

## Science

JAXA

6

2 Phase-2

Science 2023 2 24

Macromolecular organic matter in samples of the asteroid (162173) Ryugu  
Science

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2023 2 24 4

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2020 12 6

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Phase-1

6

2 Phase-2

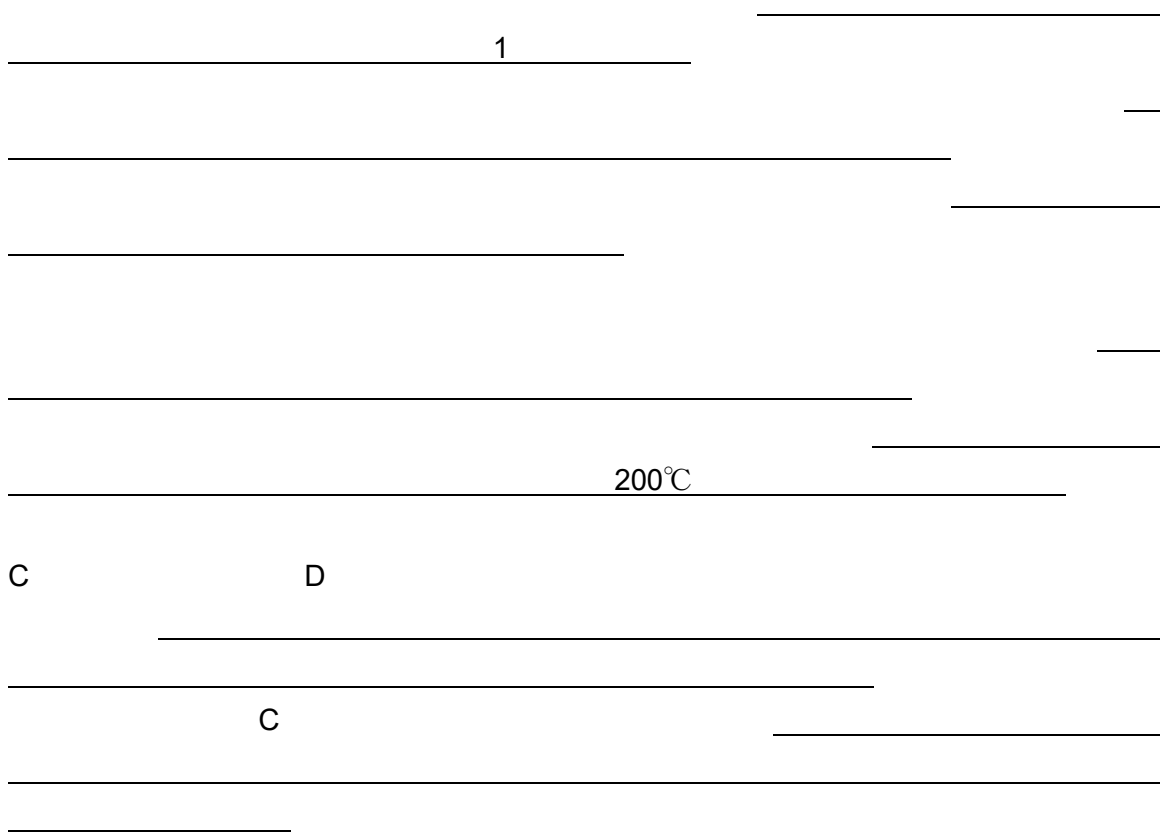
Phase-2

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[media.s@gs.mail.u-tokyo.ac.jp](mailto:media.s@gs.mail.u-tokyo.ac.jp)

Macromolecular organic matter in samples of the asteroid (162173) Ryugu



1.

