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2 **Table S1** Ray Pic basalt data. All values are in wt. %. There was not enough material to analyse
3 basalt surrounding sample Burz16 01; therefore we picked the basalt from another sample at
4 the same location.

Sample	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	Total
RayPic16 02	45.03	12.98	11.17	0.20	11.95	9.48	4.53	1.86	2.09	0.72	99.74
Lep 4	44.49	13.08	11.53	0.20	11.65	9.25	4.21	1.95	2.17	0.75	99.32
Burz16 06	45.68	13.09	11.32	0.20	11.59	9.16	4.33	2.01	2.14	0.74	100.16
Mon 1	44.50	13.16	11.42	0.20	11.91	9.44	3.71	1.70	2.17	0.74	100.01
Col 2	44.78	13.18	11.44	0.20	11.21	9.52	4.29	1.81	2.18	0.76	99.48

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8 **Table S2** Trace elements concentration of Ray Pic basalts. All values are in µg/g. <L.D. stands
9 for limits of detection, when concentrations are below minimum possible detection.

	Ray Pic16 02	Mon 1	Col 2	Lep 4	Burz16 06
As	0.90	1.15	1.27	1.53	1.20
Ba	640	660	662	650	651
Be	1.79	1.78	1.86	1.77	1.77
Bi	0.09	< L.D.	< L.D.	< L.D.	< L.D.
Cd	0.15	0.15	0.14	0.15	0.14
Co	47.1	48.3	48.4	52.2	48.8
Cr	617	639	711	691	603
Cs	0.89	0.97	0.95	0.90	0.94
Cu	39.6	36.8	38.1	37.9	35.5
Ga	19.6	19.4	20.3	20.1	19.9
Ge	1.49	1.50	1.55	1.49	1.51
Hf	5.75	5.86	5.94	6.00	6.01
In	0.07	0.07	0.07	0.07	0.07
Mo	3.24	2.00	4.32	6.07	3.02
Nb	81.7	80.7	84.0	83.1	82.0
Ni	347	355	388	478	360
Pb	4.13	4.08	4.49	3.92	3.80
Rb	59.2	56.8	62.9	60.4	61.2
Sb	0.11	0.10	0.13	0.15	0.10
Sc	22.39	21.27	21.45	21.09	20.82
Sn	2.27	2.07	2.19	2.01	1.83
Sr	816	844	861	845	835
Ta	5.77	5.84	5.93	5.97	5.89
Th	6.53	6.79	6.83	6.73	6.67
U	1.73	1.68	1.79	1.79	1.66
V	182	181	186	185	183
W	1.12	< L.D.	1.34	1.61	1.01
Y	25.9	26.2	26.6	26.6	26.4
Zn	112	116	115	115	113
Zr	273	278	282	278	276
La	53.2	54.5	55.6	54.4	53.9
Ce	100	103	105	104	103
Pr	11.4	11.7	11.9	11.7	11.6
Nd	44.1	44.9	46.1	45.2	44.8
Sm	8.51	8.68	8.90	8.81	8.70
Eu	2.67	2.68	2.76	2.76	2.74
Gd	7.03	7.11	7.25	7.24	7.18
Tb	0.975	0.984	1.01	1.03	1.00
Dy	5.51	5.51	5.59	5.65	5.55
Ho	1.00	1.02	1.03	1.05	1.03
Er	2.46	2.46	2.50	2.59	2.53
Tm	0.334	0.337	0.340	0.352	0.345
Yb	2.04	2.03	2.06	2.12	2.09
Lu	0.295	0.290	0.302	0.303	0.300

11 **Table S3** Concentration in Al₂O₃ and H₂O of pyroxenes in the xenoliths from Ray Pic (Denis
 12 et al. 2015) and Allègre (Gu, 2016).

Ray Pic (Denis et al. 2015)	Al ₂ O ₃ % opx	OH opx wt. ppm H ₂ O	Al ₂ O ₃ % cpx	OH cpx wt. ppm H ₂ O
13RP05	2.81	100	3.49	357
13RP17	3.63	107	4.74	559
13RP01	3.33	68	6.08	381
13RP02	3.94	114	6.09	363
13RP12	3.93	148	6.20	391
13RP04	3.58	100	5.63	335
13RP14	3.07	140	4.18	482
13RP03	3.51	102	3.90	339
13RP11	4.33	171	6.13	623
14RP06	4.43	112	6.22	413
Allègre (Gu, 2016)				
AL22	3.15	41	5.75	161
AL41P1	2.43	34	3.37	112
AL44	3.68	23	6.89	113

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Figure S1 Left: Map of France showing the location of the French Massif Central (FMC). The red letters mark the location of the two sample localities, A for Allègre and R for Ray Pic. The 45°30'N boundary divides the FMC into north and south domains. Map modified from Wikimedia Commons (Technob105). Right: Geological map of the southeast part of the FMC (Carte Géologique de la France" ISBN 978-2-7159-2158-0). The light blue area where Allègre is located (yellow triangle) is showing the Devès volcanic region, while the dark green-blue area where Ray Pic is located (yellow triangle) is marking the Velay Oriental volcanic region.

