# **Supplementary information**

# Impact remnants rich in carbonaceous chondrites detected on the Moon by the Chang'e-4 rover

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2	Supplementary Information for
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4	Impact Remnants Rich in Carboncaous Chondrites Detected
5	on the Moon by the Chang'E-4 Rover
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27	This PDF file includes:
28 20	Supplementary Figures 1 to 4
29	Supplementary Tables 1 to 11.



#### 31 Supplementary Fig. 1.

The measured and modeled radial elevation profiles for (a) the small fresh crater observed on Day 9 and (b) the Zhinyu crater (right). Black lines are the observed profiles obtained from the DEM

(Fig. 4a) data and https://quickmap.lroc.asu.edu/, respectively. The red lines are the initial profiles

(1) g. (a) data and <u>integrity queekingtheorem</u>, respectively. The real mes are the initial promote

35 set for the degradation model, and blue lines represent the best-fit results. The observed profiles 36 are not well fitted, because these two craters are younger than those fresh craters (~1 Ma) we used

to build the crater degradation-age model (*ref. 22, 23*). Therefore, the age of the small crater and

38 Zhinyu crater might be less than 1 Ma.



40 Supplementary Fig. 2.

- 41 HAZCAM image and enlarged CMOS image for each VNIS measurement site around the small
- 42 crater. The yellow boxes in HAZCAM images indicate the areas imaged by the CMOS camera.



#### 44 Supplementary Fig. 3

- 45 (a) Original CMOS spectra of the four ROIs in N66, N64, N63, and N57, and the reflectance
- 46 spectra of a film material which is the same as the cover material of the Yutu-2 rover. (b) The
- 47 CMOS spectra of the four ROIs before and after correction.



#### 50 Supplementary Fig. 4.

- 51 Reflectance spectra of N66 ROI (corrected to standard angles, see Methods) and unmixing results
- 52 of three tests: (1) with all endmembers used; (2) only excluding the CC endmember; (3) only excluding the agglutinate endmember. The model fails to reproduce the Chang'E-4 spectra without
- 53
- 54 the CC endmember (the green dashed line).

#### 55 Supplementary Table 1.

56 Sample information for selected endmember spectra.

		Composition				
Endmember	RELAB Spectra l File ID	in solid solution (%)*	Particle size (µm)	Refractive index (n)	Origin	References
Olivine	c1lr212	Fo34.8	<45	1.83	Apollo 15555, 965	
OPX	c11r209	En51.3; Fs40.9; Wo7.8	<45	1.77	1.77 Apollo 15058, 276, green pyroxene	
CPX1	c11r208	En23.0; Fs54.9; Wo22.2	<45		Apollo 15058, 276, brown pyroxene	(16, 48, 69)
CPX2	c11r213	En40.3; Fs44.7; Wo15.0	<45	1.72	Apollo 15555, 965, light-brown pyroxene	(16, 48, 69)
CPX3	c1lr215	En33.3; Fs32.6; Wo34.2	<45	1.75	Apollo 70017, 535, deep-brown pyroxene	(16, 48, 69)
CPX4	c1lr219	En37.1; Fs31.0; Wo31.9	<45		Apollo 70035, 188, dark-brown pyroxene	(16, 48, 69)
Plagioclase	c1lr223	An94.2	<45	1.56	Apollo 62241, 21	(16, 48, 69)
Ilmenite	c1lr222		<45	2.13	Apollo 70035, 188	(16, 48)
Agglutinate	c11u07		100- 1000	1.49	Separate from LUNA 20	(16)
Glass1	c1lr51	Fo40.1; An:92.1	15#	1.64	Apollo 74220, 806, orange glass	(16, 69, 70, 71)
Glass2	c1lr52	Fo47.1; An98.3	15#	1.64	Apollo 15401, 136, green glass	(16, 69, 70, 71)
Glass3	c1lr50		15#	1.64	Apollo 74001, 439, black spherules	(16, 69, 70, 71)
CC	c1mb77		<125	1.93**	Y-693, CK	(30)

57 \*Fo: Mg number defined as molar Mg/(Mg+Fe); En, Fs, and Wo represent the three typical

58 pyroxene end-members of enstatite ( $Mg_2Si_2O_6$ ), ferrosilite(Fe<sub>2</sub>Si<sub>2</sub>O<sub>6</sub>), and wollastonite(Ca<sub>2</sub>Si<sub>2</sub>O<sub>6</sub>), 59 respectively; An represents the typical end-member of anorthite (CaAl<sub>2</sub>Si<sub>2</sub>O<sub>8</sub>).

60 <sup>#</sup>: No particle size is recorded in the RELAB database. A mean particle size 15 μm is assumed 61 based on the fact that the optical property lunar surface is dominated by particles at the 10-20 μm 62 group (*ref.* 69, 70).

63 \*\*: Estimated by weighting the *n* of the individual mineral (*n<sub>i</sub>*) by their relative abundance (*F<sub>i</sub>*): 64  $\bar{n} = \sum_{i} n_i F_i$  (*ref.* 72). The modal abundances of Y693 are 2.1 vol.% pyroxene, 63.5 vol.% olivine,

65 11.5 vol.% plagioclase, and 22.9 vol.% opaque minerals (*ref. 30*). The opaque phases mainly

66 composed of magnetite with n=2.42 (ref. 73).