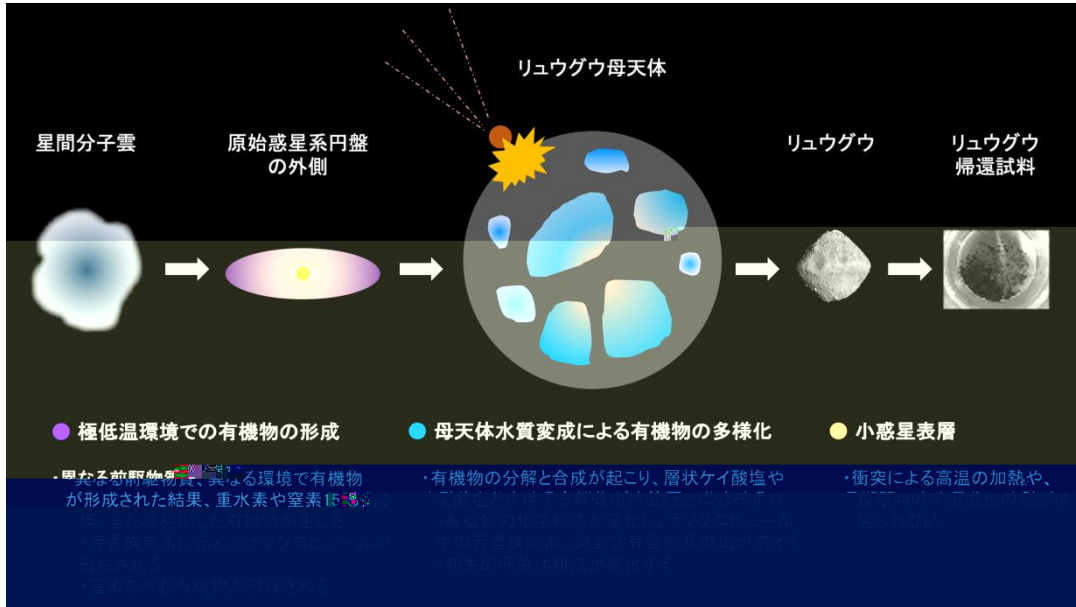
200-900 m

37

Cl

CM

200°C



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1:

1

1

2

2.

46

S

C

X

AFM

1

2

3, 6, 9

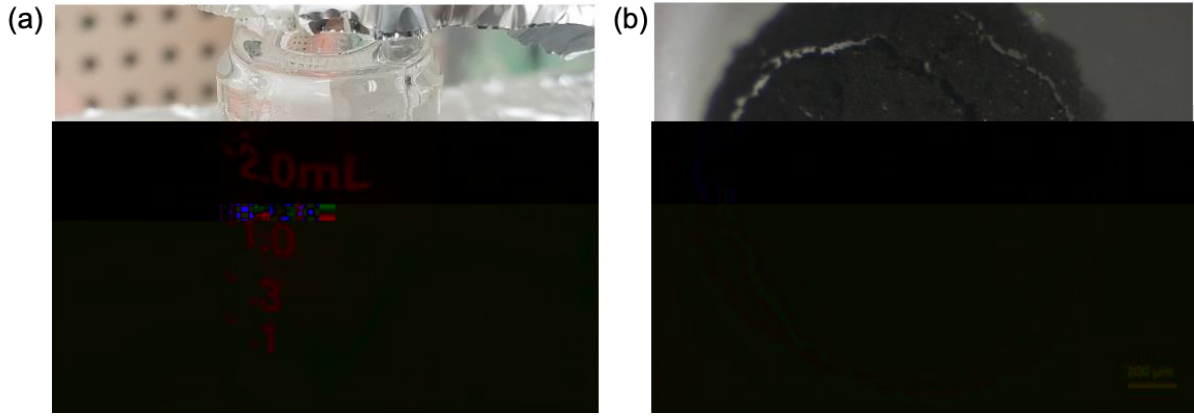
3

5, 9 i)

ii)

