## READING PASSAGE 2

*You should spend about 20 minutes on **Questions 14–26**, which are based on Reading Passage 2 below.*

# The International Meteorite Market

*Meteorites on the open market routinely fetch a higher price than the equivalent weight of gold. But how does this trade operate, and is science paying the ultimate price as…*

At 2 a.m. on 18 July 2011, nomads in the Oued Drâa valley, to the east of Tata, Morocco, witnessed a ball of fire streak across the sky, followed by a series of sonic booms.

The explanation was as surprising to scientists as to those who saw it fall: a meteorite from Mars had made its way to Earth.

Martian meteorites comprise only 0.15% of meteorites known to science—that's a mere 61 out of 41,000 specimens. The Moroccan meteorite—which was named Tissint after a village 48 km southwest of a recovery site—was particularly exciting.

Because the fall was witnessed, it took only three months for fragments to be recovered, which minimized the meteorite's exposure to oxygen, rainwater, and other contaminating factors on Earth. This, combined with the dry climate of Saharan Morocco, meant that the meteorite was in stellar condition.

"It's almost pristine, it's as if it was blasted off Mars yesterday," said Dr. Caroline Smith, Meteorite Curator at the Natural History Museum in London.

With Dr. Smith's help, the largest Tissint fragment has found a home at the Natural History Museum. But the institution's path to purchasing the 1.1 kg specimen embodies the oddities of the international meteorite market, in which the interests of science and private collectors often collide.

**Sky-rocketing prices**

As our sole source of non-microscopic space material, meteorites have much to teach us. “We’re still building a catalogue of everything that’s out there,” says Dr. Ralph P. Harvey, a Case Western Reserve University geologist and principal investigator for the Antarctic Search for Meteorites program. “Meteorite science is where biology was 200 years ago with people saying, ‘Oh, here’s a strange, long-necked beast, I wonder if it’s related to the turtle.’”

Yet scientists don’t necessarily get first dibs on meteorites that plummet to Earth. “There is a market out there that treats these [meteorites] as collectibles and curios, almost as though they were fine art or ancient artifacts,” Dr. Harvey explains.

The flurry of excitement surrounding Tissint’s fall set off a “feeding frenzy,” according to Dr. Harvey. Everyone wanted a piece of the meteorite—and with good reason. Martian meteorites are known to sell for around $1,000 per gram[3]. As a result, Harvey added, “The prices go up and up.”

The market value of meteorites began to rise in the late 1990s. Some attribute this to the advent of online businesses, which could make meteorites easily available to the public. But meteorite collector Darryl Pitt, curator of the Macovich Collection, attributes it largely to several headline-grabbing purchases whose steep prices were unprecedented.

At a New York City auction in 1998, the American Museum of Natural History spent a record-breaking $137,000 on a slice of a pallasite meteorite, whose luminous amber-toned crystals gleamed against a silvery nickel-iron matrix. Weeks later, an 18-pound iron meteorite was sold for $97,000 at an auction in San Francisco.

“What happened after two or three auctions was that word was being disseminated throughout the world about the high prices that meteorites were attaining,” says Pitt, who put both samples up for sale. “This served as a catalyst for a new generation of meteorite hunters.”

**Legal conundrums**

Eric Twelker is the owner of The Meteorite Market, an online meteorite retailer. While working full-time as a lawyer, Twelker founded the company in 1995 to make some money on the side; it’s now a full-time business, which he runs with his wife out of Juneau, Alaska.

Twelker purchases meteorites from dealers in Morocco, Russia, Canada, and Nigeria, among other countries. When asked how he determines the legality of the specimens he purchases, Twelker paused. “There’s some degree of concern,” he said. “To a large extent—and I would say this is for dealers and institutions, as well—the question [of legality] isn’t asked or it isn’t pursued.”

The law governing meteorite acquisition is diffuse. Every country has its own way of determining meteorite ownership—that is, if such laws exist at all. If a meteorite crash-lands into your rental home in the U.S. or U.K., it's considered the landlord's property. If you stumble upon a space rock in Japan, however, finders-keepers applies. In Switzerland, meteorites belong to the government—but the finder is compensated with a sum suitable to the value of the object. In India, Denmark, and most Australian states, meteorites must be handed over to specific, government-owned museums.