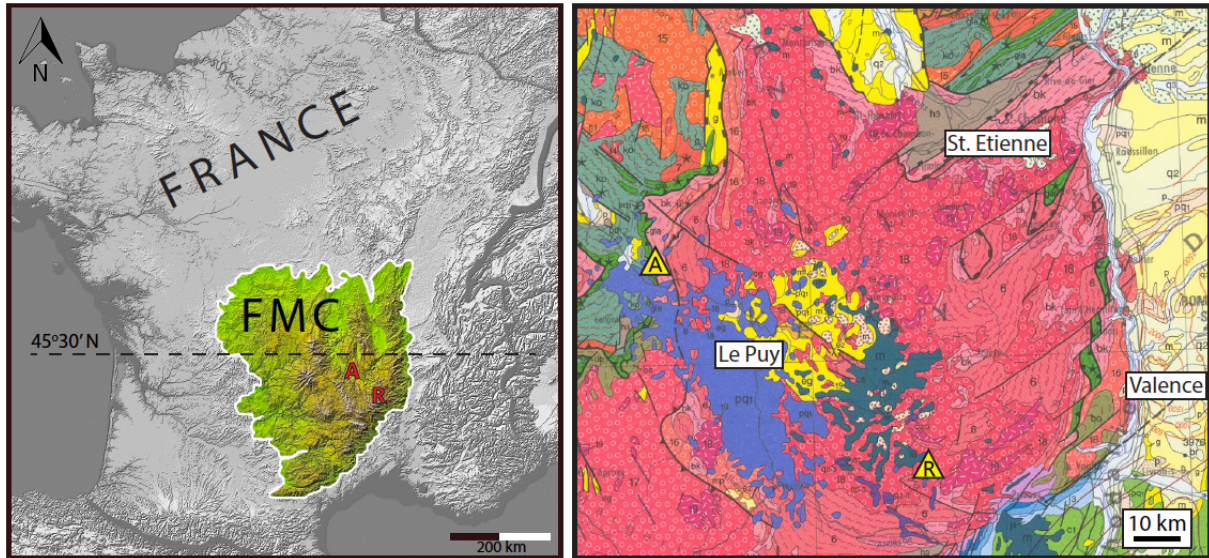


Figure S2 Panoramic view of the quarry in Allègre where samples were taken from each excavation level (fieldwork 2016). Samples were taken from the quarry walls and not from the fallen fragments.