**Supplementary Table 2.** Similarities between spectra of N66 and selected end-members. 

End-member	Spectral Angle (°)	
CC_c1mb77	2.82894	
GreenGlass_c1lr52	3.83309	High
PLG_c1lr223	4.47412	
Agg_c11u07	6.92018	
OLV_c1lr212	8.83722	
CPX_c1lr215	10.3345	Similarity
OPX_c1lr209	11.0578	
CPX_c1lr208	12.5044	
CPX_c1lr219	12.6118	
CPX_c1lr213	12.8784	Low
OrangeGlass_c1lr51	16.8984	Low
ILM_c1lr222	17.2281	
BlackSpherules_c1lr50	23.679	

# 71 Supplementary Table 3.

- 72 Modeled mineral abundances for ROIs of N66, N64, N63, and N57 which are marked out in Fig.
- 73 1d.

14.					
<b>End-member</b> *	Modeled Abundance (wt. %) (particle size: 0-75 μm)				
	N57	N63	N64	N66	
Olivine	0	9	3	8	
Pyroxene**	47	40	43	0	
OPX	0	6	0	0	
CPX1	0	9	1	0	
CPX2	0	6	0	0	
CPX3	40	10	30	0	
CPX4	7	10	12	0	
Plagioclase	0	5	2	0	
Ilmenite	0	0	0	0	
Glasses***	50	34	45	45	
Glass1	3	8	0	0	
Glass2	14	12	12	0	
Glass3	33	11	31	44	
Agglutinate	0	4	3	0	
CC (Y-693)	2	11	6	47	
npFe <sup>0</sup> (vol.%)	0.20	0.35	0.25	0.00	

<sup>\*</sup>See Supplementary Table 1 for detail information about these spectral endmembers.

75 \*\*Pyroxene: including OPX and four CPX.

<sup>\*\*\*</sup>Glasses: including green glass, orange glass, black spherules, and agglutinate.

#### 77 Supplementary Table 4.

- Modeled mineral abundances for ROIs of N60, N55, N16, and N15 which are marked out in 78
- 79 Extended Data Fig. 10.

End-member*	<b>Modeled Abundance (wt. %)</b> (particle size: 0-75 μm)				
	N65	N60	N55	N15	
Olivine	14	5	7	8	
Pyroxene**	0	61	56	41	
OPX	0	6	7	6	
CPX1	0	10	11	7	
CPX2	0	10	9	4	
CPX3	0	16	14	12	
CPX4	0	19	15	12	
Plagioclase	0	7	8	8	
Ilmenite	0	1	0	0	
Glasses***	71	19	22	34	
Glass1	4	7	7	8	
Glass2	47	0	3	7	
Glass3	20	9	6	11	
Agglutinate	0	3	7	7	
CC (Y-693)	15	6	6	8	
npFe <sup>0</sup> (vol.%)	0.00	0.40	0.16	0.11	

\*See Supplementary Table 1 for detailed information about these spectral end-members. \*\*Pyroxene: including OPX and all CPX. \*\*\*Glasses: including orange glass, green glass, black spherules, and agglutinate. 80

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# 83 Supplementary Table 5.

84 Topography profiles along four different directions.

Profile	Crater depth (m)	Crater diameter (m)	Ratio: depth/diameter
A-A'	0.343	2.129	0.16
B-B'	0.385	1.883	0.20
C-C'	0.347	1.997	0.17
D-D'	0.371	2.110	0.18

#### 86 Supplementary Table 6.

- 87 The ten CC spectra that have the highest similarities with the spectra of the observed "glassy"
- 88 material at N66.

No.	RELAB File ID	Spectral angle (°)	Туре	Meteorite name	Grain size (µm)	Viewing geometry (i°, e°)	Weathering Index
1	c11m17	2.27305	CK6	LEW87009,4	powder, unsorted?	30/0	1
2	c1mp05	2.32317	CK6	LEW87009,4	<63 (?)	30/0	1
3	c1mb88	2.45121	CK6	LEW87009,28	<125	30/0	1
4	c1mp04	2.70066	CK5-6	EET87860,5	<63 (?)	30/0	1
5	c2mb81	2.70499	CK4	ALH85002,25	<125	30/0	1
6	c1mp55	2.80362	CM or CV	A-881655	<125	30/0	unknown
7	cdmb81	2.81142	CK4	ALH85002,25	75-125	30/0	1
8	c1mb77	2.82894	CK4/5	Y-693	<125	30/0	0
9	c11m19	2.85155	CK5-6	EET87860,5	powder; unsorted?	30/0	1
10	cbmh58	2.88285	CK4	ALH85002,34	<180	30/0	1

89 *Note:* Here only the ten most similar CC spectra are listed, the comparison results of all 183 CC

90 spectra are saved as a separate Excel file titled "Supplementary\_Tables\_7\_10\_11.xlsx" in the

supporting material. The weathering index represents the degree of terrestrial alteration, a value of
0 means the meteorite is pristine (*ref. 30*).

## 94 Supplementary Table 7.

- 95 Similarities between spectra of N66 and different carbonceous chondrite samples
- 96 This table is provided in a separate excel file, see additional supplementary files.

### 97 Supplementary Table 8.

98 Incidence, emission, and phase angles of the ROIs shown in Figure 1c and Extended Data Fig.

99 10.

