☑ Fact-Checked Science

PAPER CHECK · PLANETS

Cold-season gas found only near Alba Mons may come from dormant magma; no other sign confirms it yet

Eight times in two Mars years, the ExoMars Trace Gas Orbiter caught hydrogen chloride low over the plains and fractures around Alba Mons in the cold season, when ACS found it nowhere else [1 p. 2][2 p. 15]. The authors read it as gas seeping from dormant magma through young fissures, and say a local igneous source “may best explain” it [1 p. 3]; no second instrument, sulfur gas, marsquake or hot spot has confirmed that yet. S0 News linked the paper on November 5, 2026 [3].

By Fact-Checked Science · Published November 5, 2026 · Updated November 6, 2026

OUR ANALYSIS marks our own reasoning and calculations, including the dates, distances, budget and SO_2 arithmetic and the marsquake search, and the verdicts are our assessment. Everything else comes from the numbered sources. In the paper [1], p. gives a page of the journal’s PDF and Fig. a figure; in its supplement [2], p. gives a page of that PDF and Table S1 its table.

A repeated cold-season signal near Alba Mons; dormant magma is the authors’ best reading, not a finding

OUR ASSESSMENT

8 of 78

occultations over the northern hemisphere in the cold season of two Mars years showed hydrogen chloride, all of them in one region north and northeast of Alba Mons [1 p. 2]

≤1.5 ppbv

the most HCl seen in that season, confined to the lowest layers and falling steeply over the first 10 km [1 p. 2]

522–1,675 km

from the centre of Alba Mons to the eight detections, over Phlegethon Catena, Tantalus Fossae and the plains to the north [2 p. 15][19]. Our analysis

THE PAPER’S CLAIMS

TRUE

“HCl detections during the cold aphelion season that are isolated in the Alba Mons region”

The paper’s abstract [1 p. 1]

Eight of 78 occultations over the northern hemisphere at that season in Mars years 35 and 37 showed HCl, all within 43–66°N and 87–117°W by Table S1’s positions [2 p. 15]; the rest gave no more than 0.2 ppbv [1 p. 2]. But the clustering is untested statistically, the region was singled out after the first two detections and then searched on purpose, and no second instrument has published a detection there [1 p. 2]. See sections 1 and 2.

UNCONFIRMED

“fresh and narrow (<1 meter) fissures in this area, which we interpret to be potential HCl pathways rooted into magmatic bodies at depth”

The paper’s abstract [1 p. 1]

The fissures are documented: a few tens of centimetres wide, and younger than an ice-rich mantle the paper dates to 0.63 million years [1 p. 3]. That they carry gas is the authors’ hypothesis. They searched for likely landforms, “not to find the seepage sites themselves” [1 p. 3], and say that “unequivocal identification of the seeping sites is out of reach with the available data” [2 p. 3]. See section 5.

UNCONFIRMED

“Our results are best explained by ongoing igneous processes in the Martian interior”

The paper’s abstract [1 p. 1]

A case by elimination. Atmospheric chemistry, local warmth, mud volcanism and salts are argued away [1 pp. 2–3]. Dust at the detection times and instrument effects aren’t examined, nor is a 2025 model that matched two of the profiles but not their localisation [11 §3.6]. No independent sign of magma is in: no sulfur dioxide, no marsquake located nearby, no hot spot. The authors themselves write “may best explain” and “hint at” [1 p. 3]. See sections 4 and 6.

TRUE

“sulfur dioxide, so far undetected”

The paper’s abstract [1 p. 1]

No sulfur dioxide (SO_2) has been detected on Mars [1 p. 1][14]. But here it is a weak test. Earth-like volcanic gas would carry about 1–15 ppbv of SO_2 with this much HCl, below the orbiter instrument’s best-case 1σ limit of 20 ppbv [2 p. 14][14 Abstract], and it typically measures SO_2 and HCl in different occultations [1 p. 5][14 Fig. 1]. Our analysis. See section 6.

1 · WHAT TGO SAW

Eight detections in two Mars years, low in the atmosphere, in the cold season, around Alba Mons

Since 2018 the Atmospheric Chemistry Suite (ACS) on the ESA–Roscosmos ExoMars Trace Gas Orbiter (TGO) has measured the air by watching the Sun set and rise through it, a method called solar occultation [1 pp. 5, 9]. In the warm season it finds hydrogen chloride (HCl) widely, at high latitudes in both hemispheres [2 p. 2]. In the cold season it almost never does, with eight exceptions, all in one region [1 p. 2].

What ACS measured

In the cold season of Mars years 35 and 37, between solar longitudes (Ls) 100° and 120°, ACS made 78 occultations over the northern hemisphere. Eight showed “confident HCl signatures”. The others, “including a few at the Alba Mons region”, gave no more than 0.2 ppbv “down to the low altitudes” [1 p. 2], and down to 2 km near the detections [2 p. 2].

The HCl sat in the lowest layers, “with a steep gradient in the first 10 km and maximum abundances up to 1.5 ppbv” [1 p. 2]. The lowest detections were 0.9–5.4 km above the ground [2 pp. 3–11]. All were made at the evening terminator, between local times 19 h and 3 h; no morning-side measurements were made in the region [2 p. 3].

How it was measured

ACS’s mid-infrared channel recorded diffraction orders 173–175, 2,894–3,239 cm^{-1}, where HCl absorbs, and its near-infrared channel measured temperature and water in the same occultations [1 p. 5]. The absorption lines were about 1% deep in the spectra at the lowest heights [2 p. 2]. The paper gives the detections’ positions in its Table S1 [2 p. 15] and their profiles, with uncertainty shading, only as a figure [1 Fig. 1]. It gives ACS’s detection capability as ≤0.1–0.2 ppbv [2 p. 2] but no criterion, such as a significance level, for calling a detection “confident”.

The eight cold-season detections

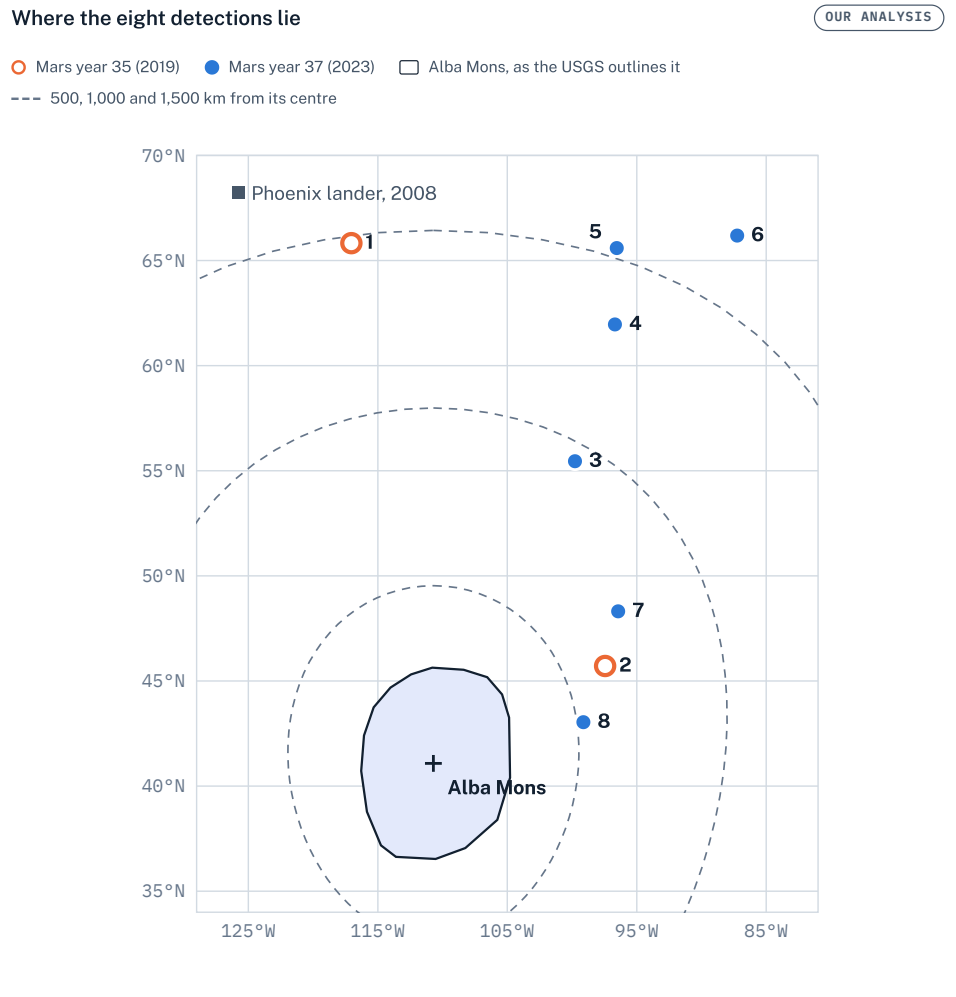
Scroll sideways to see the whole table →

