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Science

JAXA 6
2 Phase-2

Science 2023 2 24

(162173)

Soluble organic molecules in samples of the carbonaceous asteroid (162173)

Ryugu

Science

D O I 10.1126/science.abn9033

2023 2 24 4

2020 12 6

JAXA

Phase-1

6

2 Phase-2

Phase-2

本件内容の問い合わせ先

研究内容、論文に関すること
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(162173)

Soluble organic molecules in samples of the carbonaceous asteroid (162173) Ryugu

1.

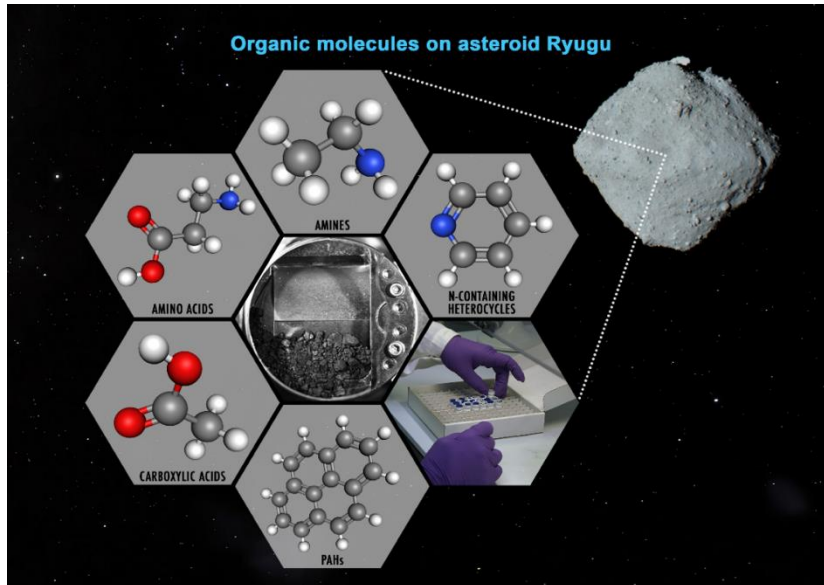
炭化水素としてはアルキルベンゼンや多環芳香族炭化水素であるナフタレン、フェナントレン、ピレン、フルオランテンなどが主に存在した。これらの存在パターンは地球上の熱水原油のパターンと似ており、リュウグウ母天体上で水の影響を受けていたことが示唆される。試料表面をメタノールでスプレーしてその場分析すると、異なる有機分子が異なる空間分布で存在しており、リュウグウ母天体上で、流体と鉱物との相互作用の中で、有機化合物が移動・分離した可能性が示唆された。

2.

C

1

1



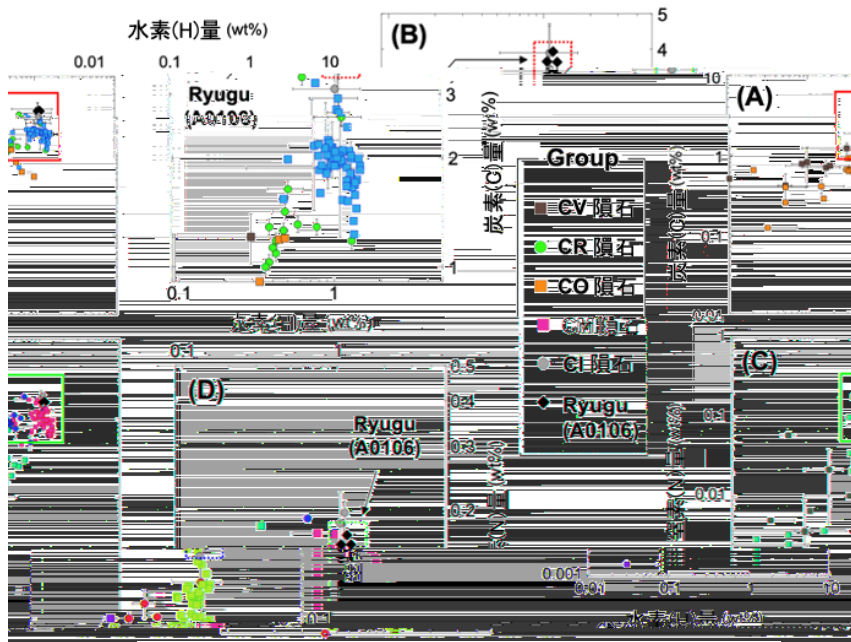
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1

3.