Site No.	Incidence Angle (deg.)	Emission Angle (deg.)	Phase Angle (deg.)
N66	71.0	50.0	98.9
N64	68.8	45.7	93.4
N63	67.8	45.8	92.3
N57	65.4	46.7	43.1
N65	70.0	51.8	98.5
N60	58.4	48.4	47.9
N55	73.4	48.2	44.6
N15	63.4	43.8	63.4

**Supplementary Table 9.** The IDs for the Chang'E-4 spectral and image data used in this work. These data are archived at 102 http://moon.bao.ac.cn/searchOrder\_pdsData.search 103

Data	Data ID
	CE4 GRAS VNIS-VD SCI N 20190825003001 20190825053000 0054 B.2B
	CE4 GRAS VNIS-VD SCI N 20190825053001 20190825080000 0055 B.2B
	CE4 GRAS VNIS-VD SCI N 20190826010001 20190826060000 0056 B.2B
	CE4 GRAS VNIS-VD SCI N 20190826070001 20190826083000 0057 B.2B
	CE4 GRAS VNIS-VD SCI N 20190827000001 20190827020000 0058 B.2B
	CE4 GRAS VNIS-VD SCI N 20190827030001 20190827053000 0059 B.2B
Spectra data	CE4 GRAS VNIS-VD SCI N 20190827060001 20190827100000 0060 B.2B
•	CE4 GRAS VNIS-VD SCI N 20190903143001 20190903150000 0062 B.2B
	CE4_GRAS_VNIS-VD_SCI_N_20190904010001_20190904040000_0063_B.2B
	CE4_GRAS_VNIS-VD_SCI_N_20190904053001_20190904073000_0064_B.2B
	CE4_GRAS_VNIS-VD_SCI_N_20190904093001_20190904113000_0065_B.2B
	CE4 GRAS VNIS-VD SCI N 20190904130001 20190904140000 0066 B.2B
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	CE4 GRAS PCAML-C-
	013 SCL N 20190925033558 20190925033558 0076 B.2B
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	021 SCI N 20190925035217 20190925035217 0076 B.2B
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005_SCI_N_20190925052225_20190925052225_00/6_B.2B
UE4_UKAS_YUAMK-U-
004_5C1_N_20190925052545_20190925052545_00/6_B.2B
UE4_UKAJ_KUANIK-U- 005 SCI N 20100025022502 20100025022502 0074 D 2D
003_5C1_19_20190925052505_20190925052505_0070_B.2B
UL4_UKAJ_PUAMIK-U-

006_SCI_N_20190925032623_20190925032623_0076_B.2B
CE4_GRAS_PCAMR-C-
007 SCI N 20190925032743 20190925032743 0076 B.2B
CE4_GRAS_PCAMR-C-
008_SCI_N_20190925032903_20190925032903_0076_B.2B
CE4_GRAS_PCAMR-C-
009_SCI_N_20190925033023_20190925033023_0076_B.2B
CE4_GRAS_PCAMR-C-
010_SCI_N_20190925033143_20190925033143_0076_B.2B
CE4_GRAS_PCAMR-C-
011_SCI_N_20190925033303_20190925033303_0076_B.2B
CE4_GRAS_PCAMR-C-
012_SCI_N_20190925033423_20190925033423_0076_B.2B
CE4_GRAS_PCAMR-C-
013_SCI_N_20190925033543_20190925033543_0076_B.2B
CE4_GRAS_PCAMR-C-
014_SCI_N_20190925034241_20190925034241_0076_B.2B
CE4_GRAS_PCAMR-C-
015_SCI_N_20190925034401_20190925034401_0076_B.2B
CE4_GRAS_PCAMR-C-
016_SCI_N_20190925034521_20190925034521_0076_B.2B
CE4_GRAS_PCAMR-C-
017_SCI_N_20190925034641_20190925034641_0076_B.2B
CE4_GRAS_PCAMR-C-
018_SCI_N_20190925034801_20190925034801_0076_B.2B
CE4_GRAS_PCAMR-C-
019_SCI_N_20190925034921_20190925034921_0076_B.2B
CE4_GRAS_PCAMR-C-
020_SCI_N_20190925035041_20190925035041_0076_B.2B
CE4_GRAS_PCAMR-C-
021_SCI_N_20190925035201_20190925035201_0076_B.2B
CE4_GRAS_PCAMR-C-
022_SCI_N_20190925035321_20190925035321_0076_B.2B
CE4_GRAS_PCAMR-C-
023_SCI_N_20190925035441_20190925035441_0076_B.2B
UE4_UKAS_PUAMR-U-
024_SCI_N_20190925035001_20190925035001_0076_B.2B
UE4_UKA5_PUAMIK-U-
025_SCI_N_20190925055721_20190925055721_0070_B.2B
CE4_UKA5_PCAMIK-C- 026 SCI N 20100025025841 20100025025841 0076 D 2D
020_3C1_11_20190923033641_20190923033641_0070_D.2D
CL4_UKA5_FCAMIK-C- 027 SCL N 20100025040001 20100025040001 0076 D 2D
027_3C1_11_20190923040001_20190923040001_0070_B.2B CE4_CPAS_DCAMP_C
CL4_UKA5_FCAMR-C- 028 SCL N 20100025040017 20100025040017 0076 B 2B
028_SCI_IV_20190925040917_20190925040917_0070_D.2D
020 SCL N 201000250/13/7 201000250/13/7 0076 B 2B
029_SCI_IV_20190925041547_20190925041547_0070_D.2D
UL4_UNAS_FUANIK-U- A3A SCI N 201000250/1507 201000250/1507 0076 D 2D
050_5C1_11_20170725041507_20170725041507_0070_D.2D CEA CRAS DCAMD C
$\begin{array}{c} CL_{-} \\ CL_{-$
CF4 GRAS PCAMR_C_
032 SCL N 20190925041747 20190925041747 0076 R 2R
052_5C1_11_20170725041747_20170725041747_0070_D.2D