#	ORBIT	MARS YEAR	LS	DATE (UTC) OUR ANALYSIS	POSITION AT 10 KM	GROUND HEIGHT	FROM ALBA MONS’S CENTRE OUR ANALYSIS	SETTING
1	8886	35	109.45°	20 Nov 2019	65.83°N, 117.05°W	−3.7 km	1,479 km	Ridges with fissure sw Scandia Colles [2 pp.
2	9034	35	115.01°	2 Dec 2019	45.71°N, 97.45°W	−0.3 km	631 km	Phlegethon Catena, a c [2 pp. 9–11]
3	25615	37	107.56°	21 Aug 2023	55.45°N, 99.77°W	−1.4 km	950 km	Tantalus Fossae grabe spatter ramparts [2 pp
4	25652	37	108.94°	24 Aug 2023	61.96°N, 96.69°W	−3.2 km	1,332 km	Fractures parallel and perpendicular to Tanta [2 pp. 7–8]
5	25689	37	110.32°	27 Aug 2023	65.59°N, 96.55°W	−3.6 km	1,525 km	Fissures on the Tantalu trend [2 pp. 6–7]
6	25701	37	110.77°	28 Aug 2023	66.19°N, 87.25°W	−3.9 km	1,675 km	Fissured ridges with b patches [2 pp. 5–6][1
7	25887	37	117.79°	12 Sep 2023	48.31°N, 96.44°W	−0.4 km	735 km	Phlegethon Catena [2
8	25912	37	118.75°	14 Sep 2023	43.04°N, 99.12°W	+0.2 km	522 km	Phlegethon Catena [2

Orbit, Mars year, Ls, position at a tangent altitude of 10 km and the ground’s height relative to Mars’s mean level are from Table S1 [2 p. 15]; settings from the supplement’s site-by-site text. Dates and distances are ours, from the Ls formula NASA’s Mars24 uses and great circles on a 3,389.5-km sphere, from the centre the USGS Gazetteer gives for Alba Mons, 41.08°N, 249.29°E [19].

Where the eight detections lie

OUR ANALYSIS



Our map of Table S1’s positions [2 p. 15], numbered as in the table above, with Alba Mons’s outline and centre from the USGS Gazetteer, a US Government work [19], and the Phoenix lander’s site for scale. Data from Table S1 of the paper’s supplement, CC BY 4.0. Not a redraw of the paper’s Fig. 1, which maps the warm-season detections too [1 Fig. 1]. Its orbital images are linked, not copied, in section 5.

What the authors interpret

“We interpret these results as potential dormant volcanism, probably interacting with permafrost while being released into the atmosphere” [1 p. 1]. The source would be persistent over the years observed, “although it may be short lived on geological timescales” [1 p. 3]. Gas from magma bodies at depth would rise through fractures, with ice-rich ground acting as “a buffer” before it seeps out [1 p. 3].

What was already published

The first two detections are not new. The same team first reported them in 2021, when HCl’s lines were distinct up to above 10 km [5 §4], perhaps “indicative of local dust events or possible outgassing” [5 Figs. A6–A7]. The new paper calls the pair “inconclusive because of limited data” [1 p. 2]. We take that to mean too few detections to point to a source, not doubt that HCl was there. They led to a dedicated search in Mars year 37 [1 p. 2][7], whose six detections make the eight.

2 · ONLY NEAR ALBA

“Isolated in the Alba Mons region” holds on ACS’s data; how strongly is untested

Every detection falls in one region, and the rest of the cold-season occultations found nothing. That supports the claim as a description. How unlikely it is by chance can’t be worked out from what the paper gives, and no second instrument has published a confirmation [1 p. 2].

DETECTIONS IN THE COLD SEASON

8 of 78

northern-hemisphere occultations at Ls 100–120°, Mars years 35 and 37 together; no split by year is given [1 p. 2]

THE BOX THEY SPAN

OUR ANALYSIS

1.39 million km²

43.0–66.2°N and 87.3–117.1°W, from Table S1 [2 p. 15], about 1% of Mars’s surface

NON-DETECTIONS INSIDE THE REGION

“a few”

the paper’s words; it gives no count [1 p. 2]

What “the region” means

The paper gives no boundary for it. It speaks of detections “above the Alba Mons region on Mars, in the northern Tharsis plateau” [1 p. 1], “mainly northeast to Alba Mons” [1 p. 2], and of HCl “north of Alba Mons” [1 p. 3], and its geological map covers “the Alba Mons–Scandia Colles region” [1 Fig. 2]. In practice the region is what the detections span: from Phlegethon Catena, 522–735 km from the volcano’s centre, through Tantalus Fossae and its trends at 950–1,525 km, to the plains of Scandia Colles and Vastitas Borealis up to 1,675 km away [2 pp. 3–15]. Most of the eight lie below Mars’s mean surface level, at −3.9 to +0.2 km [2 p. 15].

The region was chosen after the first detections

The search in Mars year 37 was “dedicated” to “this time period and geographic region” [1 p. 2], chosen because of the two detections of Mars year 35. That is the right way to follow up a hint, but it means the region was defined after seeing the data and then searched on purpose. A fair test of “only here” has to allow for both.

Could the region simply be easier to see into?

The team once described the area as “a relatively high elevation plateau” with “ideal observation conditions” [6 p. 16]. Most of these eight sites, though, lie low, in the northern plains [2 p. 15]. And near the detections, ACS reached limits of 0.2 ppbv down to 2 km without finding HCl [2 p. 2]. So easier viewing doesn’t obviously explain the cluster.

OUR ANALYSIS

The chance test we planned, and why it couldn’t be run

Before reading any count, we wrote rules for a test of the clustering. The test asks how likely it would be, if every occultation were equally likely to find HCl, that all detections fall inside the region. It would use the paper’s own counts of occultations inside and outside the region, and repeat the test without Mars year 35 and without the dedicated search. The paper gives the totals, 8 detections in 78 occultations, all inside. It does not give how many of the 78 fell inside the region, where the region’s edge is, the split by year, which occultations the dedicated search added, or whether all 78 used the instrument settings that see HCl. Our rules say no test without the counts inside and outside the region, so we ran none. A count read off the paper’s map would be our transcription, which the rules exclude. Even a striking result would show only that the cluster is unlikely to be chance, not that its source is magma. The rules are hosted in section 9.