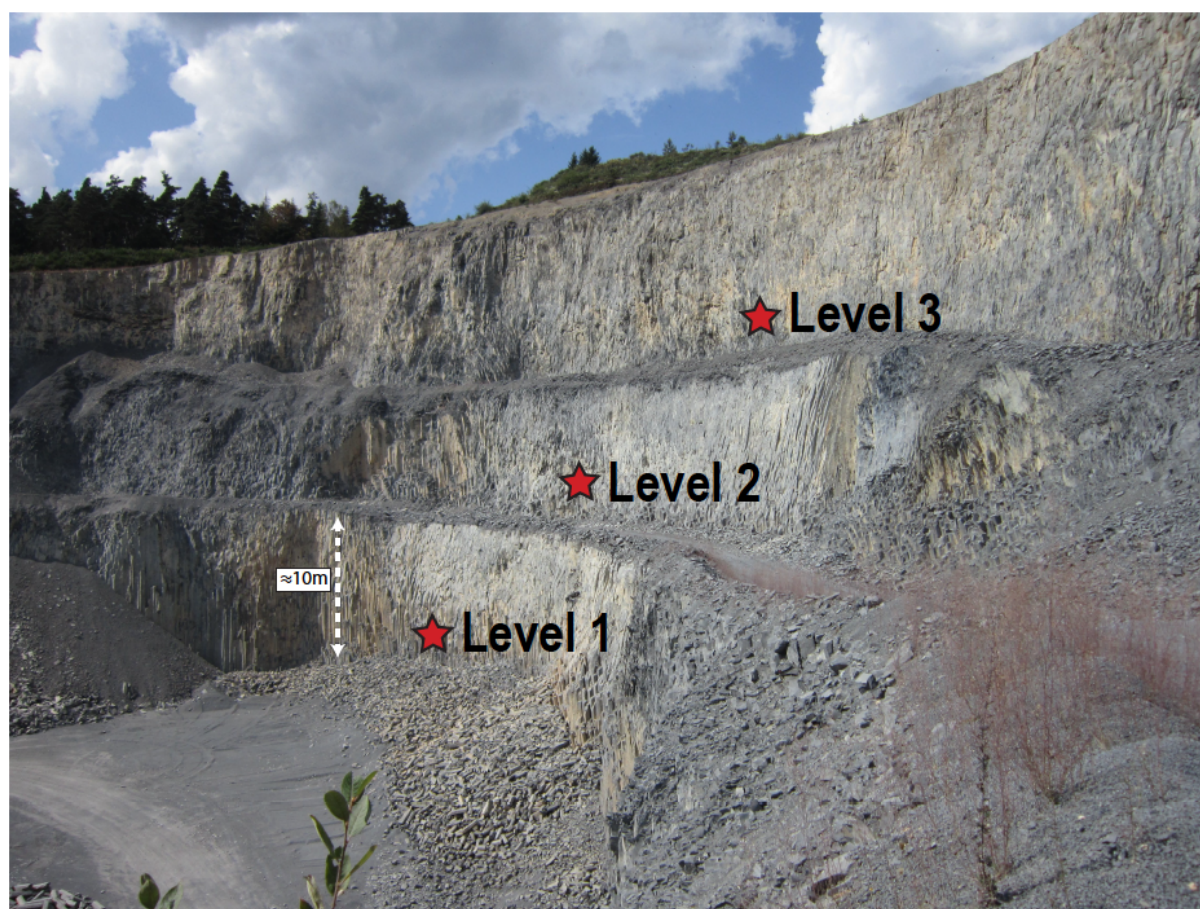


Figure S3 Detailed geological map of the sampling area at Ray Pic (Bambier et al. 1985). With a yellow circle, we underlined the maar crater of Ray Pic. The yellow dashed line is showing the direction of the river and the lava flow. This was also the route we followed to collect samples in the lava flow. The sampling locations are marked with yellow triangles for the 2020 fieldwork and white for the 2016 fieldwork. Dark purple represents the basaltic flow and the dominant red colour the Velay granite.