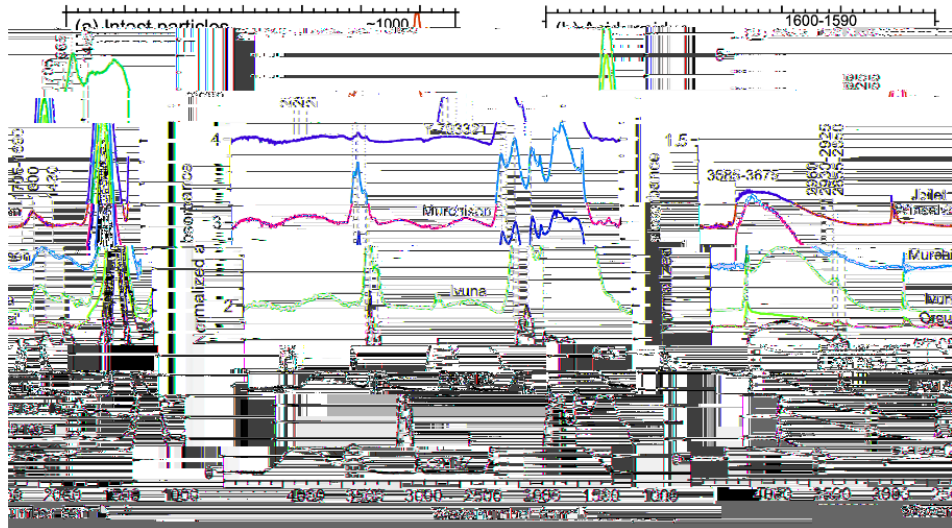
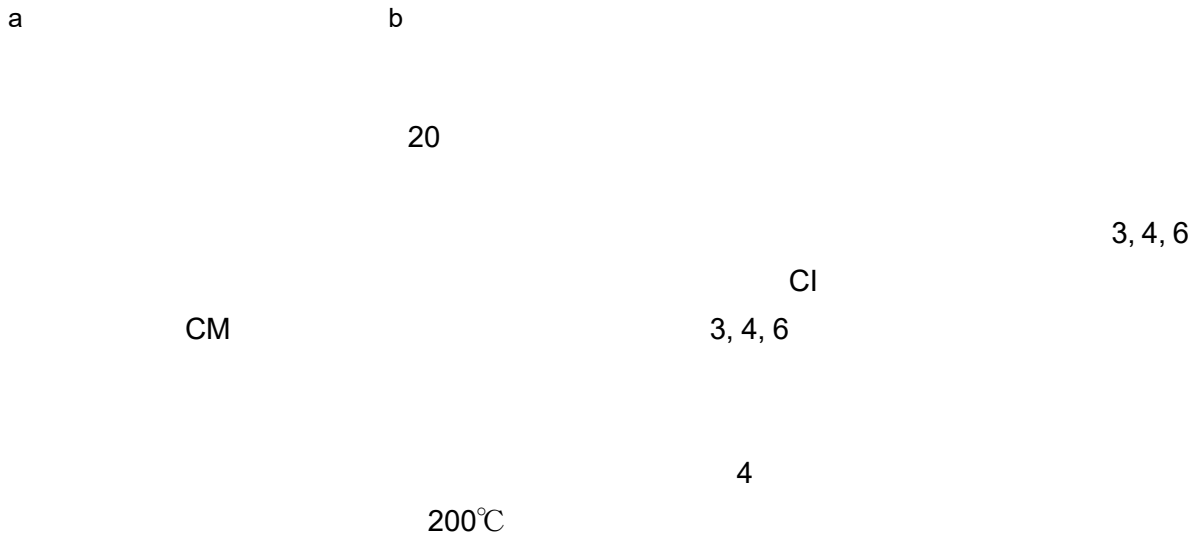
iii)

iv)



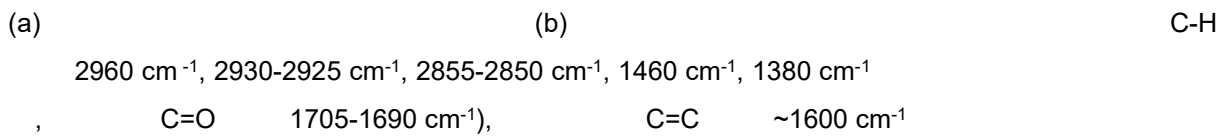
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2.



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3.



4.

D

G

D, G ]