The other instrument and the telescope

NOMAD, TGO’s other spectrometer

The paper mentions NOMAD only for warm-season HCl [1 p. 4][2 p. 2]; it reports nothing from NOMAD for the cold season. A paper by NOMAD’s team found no HCl above about 0.3 ppbv at the northern summer solstice of Mars year 35 [9 §3]. A 2026 NOMAD abstract reports, over four Mars years, “no robust detections” in the cold season “at tangent altitudes with optimum transmittance levels”, and notes that cold-season detections from orbit “remain rare and close to instrumental detection limits” [10]. We take those levels to be NOMAD’s best-measured heights, above the lowest layers where ACS saw HCl; if so, this neither confirms nor contradicts the eight detections.

Mars year 38, in 2025

The paper says observations in the cold season of 2025 “also revealed HCl detections confined to the Alba Mons region; detailed analyses will be presented elsewhere” [1 p. 2]. A 2025 conference abstract by the same team says that campaign was “accompanied this time by NOMAD and the iSHELL spectrograph” of NASA’s Infrared Telescope Facility [8 p. 26]. We found no published result from either.

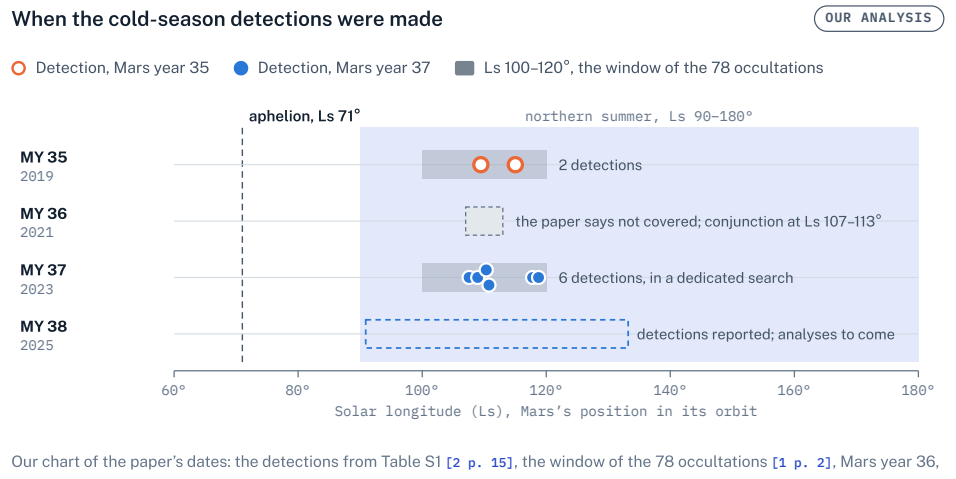
3 · SEASONS, NOT THE SUN

“The cold aphelion season” is about Mars’s orbit, not about the Sun’s activity

Aphelion is the point of Mars’s orbit farthest from the Sun, at solar longitude 71°, just before northern summer [1 p. 2]. Mars’s orbit is eccentric, so its seasons are lopsided: southern summer comes at perihelion and is warmer, dustier and wetter, and that is when HCl appears at high latitudes in both hemispheres, peaking at 4–5 ppbv between Ls 230° and 330° [1 p. 2][2 p. 2].

When the cold-season detections were made

OUR ANALYSIS



Our chart of the paper’s dates: the detections from Table S1 [2 p. 15], the window of the 78 occultations [1 p. 2]. Mars year 36, when “the latitude coverage of solar occultations did not include the Alba Mons region” and solar conjunction stopped operations at Ls 107–113° [2 p. 2], and Mars year 38, whose box is June to August 2025, our reading of the paper’s “terrestrial summer 2025” [1 p. 2]. Data from [1] and [2], CC BY 4.0. A Mars year lasts about 1.9 Earth years.

Why the season, per the paper

Northern summer warms the atmosphere, which “has been demonstrated to reduce ice load”, and HCl is removed “presumably by ice aerosols”, so more of it can build up. “This explains the seasonality of detections, but not their localization” [1 p. 2].

OUR ANALYSIS

Nothing about the Sun or magnetic fields

We searched the paper and its supplement, leaving out the reference lists. “Solar” and “Sun” appear 14 times, all in “solar occultation”, “solar longitude”, “Solar System”, “solar light”, “Sun ingress” and the 2021 “solar conjunction when Mars was behind the Sun”, never about the Sun’s activity. “Magnetic”, “geomagnetic”, “solar wind” and “cosmic” don’t appear, and nothing describes HCl or activity starting or growing over the years observed [1][2]. The paper’s proposed source is inside Mars, and its timing is the seasons.

4 · WHAT ELSE COULD MAKE THE GAS

The case for magma is by elimination; some alternatives are argued away, others aren’t addressed

“It follows that a local, igneous source may best explain the ACS measurements reported here” [1 p. 3]. That conclusion is as strong as the list of rivals it rules out.

The alternatives, and what the paper does with each

ALTERNATIVE	WHAT THE PAPER DOES	WHAT STAYS OPEN
Atmospheric chemistry: dust, water and their products making HCl	Finds current models “incompatible with our aphelion observations in terms of both HCl abundance and distribution”. One predicts negligible HCl; others predict ppbv levels over the whole north polar region, “not confirmed by the ACS multiannual survey” [1 pp. 2–3]	Not discussed: a 2025 model that reproduced the two Mars-year-35 profiles but, by its authors’ account, made HCl far more widely than ACS sees, partly from its too-wet air [11 §3.6]. The paper’s general objection to such models applies to it [1 p. 3]
Local warmth or water	Temperature and water profiles at the detections match those at non-detections. A daytime warm area over Tharsis leaves the north of the region “only at the edge”. Water vapour gathers in three corridors, “but not over the Alba Mons region” [2 pp. 12–13][1 p. 3]	—
Less ice to remove HCl	Explains the season but not the place; ice load is if anything slightly higher over Alba Mons [1 p. 2][2 p. 13]	—
Mud volcanism	Thought to be “pervasive in the northern lowlands” and so unable to explain a local signal; mud meeting magma would point “again to a volcanic origin” [1 p. 3]	—
Perchlorates and other chlorine salts	Also pervasive, so unable to explain a local signal; the Phoenix lander found perchlorates north of the detections [1 p. 3]	They are part of the paper’s own model, “fed by HCl of igneous origin” [1 p. 3]
HCl stored in ice and released	Built into the model as a buffer for magmatic HCl; at one site, release from ice by trough formation “alone cannot explain all the HCl aphelion detections” [1 p. 3][2 p. 7]	A store with no magma behind it, released locally, isn’t tested beyond the argument that the ground is icy everywhere
Gas carried in from elsewhere	A lifetime of “less than several sols” keeps HCl from mixing; the profiles point to a source near the ground at each detection [1 p. 3][2 p. 13]	No transport model is run
Local dust	Notes that northern summer has “little dust in the atmosphere” [1 p. 2]. The supplement lists four proposed ways dust could make HCl: by oxidation with water-vapour products, by acids, by ultraviolet light on freshly exposed dust or by electrostatic discharges. It finds that the HCl–water correlation “supports only the first”, and that the cold-season detections are “not consistent with” the models built on it [2 pp. 11–12]. The dust-storm pathways aren’t tested against them	Dust at the detection times isn’t examined. The team’s earlier papers linked this HCl with dust: in one of the two 2019 occultations, “dust is observed at the same altitudes at which we observe HCl” [5 §4]; in 2024 they wrote that the season “is coincident with the period of peak dust activity at northern latitudes for MYs 34–36”, with “a regional dust storm over this area” in Mars year 36 [6 p. 16]
An instrument or retrieval effect	Not discussed, beyond lines about 1% deep at several heights and the profiles’ uncertainty shading [2 p. 2][1 Fig. 1]; the retrieval follows the team’s published method [1 p. 5]	ACS’s known line-shape “doubling” is modelled in its retrievals [14 §§2–3]. An instrument effect would not obviously cluster in one region, but the paper shows no spectra or fits
Hot water reacting with salts	Folded into the model as “the top of a hydrothermal system connected to a volcanic plumbing system” [1 p. 3]	—

In the authors’ words How firmly the paper puts it, from the abstract to the supplement.