	CE4_GRAS_PCAMR-C-
	033 SCI N 20190925041907 20190925041907 0076 B.2B
	CF4 GRAS PCAMR-C-
	024 SCI N 20100025042027 20100025042027 0076 D 2D
	034_5C1_11_20190925042027_20190925042027_0070_D.2D
	CE4_GRAS_PCAMR-C-
	035_SC1_N_20190925042147_20190925042147_0076_B.2B
	CE4_GRAS_PCAMR-C-
	036_SCI_N_20190925042307_20190925042307_0076_B.2B
	CE4_GRAS_PCAMR-C-
	037_SCI_N_20190925042427_20190925042427_0076_B.2B
	CE4 GRAS PCAMR-C-
	038 SCI N 20190925042547 20190925042547 0076 B.2B
	CE4 GRAS PCAMR-C-
	039 SCL N 20190925042707 20190925042707 0076 B 2B
	CE4 GRAS PCAMP_C
	040 SCI N 20100025042927 20100025042927 0076 D 2D
	040_5C1_N_20190925042627_20190925042627_0070_D.2D
	CE4_OKA5_PCAMR-C-
	041_SC1_N_20190925042947_20190925042947_0076_B.2B
	CE4_GRAS_PCAMR-C-
	042_SCI_N_20190925044042_20190925044042_0076_B.2B
	CE4_GRAS_PCAMR-C-
	043_SCI_N_20190925044202_20190925044202_0076_B.2B
	CE4 GRAS PCAMR-C-
	044 SCI N 20190925044322 20190925044322 0076 B.2B
	CE4 GRAS PCAMR-C-
	045 SCL N 20190925044442 20190925044442 0076 B 2B
	CE4 GRAS PCAMP_C_
	046 SCL N 20100025044602 20100025044602 0076 D 2D
	040_5C1_N_20190925044002_20190925044002_0070_D.2D
	UE4_UKA5_PUAMIK-U-
	047_SCI_N_20190925044722_20190925044722_0076_B.2B
	CE4_GRAS_PCAMR-C-
	048_SCI_N_20190925044842_20190925044842_0076_B.2B
	CE4_GRAS_PCAMR-C-
	049_SCI_N_20190925045002_20190925045002_0076_B.2B
	CE4_GRAS_PCAMR-C-
	050_SCI_N_20190925045122_20190925045122_0076_B.2B
	CE4 GRAS PCAMR-C-
	051 SCI N 20190925045242 20190925045242 0076 B.2B
	CE4 GRAS PCAMR-C-
	052 SCL N 20190925045402 20190925045402 0076 B 2B
	$CF4 GRAS PCAMR_C$
	053 SCL N 20100025045522 20100025045522 0076 B 2B
	055_5C1_1(_20190925045522_20190925045522_0070_D.2D
	UE4_UKA5_PUAMIK-U-
	054_SCI_N_20190925045642_20190925045642_0076_B.2B
	CE4_GRAS_PCAMR-C-
	055_SC1_N_20190925045802_20190925045802_0076_B.2B
Extended Data Fig. 2 PCAM data	CE4_GRAS_PCAML-C-
	000_SCI_N_20190827094241_20190827094241_0060_B.2B
	CE4 GRAS PCAML-C-
	001 SCI N 20190827094410 20190827094410 0060 B.2B
	CE4 GRAS PCAML-C-
	002 SCL N 20190827094539 20190827094539 0060 R 2R
	CFA GRAS PCAMI_C_
	CL4_ORAS_FCAML-C-