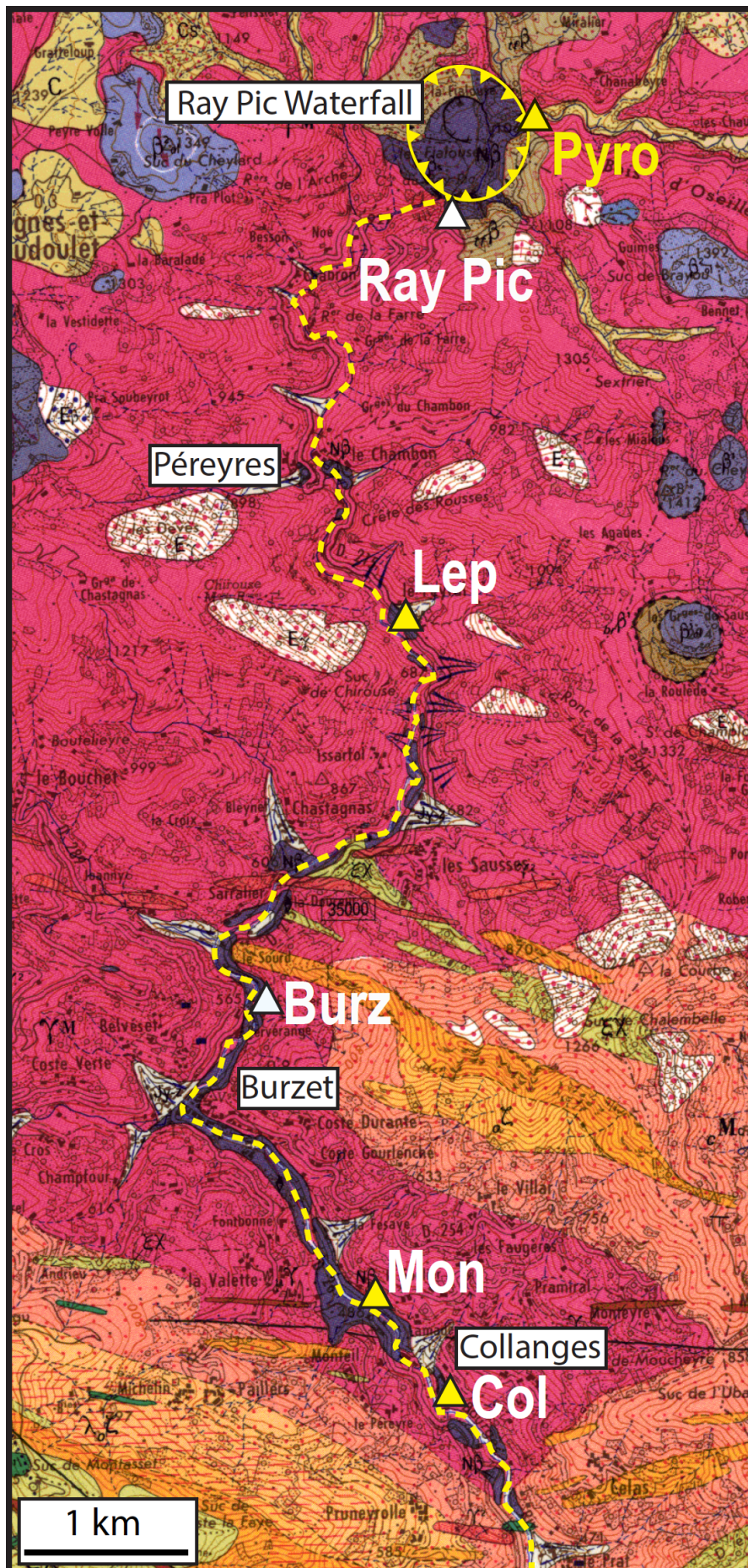
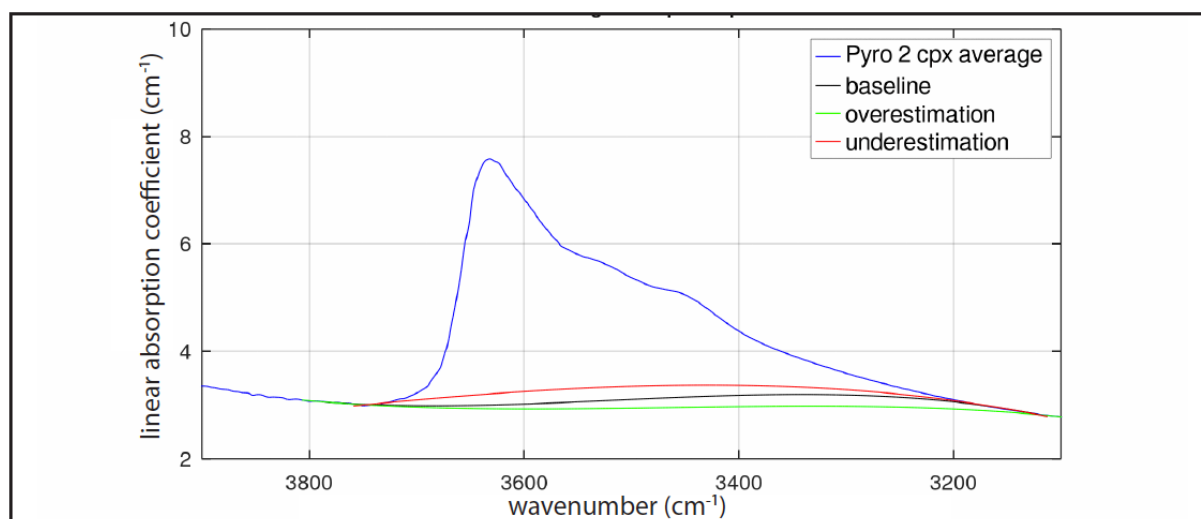
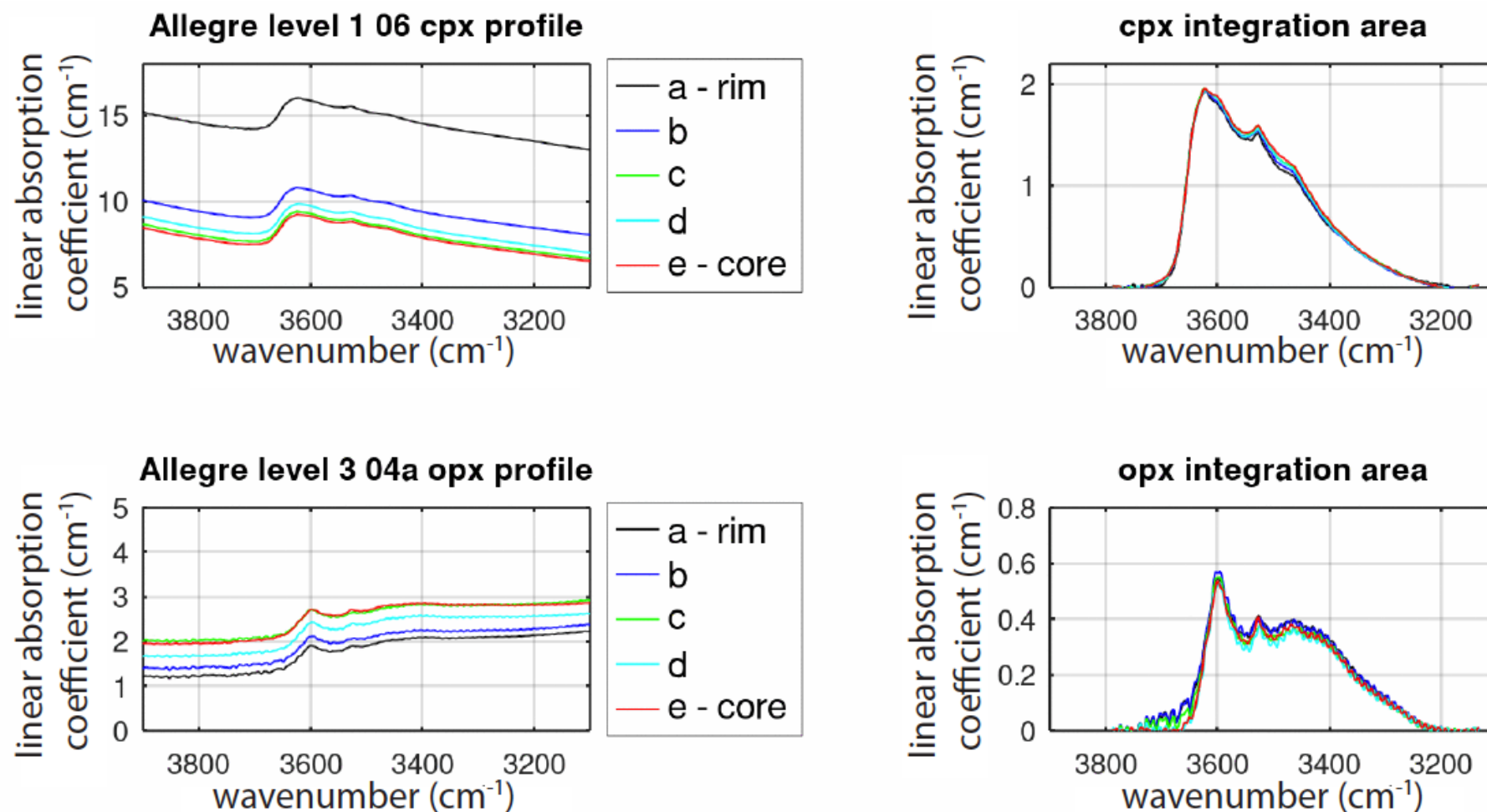