> *“Localized aphelion detections of HCl at low altitudes, unexplained by observed atmospheric state and models, together with the geological context of the region, hint at an igneous origin of this gas.”*
>
> Trokhimovskiy et al. (2026) [1 p. 3]

> *“Overall, observations of the atmospheric state suggest that the source is non-atmospheric and is plausibly located within subsurface fractures.”*
>
> The supplement [2 p. 13]

The team’s earlier papers concluded, for the warm-season HCl, that magmatic HCl “should be accompanied by seismic activity” and sulfur gases [13], and that their absence “strongly suggests that volcanism is not the source” [12 §1]. The new paper still finds warm-season HCl “unlikely to be directly volcanic”, though it now suggests a fraction may be “ultimately of igneous origin” [1 p. 5]. It argues that the cold-season detections are different.

5 · THE FISSURES

Narrow, young fissures are documented; that gas comes up through them is the authors’ model

Under each detection, the team looked at the best orbital images for landforms that could let gas out, within about 1° of latitude of the lowest detection point [1 p. 5]. They found fissures “a few tens of centimeters wide, sometimes forming swarms up to tens of kilometers long on topographic ridges up to 30 m high” [1 p. 3].

WIDTH

tens of cm

dark central lines up to about 0.5 m wide at one site [1 p. 3][2 p. 4]

LENGTH

up to 236 m

for single fissures at one site, where 336 longer than 50 m were mapped [2 p. 9][2 p. 25]

AGE

<0.63 million years

they cut an ice-rich mantle the paper dates to 0.630 million years; the supplement says “several m.y. or less” [1 p. 3][2 p. 5]

What “fresh” means here

“Fresh” is geological. The fissures cut the latitude-dependent mantle, a layer of icy dust that settles in cycles of Mars’s tilt, so they are younger than its 0.63 million years; the paper dates them no more closely [1 p. 3]. It argues they are kept open today: they are so narrow that, “if not maintained until now”, they “should disappear fast” [1 p. 3]. The lander Phoenix faded from orbital view within about a Martian year, which suggests small landforms at these latitudes don’t last unless something renews them [1 p. 6]. The paper’s image comparisons could catch changes only in features larger than about 15 m, so whether any fissure is new is untested [1 p. 6].

Why not ordinary frost cracks?

Ice-rich ground cracks into polygons as it freezes and thaws, and some of these fissures look like cracks described at a candidate Phoenix landing site [2 p. 3]. The authors keep only fissures that line up with Alba Mons’s grabens and volcanic depressions over kilometres, a “specificity criterion” [1 pp. 5–6]. One trough type turns up only between two detection sites; similar troughs at about 46°N, 130°W, where ACS made no nearby observation, can’t be tested [2 p. 11]. No survey of the ground under the non-detections is reported.

THE AUTHORS’ MODEL, 1

Magma at depth

Dormant magma bodies and cooling dikes under the region give off HCl, which, being more soluble in magma than SO_2, keeps degassing after eruptions end [1 p. 1][1 Fig. 2][2 p. 14]

2

Fractures

Deep fractures, “the top of a hydrothermal system”, carry gas up through the crust [1 p. 3]

3

Icy ground

The ice-rich subsurface holds the HCl until ice sublimates; perchlorates may store and release it [1 p. 3]

4

Seepage

Gas leaves through narrow fissures; ice in the air removes it within sols, so it is seen only near the ground and nearby [1 p. 3]

Our summary of the model the paper proposes in words and in its Fig. 2 [1 p. 3][1 Fig. 2]: an interpretation, not something any instrument observed. The paper’s images are orbital data and are not ours to host. See for example HiRISE’s PSP_001431_2460 (a fissure on a ridge in Scandia Colles) and ESP_082648_2260 (a fissure in a graben), both in its Fig. 2 [1 Fig. 2], and ESA’s CaSSIS image in its release [4].

6 · NO SO_2, NO QUAKE, NO HOT SPOT

None of the independent signs of magma has been seen, and two of the tests are weak

If magma were degassing under Alba Mons, other evidence could show it: sulfur gases in the air, marsquakes, or heat at the surface. None has been found. The paper argues that neither SO_2 nor a heat signature is required [1 pp. 1, 3][2 p. 14]; it doesn’t discuss quakes at Alba Mons.

Sulfur dioxide

What the paper says

SO_2 has not been detected “within the current upper detection limits”, from 0.3 ppbv over the whole planet to 3 ppbv over volcanic regions, measured from Earth, and “The absence of these detections should not be interpreted as evidence of Martian volcanic inactivity” [1 p. 1]. ACS’s own best-case limit is 20 ppbv, at 1σ [2 p. 14][14 Abstract]. The authors argue that cold climates favour chlorine-rich, sulfur-poor plumes, that HCl keeps coming out of magma after eruptions end, and so that HCl without SO_2 “may reflect dormant volcanic activity in a cold environment” [2 p. 14].

The HCl occultations were set for HCl, not SO_2

“Typically, one occultation is dedicated to a certain secondary grating position” [1 p. 5]. The HCl measurements used positions 11 and 12 [1 p. 5], while ACS’s SO_2 search used position 9 [14 Fig. 1]. The paper reports no SO_2 measurement made with or near its detections. Mars may also make sulfur-richer gas than Earth: one study puts Tharsis-era volcanic gases at 10–100 times the sulfur of Earth’s [15 Abstract].

How much SO_2 Earth-like volcanic gas would carry with this HCl

OUR ANALYSIS

RATIO FROM	WITH 1 PPBV HCL	WITH 1.5 PPBV	ACS’S BEST 1Σ LIMIT
HCl/SO_2 by mass 0.1–0.9 in Earth’s volcanic gas, as Braude et al. cite it [14 §5]	0.6–5.7 ppbv	0.9–8.5 ppbv	20 ppbv
SO_2 5–10 times HCl, as the team put it in 2024 [6 p. 13]	5–10 ppbv	7.5–15 ppbv	
The world’s arc volcanoes: about 0.49 HCl per SO_2, by our ratio of Fischer’s fluxes [16 Table 4]	2.0 ppbv	3.1 ppbv	
The paper’s own case: 1–4 times [2 p. 13]	1–4 ppbv	1.5–6 ppbv	

About 1 ppbv is the paper’s typical value and 1.5 ppbv its maximum [1 pp. 2–3]. Every case is below ACS’s best-case 1σ limit of 20 ppbv [14 Abstract], so ACS couldn’t have seen the SO_2 even had it looked in the same air. Ground-based limits are lower, but they cover the whole disc or other regions and date from before these detections [1 p. 1]. Our arithmetic.