Extended Data Fig.         CE4_GRAS_PCAML-C- 004_SCI_N_20190827094836_20190827095005_0060_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190827095005_20190827095005_0060_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905071818_20190905071818_0067_B.2B CE4_GRAS_PCAML-C- 000_SCI_N_20190905071947_20190905071818_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071947_20190905071818_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905072116_20190905072116_0067_B.2B CE4_GRAS_PCAML-C- 003_SCI_N_20190905072359_20190905072539_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072539_20190905072539_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072539_20190905072539_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072539_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_2019090507257_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_2019090507257_20190905072657_0067_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012057_0067_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190923013000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909240951132_0067_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092409510_2019092403500_0070_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924060001_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924063001_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092407301_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924063001_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092407301_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092407301_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_2019092406500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925040000_0073_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190925013000_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_2019092406500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925010001_20190925013000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_2019092504500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019002030001_20190925043000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019002030001_2019092504500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002045300_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001		003 SCI N 20190827094707 20190827094707 0060 B.2B
Extended Data Fig. 3a PCAM data         004_SCI_N_20190827094836_20190827094836_0060_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190729012457_20190729012457_0050_B.2B           Extended Data Fig. 3a PCAM data         CE4_GRAS_PCAML-C- 000_SCI_N_20190905071818_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071947_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071147_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_20190905072156_20190905072156_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072567_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072567_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072567_20190905072528_0067_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909231001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924061001_20190924061500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092407301_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924013001_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092407301_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092407301_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092407301_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_2019092401500_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_20190925054000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_20190925054000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_20190925054000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925012001_20190925054000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_201900225010001_2019002054500_0008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002075000_2015_B.2B CE4_GRAS_VNIS-VD_SCI_N_201910020750001_2019100204500_00078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002075000_201908_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002075000_2015_B.2B CE4_GRAS_VNIS-VD_		CF4 GRAS PCAML-C-
Extended Data Fig.         CE4_GRAS_PCAML-C- 005_SCI_N_20190827095005_20190827095005_0060_B.2B CE4_GRAS_PCAMR-C- 004_SCI_N_20190729012457_20190729012457_0050_B.2B           Extended Data Fig.         CE4_GRAS_PCAML-C- 000_SCI_N_20190905071818_20190905071818_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071147_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_20190905072116_2019090507216_0067_B.2B CE4_GRAS_PCAML-C- 003_SCI_N_20190905072359_20190905072359_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072352_2019090507258_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072657_2019090507258_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905012657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905013132_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923010001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924005001_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924005001_2019092406500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924005001_2019092406500_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924005001_2019092406500_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924005001_2019092401500_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924005001_20190925054000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925080001_20190925054000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925080001_20190925054000_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925080001_20190925054000_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925080001_201909250130000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203000_00176_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002073000_0081_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002073000_0081_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002073000_0081_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002073000_0081_B.2B CE4_GRAS_VNIS-VD_SCI_N_201910002070001_20191002074		004 SCL N 20190827094836 20190827094836 0060 B 2B
Extended Data Fig.         CE4_GRAS_VIS-VD_SCI_N_20190827095005_0060_B.2B           CE4_GRAS_PCAMR-C-         004_SCI_N_20190729012457_0050_B.2B           CE4_GRAS_PCAMR-C-         000_SCI_N_20190729012457_0050_B.2B           CE4_GRAS_PCAML-C-         000_SCI_N_20190905071818_0067_B.2B           CE4_GRAS_PCAML-C-         001_SCI_N_2019090507147_20190905071818_0067_B.2B           CE4_GRAS_PCAML-C-         001_SCI_N_20190905072116_0067_B.2B           002_SCI_N_20190905072359_20190905072359_0067_B.2B         CE4_GRAS_PCAML-C-           003_SCI_N_20190905072359_20190905072359_0067_B.2B         CE4_GRAS_PCAML-C-           004_SCI_N_20190905072359_20190905072528_0067_B.2B         CE4_GRAS_PCAML-C-           005_SCI_N_20190905072557_20190905072558_0067_B.2B         CE4_GRAS_PCAML-C-           005_SCI_N_20190905072557_201909050712657_0067_B.2B         CE4_GRAS_PCAML-C-           006_SCI_N_201909050713132_20190923110000_0068_B.2B         CE4_GRAS_VNIS-VD_SCI_N_2019092301201_20190923110000_007B_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924035000_0070_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092408000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924015000_0073_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092504000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925003001_2019092504000_0077_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925003001_2019092504000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_2019092504000_007		$CE4 GBAS PCAML-C_{-}$
Extended Data Fig.         CE4_GRAS_PCAML-C- 004_SCI_N_20190905071818_0067_B.2B           Extended Data Fig.         CE4_GRAS_PCAML-C- 000_SCI_N_20190905071947_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071947_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_20190905072116_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_20190905072359_20190905072359_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072528_201909050725528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072528_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072552_20190905072657_0067_B.2B           CE4_GRAS_PCAML-C- 006_SCI_N_20190905072528_20190905072657_0067_B.2B           CE4_GRAS_PCAML-C- 006_SCI_N_20190905072552_20190905072657_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923072657_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923013000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092313000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924061000_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401000_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924094501_2019092401000_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925003001_20190925054500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925003001_20190925054500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925003001_20190925013000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002003001_20190925013000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_201910020010001_0019925100000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_201910020		005 SCI N 20100827005005 20100827005005 0060 B 2B
Extended Data Fig.         CE4_GRAS_PCAML-C- 000_SCI_N_20190905071818_20190905071818_0067_B.2B           Extended Data Fig. 3a PCAM data         CE4_GRAS_PCAML-C- 001_SCI_N_20190905071947_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_20190905072116_20190905072116_0067_B.2B CE4_GRAS_PCAML-C- 003_SCI_N_20190905072359_20190905072359_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072557_20190905072567_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905072567_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905072567_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_2019092313000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_2019092405000_0072_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190925014000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250220001_2019092505400_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250220001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250200001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250120000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250120000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250120000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250120000_1075_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250120000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250120001_20191002075000_008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204500_0080_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204500_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002045000_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191		CE4 GPAS DCAMP C
Extended Data Fig.         CE4_GRAS_PCAML-C- 000_SCI_N_20190905071818_0017947_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071947_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_2019090507216_0017947_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_20190905072359_20190905072359_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072528_00172528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072657_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905081132_0067_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019092405101_20190924061500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924015001_20190924061500_0070_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924015001_20190924061500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924015001_20190924061500_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924094501_2019092410500_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190924061500_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190925015000_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190925015000_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190925113000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190925113000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20190925113000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20190925113000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204500_0008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204500_0008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204500_0008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100204500_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002054500_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_20191002054500_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_201910002050000_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_201910020		CL4_URAD_FCAMR-C- 004 CCL NL 20100720012457 20100720012457 0050 D 2D
