

Significance of Fracture-Filling Rose-Like Calcite Crystal Clusters in the SE Pyrenees

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Carbon and Oxygen Stable Isotopes

Table S1. $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values of the carbonate host rocks and bladed calcite crystals precipitated in the Cadí thrust sheet.

Sample	Description	$\delta^{13}\text{C}$ ‰ PDB	$\delta^{18}\text{O}$ ‰ PDB
B14C	Corones Formation	−0.94	−10.02
B14I	Corones Formation	−1.36	−10.65
B14A	Bladed calcite	−1.1	−15.45
B14F	Bladed calcite	−3.89	−14.48
B14G	Bladed calcite	−1.22	−16.94
B14H	Bladed calcite	−3.70	−14.54

Clumped Isotopes

Table S2. $\delta^{13}\text{C}$, $\delta^{18}\text{O}$, Δ_{47} and $\delta^{18}\text{O}_{\text{fluid}}$ of one sample of bladed calcites within the Cadí thrust sheet. n represents the number of analyses per sample.

Sample	n	$\delta^{13}\text{C}$ ‰ VPDB ^a	$\delta^{18}\text{O}$ ‰ VPDB ^a	Δ_{47} ^b	T °C	$\delta^{18}\text{O}_{\text{fluid}}$ ‰ VSMOW
B14O	3	−3.14 (0.07)	−14.58 (0.06)	0.594 ± 0.02	62.13 ± 5.25	-5.52 ± 0.97

^a 1 σ error for $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ of calcite cements. ^b Error for Δ_{47} is presented as standard error and calculated by the replicate standard deviation divided by square root of n.

Strontium Isotopes

Table S3. $^{87}\text{Sr}/^{86}\text{Sr}$ values of the Corones Formation and one sample of bladed calcite precipitated in the Cadí thrust sheet.

Sample	Description	$^{87}\text{Sr}/^{86}\text{Sr}$	$\pm$ StdErr
B24D	Corones Formation	0.707888	0.000003
B14E	Bladed Calcite	0.707903	0.000003

Elemental Composition

Table S4. Mg, Sr, Fe, Mn and Ca content of bladed calcites (d.l. means below the detection limit).

Sample	Mg (ppm)	Sr (ppm)	Fe (ppm)	Mn (ppm)	Ca (ppm)
B14	1590	5207	d.l	243	396581
B14	1490	5918	d.l	164	395581
B14	1466	5367	d.l	136	398940
B14	1364	5921	d.l	150	398797
B14	1122	4967	d.l	d.l	397439
B14	1420	5125	d.l	319	398654
B14	1775	3438	d.l	d.l	396867
B14	1569	6787	d.l	d.l	398511
B14	1528	4556	d.l	d.l	396581
B14	1372	5425	d.l	231	398368
B14	1214	4872	d.l	156	395509
B14	1542	4230	d.l	d.l	396296
B14	1610	4886	d.l	d.l	397653
B14	1112	504	d.l	309	397653
B14	1031	3605	d.l	d.l	397582
B14	1157	5591	d.l	d.l	397439
B14	2441	1578	d.l	365	399583
B14	1436	4221	d.l	185	399798
B14	1124	6094	d.l	d.l	396010
B14	1290	6470	d.l	166	395009

Table S5. Mg/Ca, Sr/Ca, Ca/Fe and Mn/Ca molar ratios of bladed calcites.

Sample	Mg/Ca		Sr/Ca		Ca/Fe		Mn/Ca	
B14	Max.	0.05	Max.	0.09	Max.	-	Max.	0.0003
	Min.	0.02	Min.	0.02	Min.	-	Min.	0.0001
	Mean	0.03	Mean	0.07	Mean	-	Mean	0.0002

Rare Earths and Yttrium Composition

Table S6. Rare earths and yttrium content in ppm of the Coronas Formation and bladed calcites within the Cadí thrust sheet.

Lu	Yb	Er	Ho	Y	Dy	Tb	Gd	Eu	Sm	Nd	Pr	Ce	La	Description	Sample
0.12	0.35	0.33	0.17	3.94	0.63	0.18	0.77	0.24	0.7	3.07	0.9	6.91	3.91	Corones Formation	B14M
0.1	0.43	0.39	0.15	5.34	0.78	0.16	0.93	0.25	0.92	4.58	1.26	10.07	6.01	Corones Formation	B14N
0.04	0.07	0.08	0.04	0.9	0.12	0.05	0.16	0.07	0.15	0.46	0.13	0.72	0.35	Bladed Calcite	B14J
0.05	0.22	0.23	0.09	3.6	0.41	0.08	0.45	0.12	0.4	1.98	0.57	4.76	2.73	Bladed Calcite	B14K

Table S7. PAAS-normalized Rare earths and yttrium contents of the Corones Formation and bladed calcites within the Cadí thrust sheet.

