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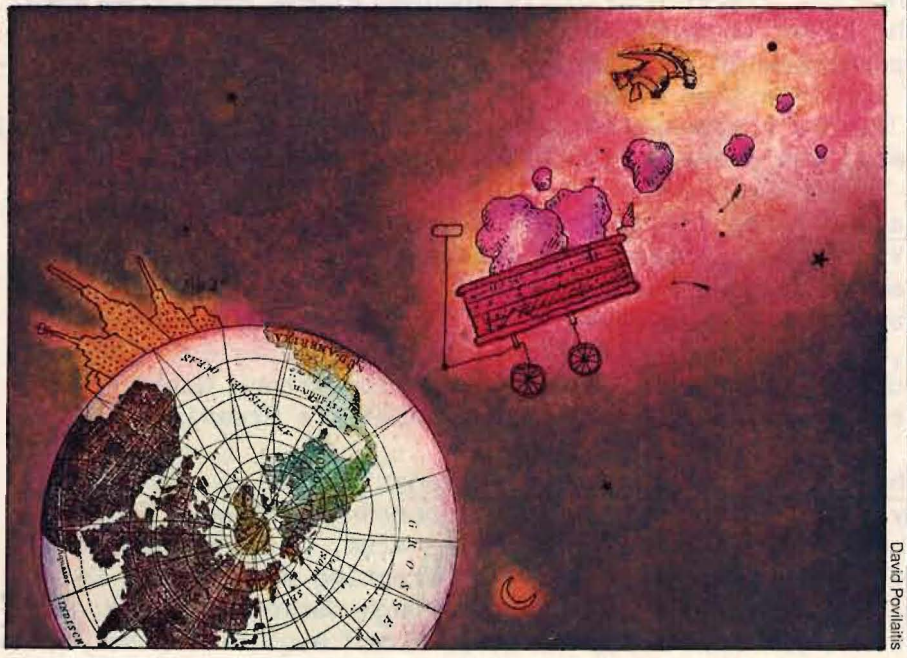
MYSTERIES

The young meteorites: origin unknown



David Povilaitis

Day after day, the Earth gets showered with tons of meteoritic debris. After analyzing about a thousand chunks that survived a blazing journey through the atmosphere, scientists have concluded that most meteorites are remnants of the solar system's birth, pieces of rock or scraps of iron and nickel that are about 4.5 billion years old.

But eight of these meteorites, collected from locations around the world, defy that description. Grouped according to composition, these shergottites, nakhlites, and chassignites—or SNCs—share a common historical feature: All came from molten rock, or lava, that formed as recently as 1.3 billion years ago. What member of the solar system could possibly be the parent of these peculiar newcomers?

Most meteorites are thought to come from the asteroid belt, which lies between Mars and Jupiter. But the asteroids had long cooled from the solar system's fiery beginnings by the time the grayish SNC rock was born. Planetologists quickly nixed the moon for the same reason.

Deducing how these space travelers might have departed their birthplace has made it possible to rule out other sources. Even if a meteorite could form on the giant outer planets, Saturn and Jupiter, it would never reach an orbit that the Earth crosses in its journey around the sun. Venus is much closer, but its gaseous atmosphere is so dense that escape seems impossible.

In the late 1970s, several meteorite experts went out on a limb to nominate Mars as a candidate. They reasoned that the red planet's giant volcanoes were spewing lava about the same time the meteoritic rock was born. As the scenario goes, chunks of Mars' billion-year-old rock were blasted into space after a giant comet or meteor crashed into the Martian surface. Certain glassy fragments in one of the shergottites, in fact, indicate that the meteoritic rock was subjected to some kind of immense shock about 180 million years ago. Could that be the signature of an impact on Mars?

This idea was highly speculative at the time, interesting cocktail chatter at planetary science conferences. But a couple of years ago, the theory got a real boost. Studies were conducted on a 17½-pound shergottite found in Antarctica in 1979, and Donald Bogard of NASA's Johnson Space Center in Houston reported that the proportions of neon, argon, krypton, and xenon trapped within the glassy fragments of the Antarctic specimen turned out to be strikingly similar to the abundances detected on Mars by the Viking landers. Shortly thereafter Richard Becker and Robert Pepin of the University of Minnesota found that the trapped gases were greatly enriched with a rare isotope of nitrogen that also is characteristic of Mars. The researchers surmise that these gases were trapped inside the rock during the impact that shot the meteorite off Mars.

There are problems, however, even with Mars. Cratering experts have tested various impact models, and when they accelerate large rocks to Mars' escape velocity of three miles per second, the blocks of solidified lava either melt, vaporize, or get ground to a powder. More complicating, some of the young meteorites do not even appear to be shocked. Can something be blasted off a planet and remain unscathed?

These dynamical hitches have prompted some researchers to look again at asteroids. Ann Vickery of the University of Arizona in Tucson is checking to see how asteroids might have been heated late in the history of the solar system and if an SNC-type composition could have evolved. Maybe an extended period of radioactive decay produced enough heat to keep an asteroid's core liquid up to one billion years ago. "It's an attractive idea," she says, "because it's so much easier to get a rock off such a body." Current theory, however, holds that it isn't possible for an object as small as an asteroid to retain heat that long.

While most scientists still favor Mars as a source, the evidence is not conclusive. At the moment, the SNCs are unclaimed. Their origin may turn out to be really bizarre.

—Marcia Bartusiak