Marsquakes

LOCATED WITHIN 1,000 KM

OUR ANALYSIS

None

of the 24 events InSight’s Marsquake Service located in 2019–2022 [17]

NEAREST LOCATED EVENTS

OUR ANALYSIS

1,532 and 2,653 km

both meteorite impacts, at their seismic locations [17]

NEAREST NOT FROM AN IMPACT

OUR ANALYSIS

about 3,300 km

S0976a, in Valles Marineris, explained by old faults slipping [17][18]

InSight’s single seismometer, on Elysium Planitia, was 104.5° of arc from Alba Mons, so a small quake there could have gone unseen; the catalogue’s most distant event was 146° away [17]. The paper itself ties marsquakes to Elysium and Cerberus Fossae, not to Alba Mons [1 p. 1], and infers that “Tharsis remains seismically active” from young surfaces and faults, not from located quakes [1 p. 5]. Our search of the catalogue, by its own published locations: rules and script in section 9.

Heat

Searches for volcanic heat on Mars “have yielded negative or inconclusive results” [1 p. 1]. ACS’s thermal channel found the detection sites no warmer than other longitudes [2 p. 13]. The authors’ model “does not require any substantial thermal signature” [1 p. 3].

7 · HOW BIG A SOURCE

The paper’s estimate of the source reproduces; it depends on how long HCl lasts in the air

Assuming the HCl-rich air holds about 1 ppbv, makes up less than 1% of the atmosphere’s 2.5 × 10^{16} kg, and keeps its HCl for 1 sol, the paper estimates seepage of under 3 kg s^{-1} [1 pp. 3–4]. The warm season’s HCl, about 3 × 10^{7} kg lasting a few sols, needs about 180 kg s^{-1}, so the authors judge it “unlikely to be directly volcanic” [1 p. 5].

COLD SEASON, THE PAPER’S INPUTS

OUR ANALYSIS

2.4–2.8 kg/s

against the paper’s “<3 kg s^{-1}” [1 p. 4]; the range comes from two ways of turning ppbv into mass

WARM SEASON, 2 SOLS

OUR ANALYSIS

148–176 kg/s

against the paper’s “~180 kg s^{-1}” [1 p. 5]

1% OF THE ATMOSPHERE

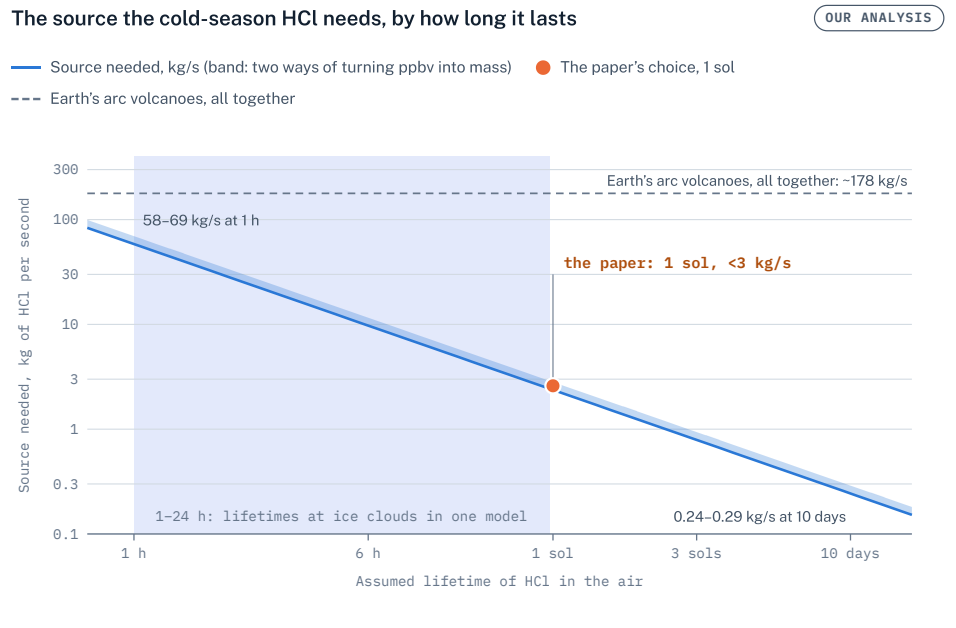
OUR ANALYSIS

1.5–2.6 million km²

of air columns: 1.5 for full columns at an assumed 600 Pa, 2.6 for the lowest 10 km only; the detections span 1.39 million km² [2 p. 15]

The source the cold-season HCl needs, by how long it lasts

OUR ANALYSIS



Our re-run of the paper’s budget [1 pp. 3–4]: about 1 ppbv in 1% of 2.5 × 10^{16} kg of air, divided by the lifetime. The shaded 1–24 h band is the lifetime one chemistry model gives where water-ice clouds are present [12 §2.2.1]; the paper says ice makes lifetimes “less than several sols” [1 p. 3]. Earth’s total from Fischer’s Table 4, 1.54 × 10^{11} mol of chlorine a year, as HCl [16 Table 4], our conversion. Both axes are logarithmic.

OUR ANALYSIS

What the size means

A few kilograms a second is the scale of a single seeping volcano on Earth: the paper puts such sources at “a few to >100 kg s^{-1}” [1 p. 4], and all of Earth’s arc volcanoes together give off about 178 kg s^{-1} of HCl [16 Table 4]. The paper’s “<3 kg s^{-1}” is “an upper limit on the seepage rate” at the one-sol “model-effective” lifetime it adopts [1 pp. 3–4]. The figure scales inversely with the lifetime: at the 1–24 h lifetimes one model gives at water-ice clouds [12 §2.2.1], it would be up to about 25 times larger, 58–69 kg s^{-1} at one hour, since a sol is 24.7 hours; at ten days, a fraction of one. The warm season’s ~180 kg s^{-1} assumes “a median lifetime of HCl during perihelion of only a few sols” from models [1 p. 5], so the paper compares the two seasons at lifetimes of the same order, 1 sol and a few sols.

8 · A PLANET WAKING UP?

If the gas is magmatic, Mars is still active inside; nothing in the paper shows it waking up

Not on this evidence. If the authors are right, igneous processes are still going on inside Mars [1 p. 1]. But they call the magma dormant, and the paper reports no eruption, no heat at the surface and nothing growing [1 pp. 2–4][2 pp. 13–14]. ESA’s release and the coverage follow, beside the paper.

What points to a Mars still active inside

The paper’s results, its abstract says, “are best explained by ongoing igneous processes in the Martian interior” [1 p. 1]. The fissures it proposes as pathways are younger than an ice-rich mantle it dates to 0.63 million years [1 p. 3], and the supplement describes volcano-tectonic structures near one detection as “reactivated very recently”, opening narrow fissures that may be “a few million years old or younger” [2 p. 9]. The paper reads surface ages “of a few to tens of millions of years” for some Tharsis lavas, with fault activity, as signs that “Tharsis remains seismically active” [1 p. 5]. The missing sulfur dioxide, it says, “should not be interpreted as evidence of Martian volcanic inactivity” [1 p. 1].

In the authors’ words: dormant, not erupting

“Igneous” in the title and abstract [1 p. 1], “potential dormant volcanism” [1 p. 1], “dormant volcanic processes of unknown duration” [1 p. 4], and “the absence of ongoing eruptions” [2 p. 14]. They leave room for “episodic, limited pyroclastic eruptions that leave little detectable trace” but report none [2 p. 14]. “Dormant” appears six times in the paper and its supplement, twice as labels in its Fig. 2.