C	N	H	S	O	
	3.8%	C 1.1%	H 0.16%	N 3.3%	S 12.9%
	CHNOS		21.3%		O

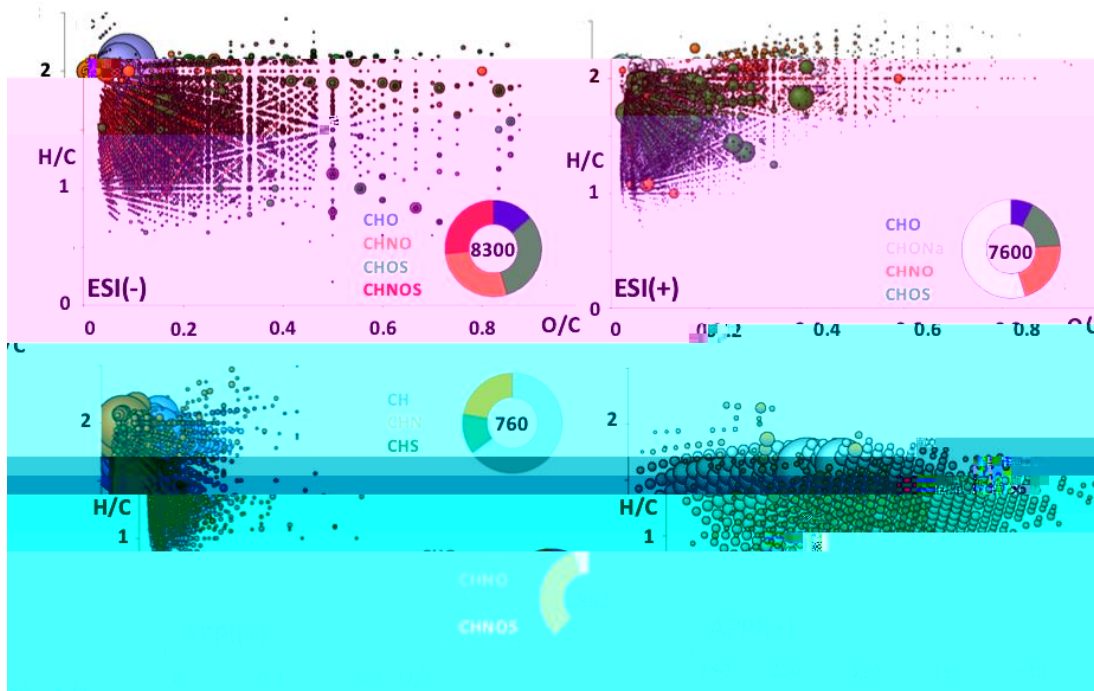
		2		1	$^{13}\text{C}/^{12}\text{C}$	$\delta^{13}\text{C}$
-0.6	$^{15}\text{N}/^{14}\text{N}$	$\delta^{15}\text{N}$	+43	D/H	δD	+250
$^{34}\text{S}/^{32}\text{S}$	$\delta^{34}\text{S}$	-3		Cl (lvuna)	