Extended Data Fig.         CE4_GRAS_PCAML-C-           000_SCI_N_20190905071818_20190905071818_0067_B.2B         CE4_GRAS_PCAML-C-           001_SCI_N_20190905071947_20190905071947_0067_B.2B         CE4_GRAS_PCAML-C-           002_SCI_N_20190905072116_20190905072116_0067_B.2B         CE4_GRAS_PCAML-C-           003_SCI_N_20190905072359_20190905072359_0067_B.2B         CE4_GRAS_PCAML-C-           004_SCI_N_20190905072528_20190905072528_0067_B.2B         CE4_GRAS_PCAML-C-           005_SCI_N_2019090507257_20190905072528_0067_B.2B         CE4_GRAS_PCAML-C-           005_SCI_N_2019090507257_20190905072657_0067_B.2B         CE4_GRAS_PCAML-C-           006_SCI_N_2019090507257_2019090507257_0067_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190923012001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0069_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190923012001_2019092310000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924005100_0071_B.2B         CE4_GRAS_VNIS-VD_SCI_N_2019092401500_20170_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092404501_2019092400000_0075_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190925034000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925054500_0076_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925054500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925054500_0076_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925010000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_201900925054500_0080_B.2		004_SCI_IN_20190729012457_20190729012457_0050_В.2В
Extended Data Fig.         000_SCI_N_20190905071818_20190905071818_0067_B.2B CE4_GRAS_PCAML-C- 001_SCI_N_20190905071947_0067_B.2B CE4_GRAS_PCAML-C- 002_SCI_N_20190905072359_0067_B.2B CE4_GRAS_PCAML-C- 003_SCI_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072552_20190905072557_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072657_20190905072557_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905072657_0067_B.2B           CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905072557_0067_B.2B           CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905072657_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092309001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092309001_20190923130000_0069_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401500_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401500_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924080000_0072_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924080000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924080000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092408000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925054500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925054500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190025030001_20190025054500_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002054500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019100203		CE4_GRAS_PCAML-C-
Extended Data Fig.         CE4_GRAS_PCAML-C-           3a         001_SCI_N_20190905071947_20190050711947_0067_B.2B           BCAM data         CE4_GRAS_PCAML-C-           3a         002_SCI_N_20190905072116_20190905072359_0067_B.2B           PCAM data         CE4_GRAS_PCAML-C-           003_SCI_N_20190905072528_20190905072528_0067_B.2B           CE4_GRAS_PCAML-C-           004_SCI_N_20190905072528_20190905072528_0067_B.2B           CE4_GRAS_PCAML-C-           005_SCI_N_20190905072557_0067_B.2B           CE4_GRAS_PCAML-C-           005_SCI_N_20190905072557_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190905081132_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092400501_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924035001_2019092401500_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924035001_2019092401500_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924035001_2019092401500_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_2019092504000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925113000_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925113000_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019002503001_20191002054500_0080_B.2B           CE4_GRAS_VNIS-V		000_SCI_N_20190905071818_20190905071818_0067_B.2B
Extended Data Fig. 3a PCAM data         001_SCI_N_20190905071947_20190905071947_0067_B.2B CE4_GRAS_PCAML-C-           002_SCI_N_20190905072116_20190905072359_0067_B.2B CE4_GRAS_PCAML-C-         003_SCI_N_20190905072359_20190905072359_0067_B.2B CE4_GRAS_PCAML-C-           004_SCI_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C-         004_SCI_N_20190905072657_20190905072657_0067_B.2B           005_SCI_N_20190905072657_20190905072657_0067_B.2B         CE4_GRAS_PCAML-C-           006_SCI_N_20190905072657_20190905072657_0067_B.2B         CE4_GRAS_PCAML-C-           006_SCI_N_20190905081132_0190905072657_0067_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_2019092310000_0069_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924021501_2019092401500_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924061500_0071_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924011000_0073_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092502001_20190924011000_0073_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_2019092504500_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925013000_0077_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925013000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925010001_20190925113000_0078_B.2B         CE4_GRAS_VNIS-VD_SCI_N_201900250001_2019002504500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002072000_0081_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100020443		CE4_GRAS_PCAML-C-
Extended Data Fig. 3a PCAM data         CE4_GRAS_PCAML-C- 002_SCL_N_20190905072116_20190905072518_0067_B.2B CE4_GRAS_PCAML-C- 003_SCL_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 004_SCL_N_20190905072528_201909050725528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCL_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCL_N_20190905081132_0067_B.2B           K         CE4_GRAS_PCAML-C- 006_SCL_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCL_N_20190905081132_0067_B.2B           CE4_GRAS_VNIS-VD_SCL_N_20190923090001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190924021501_20190924035000_0070_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190924021501_201909240500_0070_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190924000001_2019092401500_0071_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190924073001_2019092401500_0074_B.2B CE4_GRAS_VNIS-VD_SCL_N_2019092409501_2019092401500_0074_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190925020001_20190925024000_0075_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190925020001_2019092501500_0076_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190925020001_2019092501500_0076_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190925020001_2019092501500_0076_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190925020001_2019092501500_0076_B.2B CE4_GRAS_VNIS-VD_SCL_N_20190925020001_2019092501500_0076_B.2B CE4_GRAS_VNIS-VD_SCL_N_2019092500001_2019092501500_00076_B.2B CE4_GRAS_VNIS-VD_SCL_N_2019092500001_2019092501500_00076_B.2B CE4_GRAS_VNIS-VD_SCL_N_2019092500001_2019002054500_0076_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002030001_2019002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002050001_20191002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002070001_20191002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002070001_20191002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002070001_20191002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002070001_20191002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002070001_20191002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCL_N_20191002070000_20191002075000_0088_B.2B CE4		001_SCI_N_20190905071947_20190905071947_0067_B.2B
Extended Data Fig. 3a PCAM data         002_SCI_N_20190905072116_20190905072116_0067_B.2B CE4_GRAS_PCAML-C- 003_SCI_N_20190905072359_0067_B.2B CE4_GRAS_PCAML-C- 004_SCI_N_20190905072528_20190905072528_0067_B.2B CE4_GRAS_PCAML-C- 005_SCI_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905081132_0067_B.2B           VEXPREMENTION ON COMPLEXANT STATE CE4_GRAS_PCAML-C- 006_SCI_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905081132_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190905081132_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924061500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924085000_0072_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924085000_0072_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_2019092400500_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190924000_0073_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925020001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_201909250110001_20190925014000_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019002502001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019002050001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002050001_2019002054500_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002050001_20191002054000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002050001_20191002054000_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002050001_20191002057000_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002050001_20191002057000_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002050001_20191002057000_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070000_20000_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070000_20191002077000_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070000_20191002077000_0088_B.2B C		CE4 GRAS PCAML-C-
Extended Data Fig.         CE4_GRAS_PCAML_C- 003_SCI_N_20190905072359_20190905072359_0067_B.2B CE4_GRAS_PCAML_C- 004_SCI_N_20190905072552_20190905072528_0067_B.2B CE4_GRAS_PCAML_C- 005_SCI_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML_C- 006_SCI_N_20190905081132_0012057_0067_B.2B           CE4_GRAS_PCAML_C- 006_SCI_N_20190905081132_0012057_0067_B.2B           CE4_GRAS_PCAML_C- 006_SCI_N_20190905081132_00190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924061500_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924061001_2019092401500_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924061001_2019092401500_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401000_0073_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925022001_2019092504500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925054500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925010001_20190925054500_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925010001_20190925113000_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019002504500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002054500_0088_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002054500_0088_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_2019100204500_0088_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_2019100204500_0088_B.2B           CE4_GRAS_VNIS-VD_SCI_N		002 SCL N 20190905072116 20190905072116 0067 B.2B
3a         003_SCI_N_20190905072359_20190905072359_0067_B.2B           PCAM data         CE4_GRAS_PCAML-C-           004_SCI_N_20190905072528_20190905072528_0067_B.2B           CE4_GRAS_PCAML-C-           005_SCI_N_2019090507257_20190905072657_0067_B.2B           CE4_GRAS_PCAML-C-           006_SCI_N_20190905072657_20190905072657_0067_B.2B           CE4_GRAS_PCAML-C-           006_SCI_N_20190905081132_00190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_201909240011_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924006001_20190924008000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924015000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_201909240073001_2019092400000_0073_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925022001_2019092504000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092502001_20190925110000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20190925110000_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20190925100000_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043	Extended Data Fig.	CF4 GRAS PCAML-C-