[

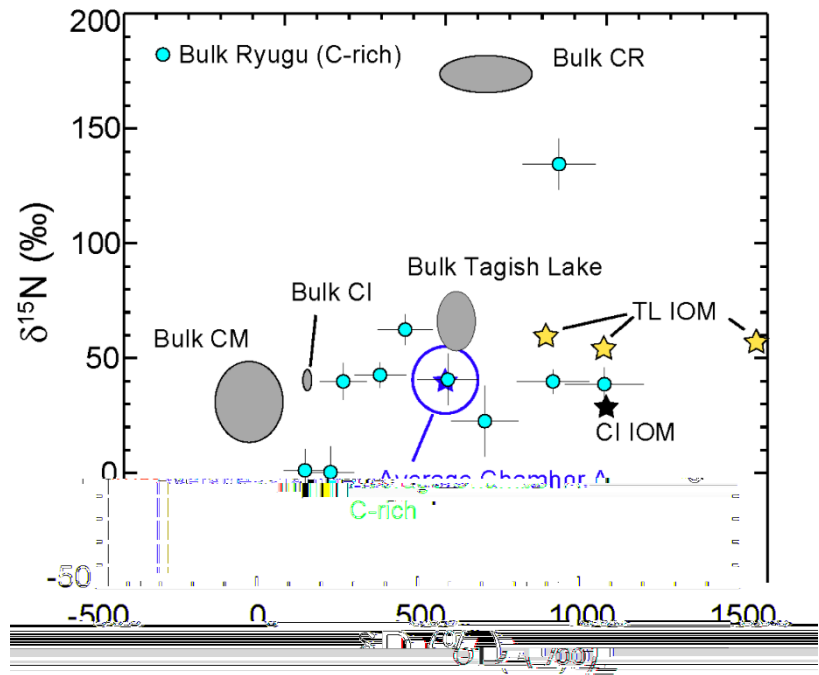
4

$\delta D$

$\delta^{15}N$

-□

□



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5.  $\delta D$   $\delta^{15}N$