Making sure that meteorites are acquired legally has proven particularly difficult in North Africa, where it's often difficult to determine the provenance of specimens for sale. "The skill level that some collectors have to get stones out of Africa rivals that of drug dealers," says Dr. Harvey. "It's clear that meteorites are so valuable to these collectors that they're more than happy to get them and worry about the cost in terms of legality later on."

Twelker acknowledges that many of the North African meteorites "probably are exported illegally," and that some institutions have chosen not to purchase meteorites from this region as a result. The Natural History Museum's policy, for example, is not to purchase a specimen from the region unless there is a clear paper trail documenting the specimen's origin and movements.

"The institutions that have taken the so-called 'principled' point of view have found themselves left in the dust by people who didn't," he said.

Yet Twelker insists that the interests of science and private collecting are not at odds. Collectors typically have specimens they hope to sell listed publicly by The Meteoritical Society—with an abstract that describes the sample's geochemical qualities and place of origin on Earth, among other characteristics. "It's basically a label of authenticity," says Twelker. To get listed, collectors must make a donation of either 20 g or 20% of a specimen to a reputable researcher, who will analyze the sample free of charge and submit his or her analysis to The Meteoritical Society.

"The availability of meteorites is much greater than when I started this business—and one of the reasons is that people have financial incentives to go out and get them," said Twelker.

**Moving up North**

Every year, Dr. Harvey and a team of six to eight scientists spend six weeks in Antarctica. At night, they sleep two-to-a-tent on the ice. By day, they criss-cross the terrain on snowmobiles, collecting samples.

Harvey and his team can usually identify meteorites by a smooth, jet-black surface called fusion crust that stands out strongly against the snow. This is caused by the meteor's surface melting and peeling off as it travels through Earth's atmosphere at 20 km/s.

The Antarctic Treaty, which was signed in 1959, specifies that the continent's resources cannot be used for commercial gain; however, specimens collected for scientific purposes may be removed for further study and exchanged free of charge.

In its 35-year history, the Antarctic Search for Meteorites program has recovered 20,000 meteorites in Antarctica. "Meteorites fall all over the world; there's nothing special about Antarctica," says Dr. Harvey. "Any place you go on this planet where the input of terrestrial stuff is pretty low, space stuff starts piling up."

Dr. Harvey feels that these Antarctic exploits dampen the meteorite frenzy by providing the scientific community with new material to study at no cost. The specimens that his team collects are sent back to the Johnson Space Center in Houston, Texas, where scientists with the National Aeronautics and Space Administration (NASA) identify the **meteorites**; NASA and the Smithsonian share long-term curation duties, facilitating the distribution of meteorites to scientists all over the world.

But the quantity of meteorites being sent back from Antarctica isn't enough, according to Harvey. "There's lots and lots of demand," he says. "If we magically started bringing back ten times as many meteorites as we do now, they'd still all get studied."

Approximately 5,000–17,000 meteorites plummet to Ear**th** every year—some the size of a washing machine, some as small as a golf ball. But when a particularly rare and scientifically valuable specimen like Tissint lands outside Antarctica, scientists and institutions such as the Natural History Museum must jockey with private collectors for the prize.

"We are competing within a commercial market, although we have extremely limited finances," said Dr. Smith. "There's a danger in the price hiking of the market. Institutions without much money to purchase things may be priced out."

In the months after Tissint's recovery, the Natural History Museum was approached by four different collectors, all hawking fragments of the rock. Pitt and Dave Gheesling, a meteorite collector based in Atlanta, Georgia, offered the largest piece of Tissint to the Natural History Museum for what Dr. Smith calls a "good price."

"We could have made a lot more money," says Pitt. "There are a lot of private collectors in Asia and the Middle East that would have paid far more than the Natural History Museum."

Asked why he and Gheesling chose to sell it to the Natural History Museum, Pitt answered: "There exists a social obligation to make the extraordinary accessible. I would not have been able to sleep at night knowing that this object was in someone's private vault."

Nevertheless, the sum well exceeded the museum's annual acquisition budget (neither Dr. Smith nor Pitt would disclose the exact sum). Half of the money was put up by an anonymous philanthropist, with dual American and British citizenship and a keen interest in the museum's meteorite collection.

Does a reliance on deep-pocketed donors spell doom for the meteorite collections of museums and other educational institutions? Dr. Smith doesn't think so: "There are enough good guys out there who are very generous when it comes to selling stones to institutions or providing material for free."

**References**
Tempelsman, A. (2012, May 25). *The international meteorite market*. The Naked Scientists.
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