OUR ANALYSIS

Waking up would mean a change, and the paper reports none in the years observed

A planet waking up would show activity starting or growing now. The paper describes a source “persistent over an observational period, although it may be short lived on geological timescales” [1 p. 3], and nothing in it or its supplement describes HCl or activity starting or growing over the years observed (section 3). The record is too short to show a trend in any case: two cold seasons, in Mars years 35 and 37, and a 2025 campaign whose “detailed analyses will be presented elsewhere” [1 p. 2]. The six detections of Mars year 37 came from a search dedicated to the region after the two of Mars year 35 [1 p. 2], so more detections needn’t mean more gas. The source the paper estimates is small, under 3 kg s^{-1} at the lifetime it adopts, the scale of a single seeping volcano on Earth (section 7), and it ties the gas to nothing outside Mars: the timing is the seasons (section 3). If the paper holds up, it supports a Mars that is, in ESA’s words, “merely sleeping” [4]; it shows no sign of one waking up, and two seasons couldn’t show a trend either way.

The release and the coverage, beside the paper

SOURCE	WHAT IT SAID	AGAINST THE PAPER
ESA’s release, November 4 [4]	Headline: “European orbiter detects fresh hints of volcanic activity on Mars”. Mars is “not geologically dead deep inside, but merely sleeping”; the gas is “a sign of dormant volcanism”; “no new lava flows or eruptions have ever been observed”. Mège: the orbiter “was able to find the smoking gun”. It describes fissures blocked by ice in winter temperatures “down to −120°C”, and calls its animation “one scenario”.	“Dormant” matches the paper [1 p. 1]. “Smoking gun” and the −120°C figure are not in the paper; the icy blocking is close to the paper’s icy-ground buffer [1 p. 3]. Its CaSSIS image, centred at 64.6°N, shows terrain about 1.6° south of detection 6, which the supplement describes as similar [2 p. 5].
National Geographic [22]	Co-author Kevin Olsen: “The nature of the source is unknown”. Mège: the signs “point to a volcanic origin”. The team “cannot be certain that the HCl is seeping out of these exact fissures”.	Careful, and closest to the paper’s hedges [1 p. 3][2 p. 3]
Sci.News [23]	Quotes the paper’s own sentences and its 3 and 180 kg/s.	Checked against the paper: they match [1 pp. 1–5]
Space.com [24]	“Mars isn’t dead — recent volcanic activity reveals it’s just sleeping”; “A clear sign of volcanism.”	Firmer than the paper’s “may best explain” [1 p. 3]
NASASpaceFlight [25]	“Newly formed fissures in the surface”; activity “on the red planet’s surface”.	“Newly formed” goes beyond the paper. It dates the fissures only as younger than a 0.63-million-year-old mantle, and its image comparisons could not see anything this narrow [1 pp. 3, 6]. The activity it proposes is underground

A still-warm Mars isn’t a new idea

From lava ages, Hauber and colleagues concluded in 2011 that Mars kept, and probably still keeps, enough internal heat for widespread volcanism across Tharsis [20]. In 2021, Horvath and colleagues dated a dark deposit at Cerberus Fossae to 53,000–210,000 years and wrote that, if it is volcanic, “Mars may still be volcanically active today” [21]. The paper builds on such work [1 p. 1]; what it adds is a gas.

A note on methane

Curiosity has reported methane at Gale crater [26], while TGO’s ACS has set limits far below it [27]. HCl differs: both of TGO’s instruments find it in the warm season, and telescopes on Earth have measured it too [1 p. 4], so the open question here is only the cold-season cluster, which so far rests on ACS alone.

9 · REPEAT OUR NUMBERS

Two scripts recompute the numbers marked “Our analysis”

It needs only Python’s standard library. Table S1’s eight rows are copied into it from the paper’s supplement, CC BY 4.0 [2 p. 15]; with `--fetch-mqs` it also downloads InSight’s catalogue [17] and checks it against the copy we used. Section 3’s word counts come instead from a search of the paper’s and supplement’s text, which anyone can repeat on the PDFs. A second script, hosted in section 11, recomputes the numbers there.

PY **mars_hcl_numbers.py**
Dates and distances for Table S1, the box they span, the timeline’s 2025 season, the budget and its lifetime grid, the SO_2 table, and the marsquake search with the catalogue’s farthest event · 12 KB

JSON **mars_hcl_numbers.json**
Its output, as run for this page, with the catalogue’s SHA-256 · 5 KB

TXT **RULES_our_analysis.txt**
The rules for the marsquake search, the budget and the chance test, written before each was run, with their amendments and hashes · 9 KB

Run it

`python3 mars_hcl_numbers.py` writes `mars_hcl_numbers.json` next to the script; add `--fetch-mqs` to fetch the 23.8 MB catalogue as well.

10 · LIMITS

What this check could and couldn’t see

The spectra

We didn’t re-retrieve any spectra; we rely on the paper’s profiles, which it shows only as a figure [1 Fig. 1].

The figures and images

We read the figures by their captions and the images by the paper’s descriptions [1][2].

The 78 occultations

They aren’t listed, so the chance test couldn’t be run (section 2).

Lava ages at Alba Mons

The paper cites crater ages near Alba Mons of 3.4 billion to “a few 10 million years” [1 p. 3]; we couldn’t read the lava-flow study it cites, so we don’t rely on those numbers.

Index copies

Three sources are read only as an index’s copy of their abstracts and are paraphrased [20][26][27].

What would change these verdicts

01

NOMAD or the iSHELL telescope detecting the same cold-season HCl near Alba Mons, from the 2025 campaign or later [8 p. 26]

02

A published list of the cold-season occultations, with the region’s boundary, so the clustering can be tested against chance

03

SO_2, a marsquake located near Alba Mons, or a thermal anomaly there, any of which would strengthen the magma reading; a fitting non-magmatic mechanism would weaken it

11 · WHERE THE PAPER’S OWN NUMBERS DON’T AGREE

Five places where the paper’s numbers, or the team’s earlier ones, don’t line up

None of these changes a verdict above, and the rest of the page doesn’t depend on them. Each could have an ordinary explanation, and we claim nothing about intent. None of the points has been put to the authors.

1. Mars year 36: observed or not?

In 2024, eight of the same authors reported that “In MY 36, a single definitive detection of HCl was made over the aphelion period, this time at Ls = 105°, but over the same geographical region” [6 p. 16], and a 2025 modelling paper with two of the new paper’s authors, Taysum and Olsen, repeats it [11 §3.6]. The new paper says the Mars-year-36 season “was not covered by observations” [1 p. 2]. Its supplement says that season’s occultations “did not include the Alba Mons region”, that operations stopped at Ls 107–113° for solar conjunction, and that “in MY 36 HCl could not be searched for in the period and location it was detected in MY 35 and further in MY 37” [2 p. 2]. Ls 105° fell on 27 September 2021, just before that gap (our dates). Ordinary explanations: the supplement’s narrower wording leaves room for a detection at Ls 105° elsewhere in the region; the detection may have been dropped on re-analysis, which neither paper says; the two papers may draw the region differently; or one of them has a slip. The instrument’s published observation geometry, or the authors, could settle it.

2. Over 2 ppbv in 2021, at most 1.5 ppbv now

The 2021 paper reported “> 2 ppbv HCl below 10 km” in the two Mars-year-35 occultations [5 Abstract]. The new paper gives “maximum abundances up to 1.5 ppbv” for the eight detections, those two included [1 p. 2]. Ordinary explanations: it cites a different retrieval description, its ref. 38 [1 p. 5], which may account for the change, though it doesn’t discuss it; and the two figures may describe different things, such as single against mean profiles or different heights, which only the profiles in its Fig. 1B could settle [1 Fig. 1]. We read figures by their captions only.