PCAM data         005_05_05_05_0507_0507_00507_0507_00500000000	<b>3</b> a	003 SCL N 20190905072359 20190905072359 0067 B 2B
Extended Data Fig. 8         CE4_GRAS_VNIS-VD_SCI_N_20190905072528_0067_B.2B           Extended Data Fig. 8         CE4_GRAS_VNIS-VD_SCI_N_20190905072657_0067_B.2B           CE4_GRAS_PCAML-C-         006_SCI_N_20190905081132_0067_B.2B           CE4_GRAS_PCAML-C-         006_SCI_N_20190905081132_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923130000_0069_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924060001_20190924061500_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924061500_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924061500_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190925024000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092502001_20190925054500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925110000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925110000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002054500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002054500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002054500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019100205001_2019100207000_0084_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002054500_0084_B.2B           CE4_GRAS_VNIS-VD_SCI_N_201910002050001_2019100207000_0084_B.2B <tr< th=""><th>PCAM data</th><th>CE4_GPAS_PCAML_C_</th></tr<>	PCAM data	CE4_GPAS_PCAML_C_
Extended Data Fig. 8       CE4_GRAS_VIIS-VD_SCI_N_2019092302200001_2019092502657_0067_B.2B         CE4_GRAS_PCAML-C-       005_SCI_N_20190905072657_20190905072657_0067_B.2B         CE4_GRAS_PCAML-C-       006_SCI_N_20190905081132_20190905081132_0067_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923130000_0069_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924060001_20190924061500_0071_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924094001_20190924080000_0072_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924080000_0073_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924080000_0073_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924080000_0074_B.2B         CE4_GRAS_VNIS-VD_SCI_N_2019092502001_2019092504000_0075_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_2019092504000_0075_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925013000_0078_B.2B         CE4_GRAS_VNIS-VD_SCI_N_2019002030001_20190925113000_0078_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204300_0079_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002030001_2019100204300_0078_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002052001_2019100204500_0083_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_2019100204500_0084_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_2019100205000_0084_B.2B         CE4_GRA		004 SCI N 20100005072528 20100005072528 0067 D 2D
Extended Data Fig. 8         CE4_GRAS_PCAML-C- 005_SCI_N_20190905072657_20190905072657_0067_B.2B CE4_GRAS_PCAML-C- 006_SCI_N_20190905081132_20190905081132_0067_B.2B           Extended Data Fig. 8         CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923130000_0069_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924060001_20190924061500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924060001_20190924061500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_201909240101000_0073_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190924101000_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925130000_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925011001_20190925113000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925110001_20190925113000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_20191002043000_0078_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100204300_0008_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100204300_0008_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100204300_008_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100204300_008_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100204300_008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002013001_2019100207000_008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002013001_2019100207000_008_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002013001_20191002010000_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002012000_20000_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_201910020120000_20084_B.2B CE4_GRAS_VNIS-VD_SCI_N_201910020120000_20000_0008_B.2B CE4_GRAS_VNIS-VD_SCI_N_201910020120000_20000_0084_B.2B		004_SCI_IN_20190905072526_20190905072526_0007_D.2D
Extended Data Fig. 8       CE4_GRAS_VNIS-VD_SCI_N_20190925026072657_0067_B.2B         CE4_GRAS_PCAML_C- 006_SCI_N_20190905081132_20190905081132_0067_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924061500_0071_B.2B         CE4_GRAS_VNIS-VD_SCI_N_201909240610001_20190924061500_0071_B.2B         CE4_GRAS_VNIS-VD_SCI_N_201909240673001_20190924061500_0077_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924011000_0073_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924115000_0074_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925024000_0075_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925110000_0077_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925113000_0078_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925010001_20190925113000_0078_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002030001_201900254500_0080_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002043000_0079_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002050001_20191002054500_0080_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002072000_0081_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002070000_82B_2.B         CE4_GRAS_VNIS-VD_SCI_N_20191002013001_2019100207000_0085_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002013001_2019100207000_0084_B.2B         CE4_GRAS_VNIS-VD_SCI_N_201910020120000_208800_20800_B000_0085_B.2		CE4_GRAS_PCAML-C-
Extended Data Fig. 8         CE4_GRAS_PCAML-C- 006_SCI_N_20190905081132_20190905081132_0067_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923001_20190923130000_0069_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924061001_20190924061500_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924061500_0072_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_2019092401500_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924013001_20190924000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019092502001_20190925044000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925044000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925044000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925044000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925044000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925044000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20190925113000_0078_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002054500_0080_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002072000_0084_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100207000_0084_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002012001_201910002060000088_B.2B           CE4_GRAS_VN		005_SCI_N_201909050/265/_201909050/265/_006/_B.2B
Extended Data Fig. 8         CE4_GRAS_VNIS-VD_SCI_N_20190905081132_0001_20190923110000_0068_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923130000_0069_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924061500_0070_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924061500_0071_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924080000_0072_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924000_0073_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924115000_0074_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925024000_0075_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_2019092504500_0076_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925113000_0077_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019100203001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002043000_0079_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002043000_0084_B.2B           CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002043000_0084_B.2B           CE4_GRAS_VNIS-VD_SCI_N_2019100203001_20191002065000_00083_B.2B           CE4_G		CE4_GRAS_PCAML-C-
Extended Data Fig. 8       CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190923123001_20190923130000_0069_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924035000_0070_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924060001_20190924061500_0071_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924060001_20190924061500_0072_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924080000_0072_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924101000_0073_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924115000_0074_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925024000_0075_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_2019092504500_0076_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925113000_0077_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20190925110001_20190925113000_0078_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002072000_0081_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002072000_0081_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_2019100207000_0082_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_2019100207000_0083_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002070001_2019100207000_0084_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002072000_0084_B.2B         CE4_GRAS_VNIS-VD_SCI_N_20191002072000_20191002075000_0084_		006_SCI_N_20190905081132_20190905081132_0067_B.2B
CE4_GRAS_VNIS-VD_SCI_N_20191003033001_20191003050000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003051501_20191003053000_0086_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0087_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003090001_20191003092000_0088_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003105001_20191003111000_0089_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191004010001_20191004020000_0090_B.2B	Extended Data Fig. 8	CE4_GRAS_VNIS-VD_SCI_N_20190923090001_20190923110000_0068_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190923123001_20190924035000_0069_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924021501_20190924061500_0070_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924060001_20190924061500_0071_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924073001_20190924080000_0072_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924101000_0073_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190924094501_20190924115000_0074_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925022001_20190925024000_0075_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925030001_20190925054500_0076_B.2B CE4_GRAS_VNIS-VD_SCI_N_20190925110001_20190925113000_0077_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002030001_20191002043000_0079_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002043000_0079_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002052001_20191002054500_0080_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191002070001_20191002054500_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_20191002072000_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_2019100203001_2019100207000_0084_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003012001_20191003050000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003033001_20191003053000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003033001_20191003053000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003051501_20191003053000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003051501_20191003073000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003053000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003053000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003053000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0085_B.2B CE4_GRAS_VNIS-VD_SCI_N_20191003071001_20191003073000_0085_B.2B