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2

					ESI	2			
	APPI	3						FT-	
ICR/MS	4		CH	CHO	CHN	CHS	CHNO	CHOS	CHNOS
	700			2		3			

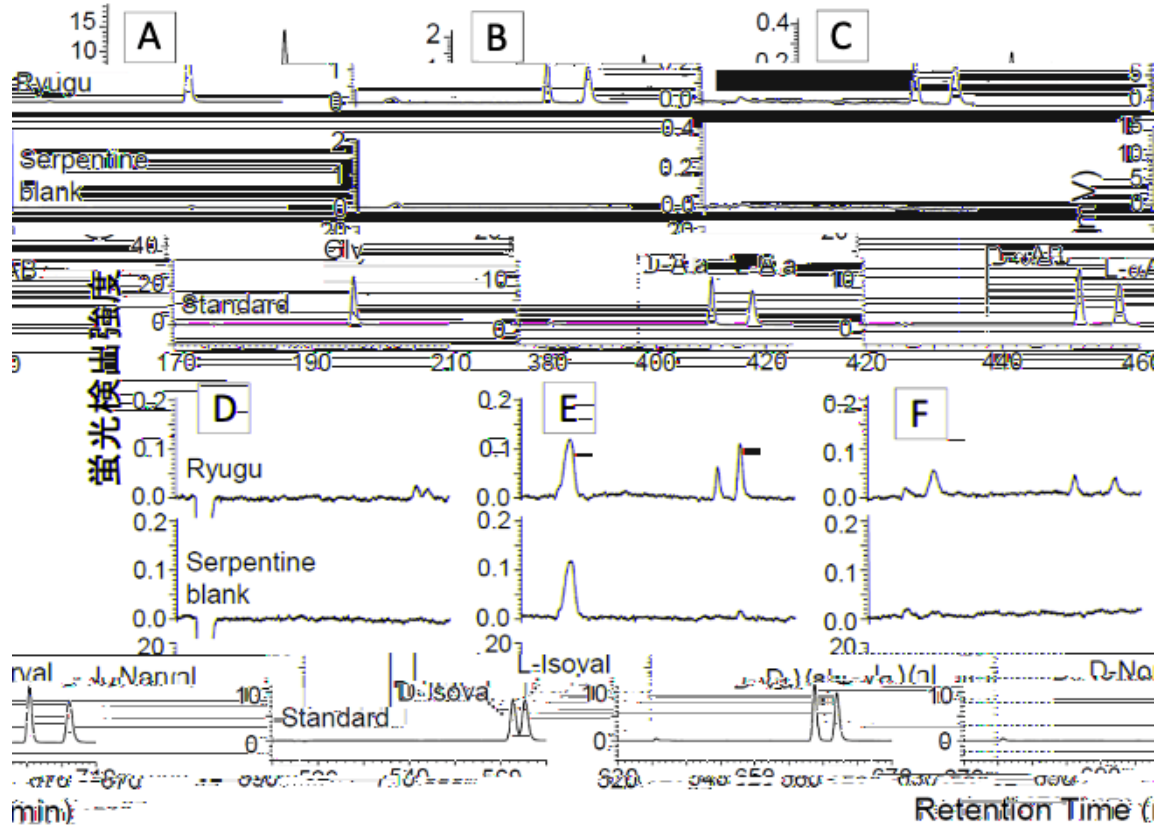


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3

2

/ LC-FD/HRMS D L- 3
 3D-HPLC/FD D L- 5
 15 1 1
 4
 (β-, γ- α-
 2 1 /g
 ppb
 Cl



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4

1013 hPa -6.3
 20 hPa 230

中には存在しているブチルアミンが検出されなかった。これらのアミン塩はリュウグウ表面で観測されている吸収帯 $\sim 3.1\mu\text{m}$ (NH)

2
Polycyclic Aromatic Hydrocarbon

4
PAH

PAH

$\text{C}_{16}\text{H}_{10}$

1 1
PAH Cl Ivuna

-CH₂-

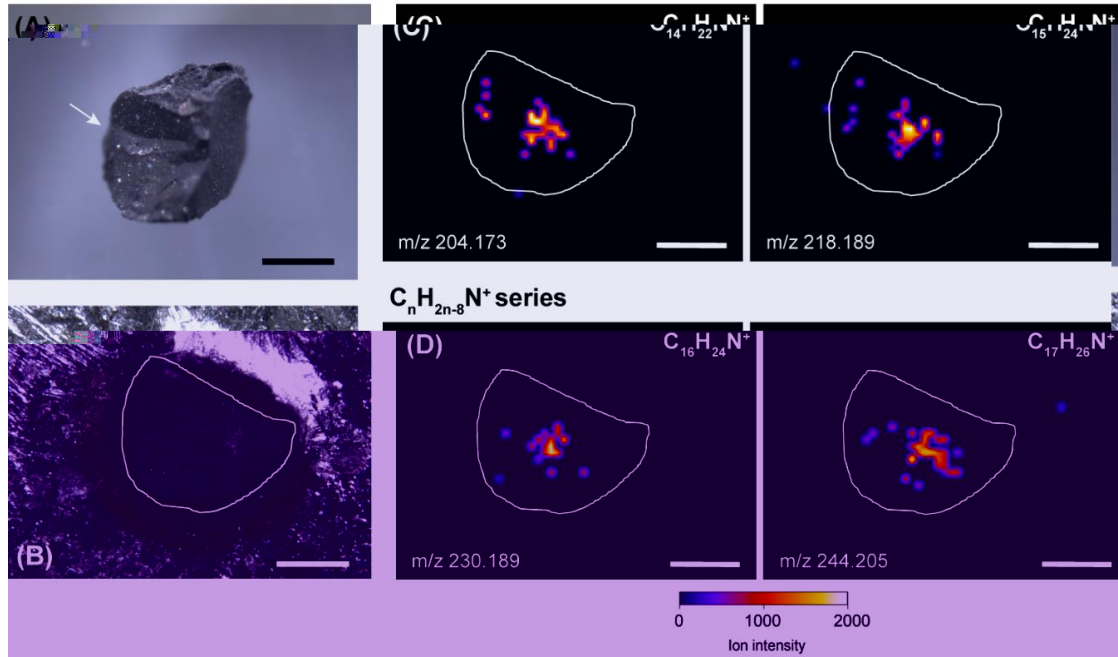
$\text{C}_n\text{H}_{2n-4}\text{N}^+$

8 16 11 11 22
17

1mm

5

Ryugu grain (A0080)



500

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4.

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5

1

C (N) H O S

2

ESI

3

APPI

ESI

ESI

4

FT-ICR/MS

5-6

5