REE+Y PAAS-normalized														Description	Sample
Lu	Yb	Er	Ho	Y	Dy	Tb	Gd	Eu	Sm	Nd	Pr	Ce	La		
0.286	0.125	0.117	0.167	0.146	0.134	0.228	0.165	0.226	0.125	0.091	0.102	0.087	0.102	Corones Formation	B14M
0.221	0.154	0.137	0.15	0.198	0.167	0.205	0.2	0.232	0.166	0.135	0.143	0.127	0.157	Corones Formation	B14N
0.092	0.026	0.028	0.043	0.033	0.026	0.059	0.035	0.068	0.027	0.014	0.015	0.009	0.009	Bladed Calcite	B14J
0.122	0.08	0.081	0.087	0.133	0.088	0.099	0.098	0.109	0.073	0.059	0.065	0.06	0.072	Bladed Calcite	B14K

Table S8. Calculated cerium (Ce/Ce*) and praseodymium (Pr/Pr*) anomalies and Y/Ho ratios for the Corones Formation and bladed calcite within the Cadí thrust sheet.

Sample	Description	Ce/Ce*	Pr/Pr*	Y/Ho
B14M	Corones Formation	0.75	1.15	23.78
B14N	Corones Formation	0.84	1.09	35.83
B14J	Bladed Calcite	0.55	1.31	20.94
B14K	Bladed calcite	0.84	1.09	41.88

Table S9. $\delta^{34}\text{S}$ and $\delta^{18}\text{O}$ of celestite-barite concretions within the Corones and Armàncies Formations.

Sample	Host Rock	$\delta^{34}\text{S}\text{‰ VCDT}$	$\delta^{18}\text{O}\text{‰ VSMOW}$	$\delta^{34}\text{S}/\delta^{18}\text{O}$
B54B	Corones Formation	50.1 ± 0.4	27 ± 0.5	1.86
GIS15B	Armàncies Formation	51.1 ± 0.4	25.3 ± 0.5	2.02

