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JUPITER'S MOON IO—A HUMAN'S GUIDE?

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Richard Harrison

Jupiter's moon Io is a truly fascinating and unique world. Located just over 400,000 kilometers from the gas giant, it is the innermost of the four Galilean moons and the most volcanically active body in the solar system. Io's surface is dotted with more than 150 active volcanoes, which spew out a variety of materials including sulfur, silicon, and methane. These eruptions have created vast plains of molten lava, as well as towering mountains and vast calderas. The surface of Io is constantly changing due to these volcanic eruptions, making it one of the most dynamic and constantly evolving bodies in the solar system.

But what causes all this volcanic activity on Io? The answer lies in the moon's unique location. Jupiter is the largest planet in the solar system, and its powerful gravity field has a strong influence on its moons. Io is caught in a tug-of-war between Jupiter and the other Galilean moons, Europa and Ganymede, which causes it to stretch and compress as it orbits. This constant deformation generates heat, which drives the volcanic activity on Io. The intense heat and volatile nature of Io's surface make it inhospitable to life as we know it. But that doesn't mean the moon is completely lifeless. Scientists have detected evidence of water ice on Io's surface, as well as a thin atmosphere made up of sulfur dioxide gas. This atmosphere is constantly replenished by the volcanic eruptions on the moon.

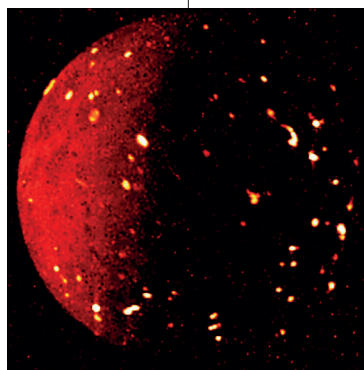
Despite its inhospitable nature, Io has captured the imagination of scientists and the general public alike. Its volcanoes have been studied by spacecraft such as NASA's *Galileo* and *Juno* missions, which have provided us with unprecedented views of this amazing moon. Io's volcanoes have also been the subject of much scientific research. These volcanoes offer a unique opportunity to study the processes that drive volcanic activity, as well as the materials that are spewed out during eruptions. This research has helped us to understand the internal structure of Io and the processes that are driving its volcanism.

But Io is more than just a scientific curiosity. Its volcanoes could also have practical applications in the future. For example, the materials spewed out by Io's volcanoes could potentially be used to create fuel for spacecraft or even for human settlements on other planets or moons.

In conclusion, Io is a truly unique and fascinating world. Its volcanically active surface and dynamic

nature make it a scientific treasure trove, and it has captured the imagination of scientists and the general public alike. As we continue to study this amazing moon, we can only imagine what other secrets it has yet to reveal.

Okay, folks, full disclosure time. Not a single one of the words above was written by me (or any other human). Everything you see above was generated *automatically* by the artificial intelligence text engine ChatGPT (<https://openai.com/blog/chatgpt/>) in response to my prompt "Write an editorial of 500 words on Jupiter's moon Io for *Elements* magazine." How did it do? I have to say I was impressed at first glance! General audience? Tick. Interesting facts? Tick. Random musings on the potential practical applications of Io's seemingly infinite energy and mineral resources? Tick. Wistful signoff? Also tick. Perhaps it is a good thing that I am approaching the end of my editorial tenure—I might be out of a job soon anyway!



Infrared image captured by the *Juno* spacecraft's Jovian Infrared Auroral Mapper (JIRAM) imager on July 5, 2022. Brighter spots indicate higher temperatures. IMAGE CREDIT: NASA/JPL-CALTECH/SWRI/ASI/INAF/JIRAM (FROM <https://www.nasa.gov/feature/jpl/nasa-s-juno-exploring-jovian-moons-during-extended-mission>)

Look a little closer, however, and the subtle hints that this was not written by an actual person appear (overuse of the word "spew" for example, or the rather trivial opening line of the conclusion that is simply the reverse of the opening line of the introduction). It begs the question: what will this technology look like in a year's time? In 10 years' time? As someone whose

research involves the increasing use of machine learning methods, I can see the enormously positive impact that artificial intelligence is already having on research (the advance in 2D and 3D automated mineralogy is one that immediately springs to mind). However, the potential negative (and quite frankly scary) implications of technologies such as ChatGPT for higher education and academia are only just dawning on us. This editorial was the product of a desperate *Elements* editor fighting writer's block and an impending deadline. But how soon will it be before an entire research paper is created using this technology by an equally desperate academic being pressured for results? What if the reviews of that paper were similarly generated—the entire publication process untouched by human hand? Who is to say that this has not already happened?

But there is light at the end of this tunnel. I can confidently reassure you that (the first half of this editorial aside) the entirety of this issue of *Elements* was (and always will be) hand-crafted by a dedicated team of actual human scientists with true knowledge of their subject. It is good to know that there is at least one trusted source of information you can always rely on!

Richard Harrison