12 100 nm

X AFM

X

diffuse carbon

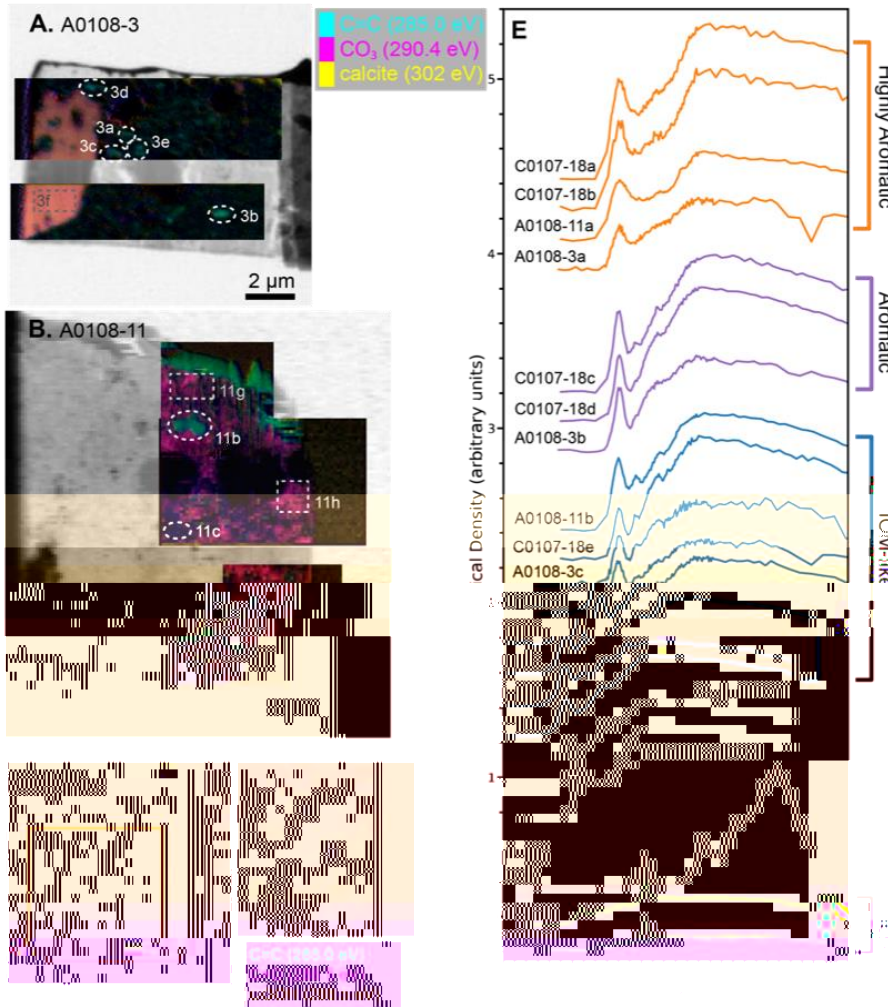
6,

7, 8 6, 7,

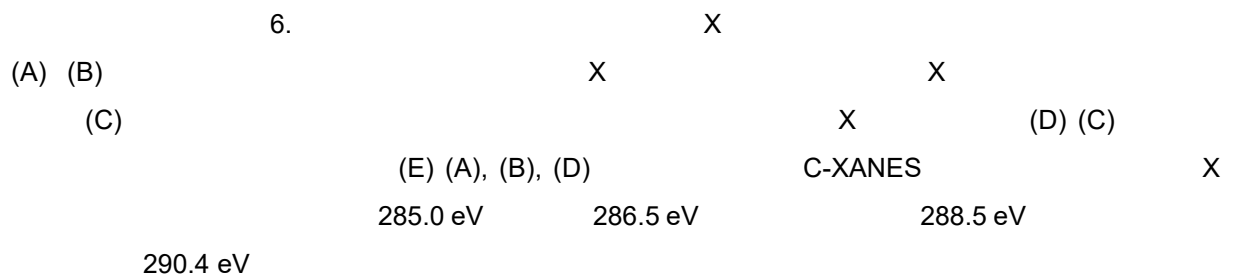
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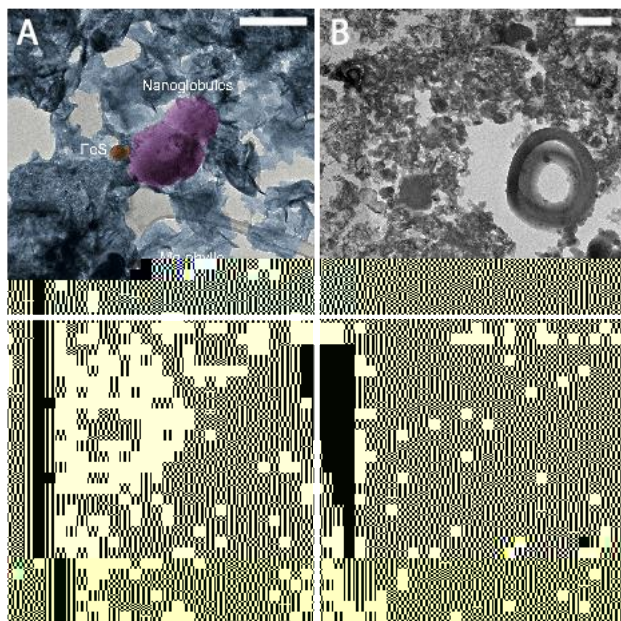
6, 7





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7.

500 nm. (A)

(B)

(C)

6B

11h

2

(Mag)

diffuse carbon

(Sulf)

(D)

6A

3a

)

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8.

AFM

C=O (1720 cm<sup>-1</sup>)

C=C (1600 cm<sup>-1</sup>)

Si-O (1020 cm<sup>-1</sup>)

D / <sup>15</sup>N  
9 D / <sup>15</sup>N  
200°C

D

C

D

N/C

CI, CM

N/C

81P/

2

N/C

N/C

C

D

CM

### 3.

#### Science

##### Macromolecular organic matter in samples of the asteroid (162173) Ryugu

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4.

1

CM

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1

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100

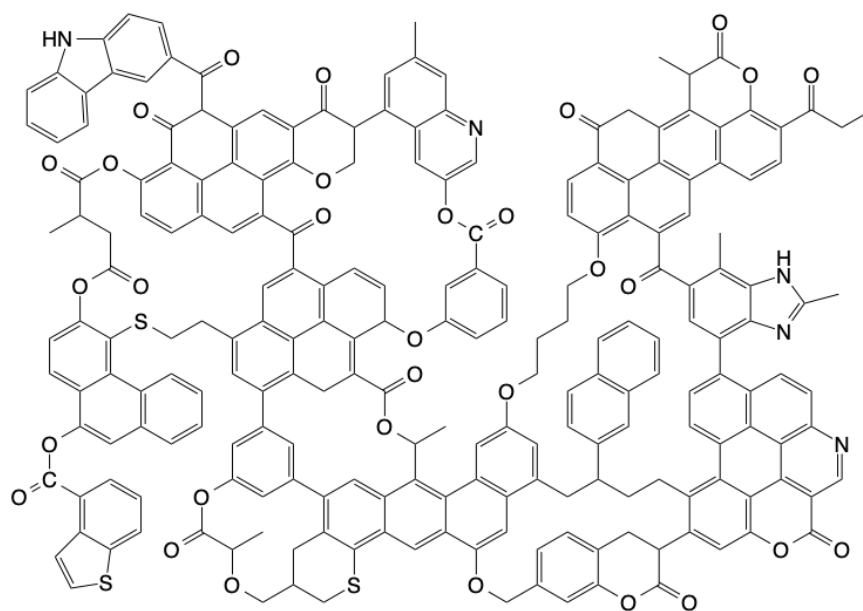
75

17

4

3

Alexander et al. 2007



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2

R

$$\frac{R}{R} = \left[ \left( \frac{R}{R} \right) - 1 \right] \times 1000$$