

Curiosity: Little CO₂ in Ancient Mars Atmosphere. What Kept Mars Warm?

Examining minerals in mudstones formed at the bottom of a lake 3.5 billion years ago on Mars deepens the 'faint young Sun' paradox.

- Satellites have spent decades looking for carbonate minerals on Mars – the remnants of a thick CO₂ rich atmosphere thought to have helped keep the planet warmer early in its history than today, despite a dimmer Sun.
- However these minerals are not as common as expected, though they may be buried deep within the crust or covered in dust, limiting visibility from space.



- The *Curiosity* Rover has sampled ancient lake sediments in Gale Crater containing volcanic minerals that should have reacted to form carbonates if a thick CO₂ atmosphere was present in early Mars.
- The Chemistry and Mineralogy (CheMin) instrument, which uses X-ray diffraction has not yet detected any carbonates. This limits ancient CO₂ in the atmosphere to tens to hundreds of times lower than the levels required to maintain lakes and rivers to form and flow on the surface without freezing in Mars climate models.
- Other explanations for how ancient Mars was warm enough for river networks and lakes to form across are needed.