3. The longitude range

The text says all eight detections “fall into a narrow longitude range of 96°W to 117°W” [1 p. 2][2 p. 2]. Its own Table S1 puts detection 6 at 87.25°W [2 p. 15], and the supplement gives its lowest point at 86.94°W [2 p. 5]. So the range is about 87–117°W, 30° wide, not 21°. A typing slip would explain it, and it doesn’t change the argument. We checked it with separate code.

4. Two lifetimes for HCl

In comparing SO_2 with HCl, the supplement says “The lifetime of both gases in the atmosphere is ~1 MY … preventing preferential accumulation of either SO2 or HCl” [2 p. 14]. Yet the paper’s budget gives HCl a lifetime of 1 sol [1 p. 4], it calls lifetimes “less than several sols” [1 p. 3], and the supplement cites 1–10 sols [2 p. 12]. If HCl lasts sols and SO_2 about a Mars year, as the paper says, SO_2 would build up. On the paper’s own numbers, a source of 2.4–3 kg/s carrying 1–4 molecules of SO_2 for each of HCl, seeping all year as the paper allows, would hold about 7–34 ppbv of SO_2 in the whole atmosphere, as a well-mixed steady state. One seeping only during the 24 sols between the first and last detections of Mars year 37 would hold 0.24–1.2 ppbv. Against these, the planet-wide limits the paper cites are 0.3 ppbv and 0.3–1 ppbv [1 p. 1][2 p. 13]. Our analysis. Ordinary explanations: the paper calls its <3 kg/s an upper limit, so on its own terms, at its one-sol lifetime, these are upper values too; the “~1 MY” may mean gas chemistry alone; the real SO_2/HCl ratio may be much lower, as the paper argues for cold, post-eruptive degassing [2 p. 14], which would scale these numbers down; the planet-wide limits were measured before the detections; and SO_2 may be lost faster.

5. Weak cold-season HCl reported in 2021

The 2021 paper also reported that “small quantities of HCl, between 0.1–0.4 ppmv” (ppbv must be meant) “were frequently found at a 3–5-σ level during the aphelion time period in both hemispheres”, “at the very limit of the capabilities of ACS MIR” [5 §4]. The new paper reports “sub-part per billion upper limits of ≤0.2 ppbv” outside the eight detections [1 p. 2]. The ordinary explanations: the 2021 values were 3–5σ, “at the very limit” of the instrument, and the new paper, which states no criterion for “confident”, seems not to count such values: its supplement puts HCl outside the warm season below ACS’s “detection capabilities ≤ 0.1–0.2 ppbv” [2 p. 2]. Its ≤0.2-ppbv limits are also for Ls 100–120° [1 p. 2], a narrower window than the 2021 statement, which covers the whole aphelion period in both hemispheres [5 §4]. The “True” verdict on the isolation claim stands, since it rates the paper’s confident detections.

PY **so2_accumulation.py**
The SO_2 build-up in point 4 and the date in point 1, from the paper’s own numbers · 3 KB

JSON **so2_accumulation.json**
Its output · 2 KB

TXT **RULES_so2_accumulation_before_running.txt**
Its rules, written before it was run · 2 KB

Related checks

MISLEADING Venus and Mars The Disaster Cycle, Fact-Checked

Sources

Bracketed numbers refer to this list. For the paper [1], read in full, p. gives a page of the journal’s PDF and Fig. a figure. For its supplement [2], read in full, p. gives a page of that PDF and Table S1 its table. In [5], an accepted manuscript, § is a section and Abstract and Figs. A6–A7 name its parts; in [6] and [8], p. is a page of the version read; in [9], [11], [12] and [14], § is a section. Abstract marks the part of a source we rely on; a source marked “Abstract only” or “Index copy” was read no further. ppbv is parts per billion by volume; Ls, solar longitude, gives Mars’s position in its orbit, with aphelion at 71°; MY is a Mars year; ACS is the Atmospheric Chemistry Suite and TGO the ExoMars Trace Gas Orbiter. Links checked November 5, 2026.

1 Trokhimovskiy, A., Mège, D., Korablev, O., Olsen, K. S., Fedorova, A. A., Taysum, B., Tesson, P.-A., Luginin, M., Montmessin, F., Vlasov, P., Grigoriev, A., Alday, J., Belyaev, D., Ignatiev, N., Patrakeev, A., Kokonkov, N., Ivanov, Y., Gurgurewicz, J., Pommerol, A., Cremonese, G., and Thomas, N. (2026). Enigmatic HCl detections as a potential signature of igneous activity on Mars. *Science Advances* 12(45), eaeb9422. Submitted September 1, 2025, accepted October 2, 2026, published November 4, 2026. Peer reviewed. CC BY 4.0. Full text, the version of record, which the site’s owner downloaded.

2 Trokhimovskiy et al. (2026). Supplementary Materials for [1]: Supplementary Text in ten sections, Figs. S1–S9 and Table S1. Under the article’s CC BY 4.0; the supplement states no licence of its own. Full text, 44 pages, which the site’s owner downloaded from the article’s page.

3 SpaceWeatherNews (S0) (November 5, 2026). Mars is Ignited, Ra Coronal Hole | S0 News Nov.5.2026. YouTube video, https://www.youtube.com/watch?v=9uKEOLm3g3Q, published at 12:26 UT. No transcript was available.

4 European Space Agency (November 4, 2026). European orbiter detects fresh hints of volcanic activity on Mars. News release, as republished by phys.org “by European Space Agency”; its animation is on ESA’s site. Full text. Its images are not ours to host.

5 Olsen, K. S., Trokhimovskiy, A., Montabone, L., Fedorova, A. A., Luginin, M., Lefèvre, F., et al. (2021). Seasonal reappearance of HCl in the atmosphere of Mars during the Mars year 35 dusty season. *Astronomy & Astrophysics* 647, A161. Full text of the accepted manuscript on HAL; locators are that version’s.

6 Olsen, K. S., Fedorova, A. A., Kass, D. M., Kleinböhl, A., Trokhimovskiy, A., Korablev, O. I., et al. (2024). Relationships between HCl, H2O, aerosols, and temperature in the Martian atmosphere: 2. Quantitative correlations. *Journal of Geophysical Research: Planets* 129, e2024JE008351. CC BY 4.0. Full text, the version of record on HAL.

7 Mège, D., Trokhimovskiy, A., Korablev, O., Olsen, K., Fedorova, A., Guerlet, S., et al. (2025). On HCl in the Martian atmosphere during northern summers. EPSC-DPS Joint Meeting 2025, EPSC-DPS2025-985. Conference abstract, CC BY 4.0. Full text.

8 Mège, D., et al. (2025). On HCl in the Martian atmosphere during northern summers. Planetary Science Conference 2025, Kraków, October 23–25, Book of Abstracts, p. 26. Conference abstract. Full text.

9 Aoki, S., Daerden, F., Viscardy, S., Thomas, I. R., Erwin, J. T., Robert, S., et al. (2021). Annual appearance of hydrogen chloride on Mars and a striking similarity with the water vapor vertical distribution observed by TGO/NOMAD. *Geophysical Research Letters* 48, e2021GL092506. Full text of the submitted manuscript on HAL.

10 Brines, A., Aoki, S., Liuzzi, G., Villanueva, G. L., Faggi, S., et al. (2026). Vertical structure and variability of HCl in the Martian atmosphere observed by TGO-NOMAD. Europlanet Science Congress 2026, EPSC2026-722. Conference abstract, CC BY 4.0. Full text.