XRD Diffraction Patterns

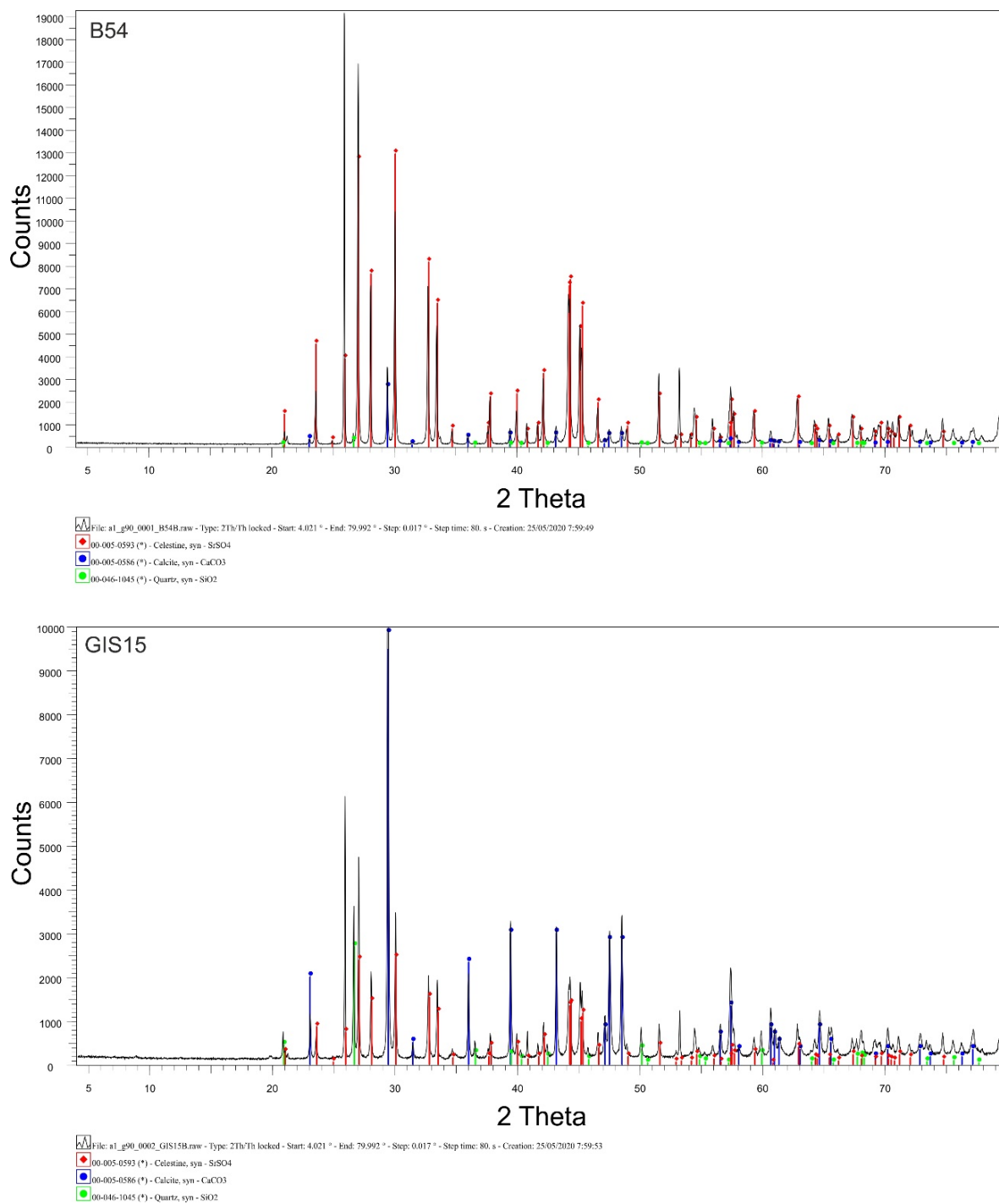


Figure S1. Pattern of celestite concretions from samples B14 and GIS15.

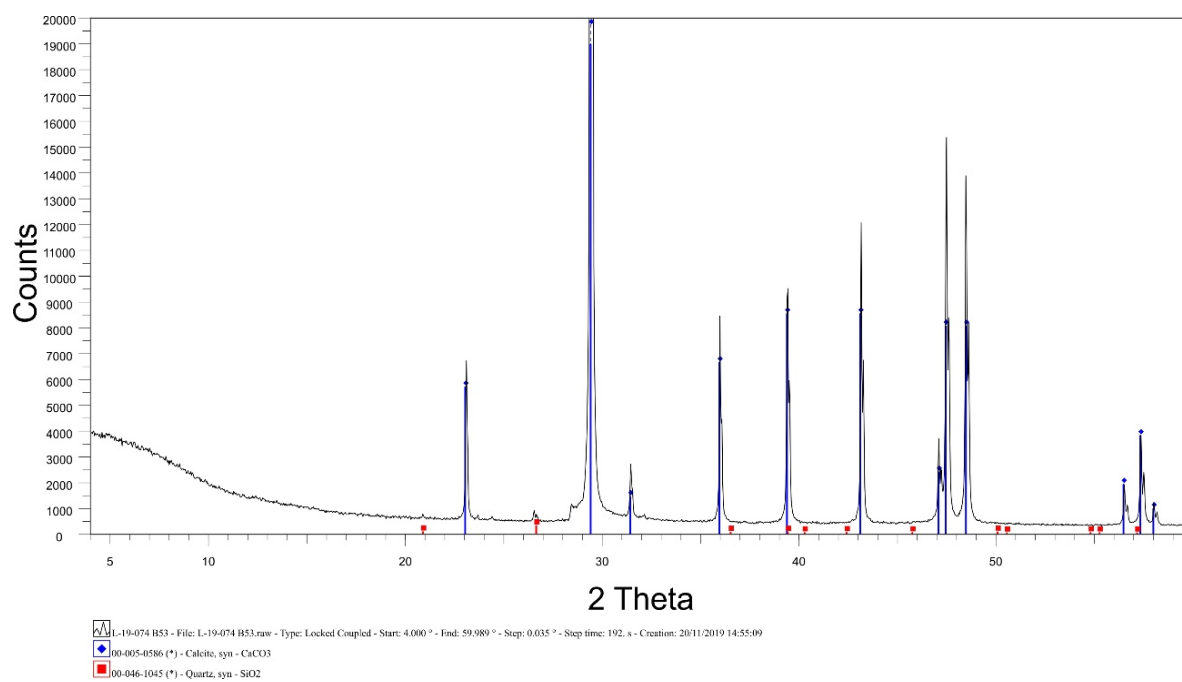


Figure S2. XRD pattern of calcite cement.