	20.79	20.88	20.72	20.79	20.87	21.12	21.35	21.09
FeO	39.16	38.83	16.28	16.95	24.70	25.35	29.02	36.68
MnO	1.01	0.79	22.36	19.77	8.91	9.28	2.20	0.72
MgO	1.94	2.18	0.39	0.44	0.51	0.43	1.24	2.33
CaO	1.27	1.10	4.35	5.49	8.38	7.77	9.45	2.88
NaO	0.01	0.03	0.01	0.00	0.02	0.00	0.00	0.03
K ₂ O	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.01
Total	100.72	100.81	100.96	100.18	100.62	100.86	101.00	100.84
Si	2.95	2.98	2.97	2.97	2.98	2.95	2.99	2.97
Ti	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Al	1.98	1.98	1.97	1.99	1.97	2.00	1.99	1.99
Fe ³⁺	0.13	0.06	0.08	0.06	0.06	0.09	0.03	0.07
Fe ²⁺	2.52	2.56	1.02	1.09	1.59	1.61	1.90	2.38
Mn	0.07	0.05	1.53	1.36	0.61	0.63	0.15	0.05
Mg	0.23	0.26	0.05	0.05	0.06	0.05	0.15	0.28
Ca	0.11	0.10	0.38	0.48	0.72	0.67	0.80	0.25
Na	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Alm	0.79	0.82	0.32	0.35	0.51	0.51	0.62	0.77
Sps	0.02	0.02	0.49	0.44	0.20	0.20	0.05	0.02
Prp	0.07	0.08	0.01	0.02	0.02	0.02	0.05	0.09
Grs	0.03	0.03	0.12	0.15	0.23	0.21	0.26	0.08
Adr	0.06	0.03	0.04	0.03	0.03	0.04	0.01	0.04

Grt1 (grains A, B, C) = detrital grains; Grt2 = Alpine metamorphic garnet. Structural formulae have been calculated on the basis of 12 oxygens. Core and rim refer to inner and outer parts for each garnet generation.

Table DR2. Representative analyses of garnet (Grt) MON'7

Mineral/ Zone	Grt1 (contact met.)	Grt1 (contact met.)	Grt2 core	Grt2 rim
Sample	MON'7	MON'7	MON'7	MON'7
SiO ₂	36.43	36.67	36.88	37.08
TiO ₂	0.00	0.00	0.00	0.00
Al ₂ O ₃	20.92	20.94	20.79	20.95
FeO	37.23	36.82	33.63	37.95
MnO	4.71	4.86	3.69	0.62
MgO	0.96	1.00	0.53	0.98
CaO	0.97	0.88	5.73	3.56
NaO	0.01	0.00	0.01	0.04
K ₂ O	0.00	0.01	0.02	0.00
Total	101.22	101.19	101.28	101.18
Si	2.95	2.97	2.96	2.98
Ti	0.00	0.00	0.00	0.00
Al	2.00	2.00	1.97	1.99
Fe ³⁺	0.10	0.06	0.11	0.05
Fe ²⁺	2.43	2.44	2.15	2.51
Mn	0.32	0.33	0.25	0.04
Mg	0.12	0.12	0.06	0.12
Ca	0.08	0.08	0.49	0.31
Na	0.00	0.00	0.00	0.01
K	0.00	0.00	0.00	0.00
Total	8.00	8.00	8.00	8.00
Alm	0.77	0.79	0.68	0.81
Sps	0.10	0.11	0.08	0.01
Prp	0.04	0.04	0.02	0.04
Grs	0.03	0.02	0.16	0.10
Adr	0.05	0.03	0.06	0.02

Sample already studied by Le Bayon and Ballèvre (2004). New analyses have been done on this sample. Grt1 from sample MON'7 = contact metamorphism garnet; Grt2 = Alpine metamorphic garnet. Structural formulae have been calculated on the basis of 12 oxygens. Core and rim refer to inner and outer parts for each garnet generation.

REFERENCES

- Armstrong, J.T., 1988, Quantitative analysis of silicate and oxide materials: comparison of Monte Carlo, ZAF and $j(rZ)$ procedures, *in* Newbury, ed., Microbeam Analysis.
- Armstrong, J.T., 1991, Quantitative elemental analysis of individual microparticles with electron beam instruments, *in* Heinrich, K.F.S., Newbury, D.E. (Eds.), Plenum Press, ed., Electron Probe Quantitation, p. 261-315.
- Le Bayon, B., and Ballèvre, M., 2004, Field and petrological evidence for a Late Palaeozoic (Upper Carboniferous-Permian) age of the Erfaulet orthogneiss (Gran Paradiso, western Alps): Comptes Rendus Geoscience, v. 336, p. 1079-1089.