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	CF4 GRAS PCAML-C-
	001 SCL N 20200428093102 20200428093102 0128 B 2B
	CF4 GRAS PCAMI_C_
	002 SCL N 20200428093231 20200428093231 0128 B 2B
	CF4 GRAS PCAMI -C-
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DCAM data	004 SCL N 20200428093529 20200428093529 0128 B 2B
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	CE4 CDAS DCAML C
	$CL4_OKAS_FCAIVIL-C-$
	CE4 CDAS DCAML C
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	CE4 CPAS PCAML C
	CL4_UKAS_FCAML-C- 008 SCL N 20200428004546 20200428004546 0128 P 2P
	CE4 CDAS DCAML C
	CL4_OKAS_FCAML-C- 000 SCL N 20200428004715 20200428004715 0128 B 2B
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Supplementary Fig.	YSBZZ_20190827_111820_0000_304600642_00c81000.tif
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	YSBZZ_20190904_213343_0000_305328754_00c31000.tif

### 105 Supplementary Table 10.

- 106 Reflectance spectra of endmembers listed in Supplementary Table 1.
- 107 This table is provided in a separate excel file, see additional supplementary files.

### 108 Supplementary Table 11.

- 109 Corrected reflectance of ROIs shown in Fig. 1d and Extended Data Fig. 10.
- 110 This table is provided in a separate excel file, see additional supplementary files.

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