11 Benne, B., Palmer, P. I., Taysum, B. M., Olsen, K. S., and Lefèvre, F. (2025). A 3D model simulation of hydrogen chloride photochemistry on Mars: Comparison with satellite data. *Astronomy & Astrophysics* 699, A362. CC BY 4.0. Full text, as arXiv 2506.18757v1.

12 Taysum, B. M., Palmer, P. I., Olsen, K. S., Luginin, M., Ignatiev, N., Trokhimovskiy, A., et al. (2024). Observed seasonal changes in Martian hydrogen chloride explained by heterogeneous chemistry. *Astronomy & Astrophysics* 687, A191. CC BY 4.0. Full text.

13 Korablev, O., Olsen, K. S., Trokhimovskiy, A., Lefèvre, F., Montmessin, F., Fedorova, A. A., et al. (2021). Transient HCl in the atmosphere of Mars. *Science Advances* 7, eabe4386. CC BY-NC 4.0. Full text, as Europe PMC’s copy.

14 Braude, A. S., Montmessin, F., Olsen, K. S., Trokhimovskiy, A., Korablev, O. I., Lefèvre, F., et al. (2022). No detection of SO2, H2S, or OCS in the atmosphere of Mars from the first two Martian years of observations from TGO/ACS. *Astronomy & Astrophysics* 658, A86. Full text, as the accepted version on arXiv 2111.10222.

15 Gaillard, F., and Scaillet, B. (2009). The sulfur content of volcanic gases on Mars. *Earth and Planetary Science Letters* 279, 34–43. Abstract only, from the manuscript on HAL.

16 Fischer, T. P. (2008). Fluxes of volatiles (H2O, CO2, N2, Cl, F) from arc volcanoes. *Geochemical Journal* 42, 21–38. Abstract and Table 4, from the publisher’s PDF.

17 InSight Marsquake Service (2023). Mars Seismic Catalogue, InSight Mission; V14 2023-04-01. ETHZ, IPGP, JPL, ICL and University of Bristol. The final catalogue, read as data from its QuakeML file; we host only numbers derived from it.

18 Song, J.-H., et al. (2026). Active crustal straining and fault reactivation at Valles Marineris. *Nature Communications* 17, 10530. CC BY 4.0. Abstract only.

19 U.S. Geological Survey, Gazetteer of Planetary Nomenclature. Alba Mons, feature 14306: centre 41.08°N, 249.29°E, diameter 548 km, and its outline. A US Government work.

20 Hauber, E., Brož, P., Jagert, F., Jodłowski, P., and Platz, T. (2011). Very recent and wide-spread basaltic volcanism on Mars. *Geophysical Research Letters* 38, L10201. Index copy: its abstract as OpenAlex holds it, paraphrased.

21 Horvath, D. G., Moitra, P., Hamilton, C. W., Craddock, R. A., and Andrews-Hanna, J. C. (2021). Evidence for geologically recent explosive volcanism in Elysium Planitia, Mars. *Icarus* 365, 114499. Abstract only, as on arXiv 2011.05956.

22 Andrews, R. G. (November 4, 2026). Something weird is seeping out of Mars. *National Geographic*. Full text.

23 de Lazaro, E. (November 4, 2026). Mysterious gas over Mars’ Alba Mons could hint at volcanic activity. *Sci.News*. Full text.

24 Lea, R. (November 4, 2026). Mars isn’t dead — recent volcanic activity reveals it’s just sleeping. *Space.com*. Full text.

25 Warren, H. (November 4, 2026). Trace Gas Orbiter discovers potential evidence of volcanic activity on Mars via atmospheric observations. *NASASpaceFlight.com*. Full text.

26 Webster, C. R., et al. (2015). Mars methane detection and variability at Gale crater. *Science* 347, 415–417. Index copy: its abstract as OpenAlex holds it, paraphrased.

27 Montmessin, F., et al. (2021). A stringent upper limit of 20 pptv for methane on Mars and constraints on its dispersion outside Gale crater. *Astronomy & Astrophysics* 650, A140. Index copy: its abstract as OpenAlex holds it, paraphrased.

METHOD

How this was checked

On November 5, 2026, we read the paper and its 44-page supplement in full, the PDFs the site’s owner downloaded, and checked every quotation, number and locator on this page against them. We read in full the team’s earlier papers on HCl [5][6][13] and four others on HCl and sulfur gases [9][11][12][14], three conference abstracts, two from the team [7][8] and one from NOMAD’s team [10], ESA’s release and four news stories [4][22]–[25]; seven were read only in part, as abstracts, a table or an index’s copy, as the list marks.

The verdicts and the items tagged “Our analysis” are our own assessment, built on the cited sources. They cover the detections’ dates and distances, how wide the region is, the chance test we could not run, the SO_2 an Earth-like gas would carry, the marsquake search, the size and lifetime of the source, what the paper means for a planet waking up (section 8), and, in section 11, the SO_2 build-up. They rate the paper’s detections as ACS reports them: we re-retrieved no spectra and read its figures only by their captions.

Two hosted scripts recompute the numbers marked “Our analysis” from the paper’s own tables and text, apart from section 3’s word counts, which come from a search of the paper’s text; the first fetches InSight’s final marsquake catalogue to repeat the search and reproduces the paper’s seepage of under 3 kg/s and its ~180 kg/s for the warm season. We wrote rules before the marsquake search, the budget and the chance test, and logged later amendments with their hashes. The chance test was not run: the paper gives no count of the occultations inside the region. Section 11 sets out five places where the paper’s numbers, or the team’s earlier ones, don’t agree; none has been put to the authors, and none changes a verdict.

On November 6, 2026, the page was revised to review the paper on its own. No transcript of the S0 News episode that linked it was available [3], and without one the site no longer comments on how an episode presented a paper. So the verdicts on the episode’s title and the link’s label were removed, and section 8 now asks what the paper means for a planet waking up, drawing on what this check had already established; the quotations it adds were checked against the text of the paper and its supplement. The verdicts on the paper’s claims are unchanged. A fresh review of the revision then made section 8 say that the paper is silent on waking, not evidence against it.

This page was researched and written with Claude, an AI assistant made by Anthropic, and then re-checked against its sources in a separate verification pass.

The verdicts on this page

UNCONFIRMED	Rests on a preliminary result that hasn’t been confirmed.
TRUE	The evidence supports the claim.

All ten verdicts, and how we check

CORRECTIONS

Corrections and changes

If we get something wrong, we fix it and record the change below with the date. If a correction changes a verdict, the log says what the old verdict was.

Change log

Nov 6, 2026	Revised to review the paper on its own. No transcript of the S0 News episode that linked it was available, and without one the site no longer comments on how an episode presented a paper. The verdicts on the episode’s title and the link’s label are removed, the section on the episode is replaced by one on what the paper means for a planet waking up, and the verdicts on the paper’s claims are unchanged. The title, the panel’s heading, the summary and the card no longer answer the episode’s title, and section 3 no longer mentions an earlier S0 video. A fresh review of the revision then made section 8 say that the paper is silent on whether Mars is waking up, rather than evidence against it, and added the supplement’s report of structures near one detection “reactivated very recently”, on a geological scale.
Nov 5, 2026	Published on factchecked.science after a full check against the sources. Built from the paper and its supplement, the team’s earlier papers and abstracts, ESA’s release and the coverage; the map, timeline and charts are our own, from the paper’s Table S1 and text, the USGS Gazetteer and InSight’s marsquake catalogue. Includes a section on five points where the paper’s numbers, or the team’s earlier ones, don’t agree, which haven’t been put to the authors.

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Last updated Nov 6, 2026