Figure S4 An example of baselines used to estimate the error on the measure of the integral absorbance. Plot of the Pyro 2 cpx average spectrum with overestimation and underestimation of the baseline.



43 **Figure S5** Example of profile measurements in an Allègre cpx crystal from level 1 and an opx crystal from level 3. For both analyses, first
 44 measurement is 30-40 μm from the rim and then progress towards the core of the crystal by 50 μm steps (spot size $50 \times 50 \mu\text{m}^2$).



46 **References**

- 47 Bambier, A., Berger, E. T., Mergoïl, J., Valadas, B., Veyret, Y., and Weisbrod, A.: Carte géol.
48 France (1/50000), feuille Burzet (840). Orléans: BRGM, 47 p., 1985.
- 49 Denis, C. M. M., Alard, O., and Demouchy, S.: Water content and hydrogen behaviour during
50 metasomatism in the uppermost mantle beneath Ray Pic volcano (Massif Central, France).
51 Lithos, 236-237, 256–274, <https://doi.org/10.1016/j.lithos.2015.08.013>, 2015.
- 52 Gu, X.: Melt-rock interaction signatures in peridotite from sub-continental mantle (French
53 Massif Central): A trace element, H, Li and $\delta^7\text{Li}$ approach. Earth Sciences. Université de
54 Lorraine, English, 10.70675/b08ad0aczfea8z47ddz913czfe7d400fa1e1, 2016.