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Meteorite found to come from Mars in study led by UCSD cosmochemist Kurt Marti

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Media Contact: Warren R. Froelich, (619) 534-8564

A football-sized meteorite that crashed into Nigeria, Africa more than three decades ago probably came from Mars, according to studies led by a cosmochemist at the University of California, San Diego.

The results confirm and augment earlier data obtained from a similar meteorite discovered in Antarctica about 12 years ago that suggested a possible link to Mars.

"Since recent spacecraft missions to Mars have failed, and no new Martian spacecraft data will be obtained during the next few years, these samples that we have will permit further study of Mars," said Kurt Marti, professor of cosmochemistry at UCSD and principal author of the study.

"The nice thing about this is that they were delivered free of charge," he added.

As described in the current issue of the journal Science, the researchers analyzed the composition and isotopic ratios or "signatures" of bubbles gas contained in tiny glassy chips removed from the Zagami meteorite, named for the Nigerian region where the grayish, basalt-like specimen fell.

Visually, formations in the specimen called "shock-melt veins" and glassy pockets suggested they were melted and cooled rapidly following an impact on the Martian surface.

The impact not only created this "shock effect," but the rapid cooling left bubbles where local atmospheric gas was trapped and sealed.

Subsequently, this basaltic material--which resembles a lava flow--was ejected from Mars following a major collision and, according to cosmic ray analysis, took about 3 million years before touching down in Africa in 1962.

Today, most of the 40-pound meteorite--minus a few tiny glassy chips removed by Marti and his co-workers--is housed in the Geological Survey of Nigeria. Another one-pound sample is on exhibit at the Smithsonian Museum in Washington.

Using a high-sensitivity mass spectrometer, Marti's team analyzed the isotopic ratios of three gases--nitrogen, argon and xenon--trapped in the glass chips. The ratios closely compared with data sent back from the Viking Spacecraft, which landed on Mars in 1976.

What emerged was a consistent "signature" for Martian atmospheric gases. For example, in the case of xenon, the ratio of Xe129/Xe132 in the sample was found to be 2.4. By comparison, the ratio on Mars discovered from the Viking mission was found to be about 2.5; the comparable figure on earth is about .98.

Though the ratio of nitrogen 15 to nitrogen 14 was about 28 percent higher in the sample than earth, it was somewhat less than the amount found by the Viking lander on Mars.

"Although there is considerable uncertainty in the 'Viking' data, the sample we have analyzed may not be pure Mars atmosphere," Marti explained. "There might be indigenous nitrogen in the solid rock or some contamination from earth because the meteorite fell in 1962.

"Nevertheless, the signature is clear."

What's more, the ratio of gases found in the Zagami meteorite closely compares with the gaseous signature from the Antarctic meteorite, designated EETA 79001.

This confirms that this Antarctic meteorite originated on Mars, Marti said.

"There were many skeptics," he said, "and this skepticism was reasonable. But, based on the information available now, the probability that these are both Martian is fairly high."

Marti added that absolute proof will require another mission to Mars.

"We would like to see confirmation by actually having Martian samples, or at least an analysis on the Martian surface," he said.

Also participating in the study were J. S. Kim, a former graduate and postdoctoral student at UCSD, now at the Korea Research Institute of Standards and Science; A. N. Thakur, a researcher at UCSD's Scripps Institution of Oceanography; and T.J. McCoy and K. Keil, both of the University of Hawaii at Manoa.