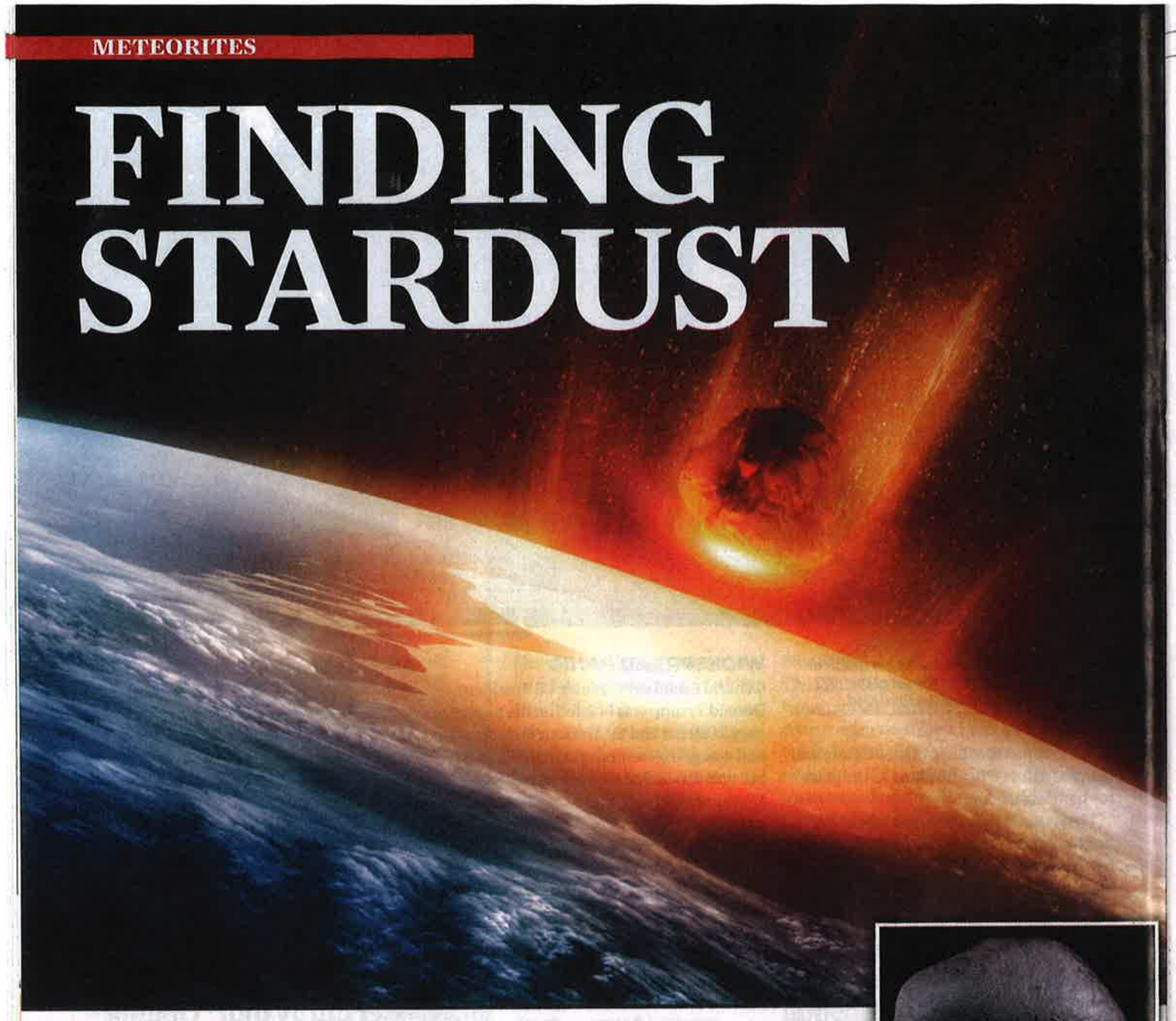
FINDING STARDUST



The Auckland meteorite's black fusion crust. Top: a meteor glows as it hits the Earth's atmosphere.

Space debris that landed in an Auckland living room in 2004 was probably from an asteroid collision 470 million years ago. by JAMES SCOTT

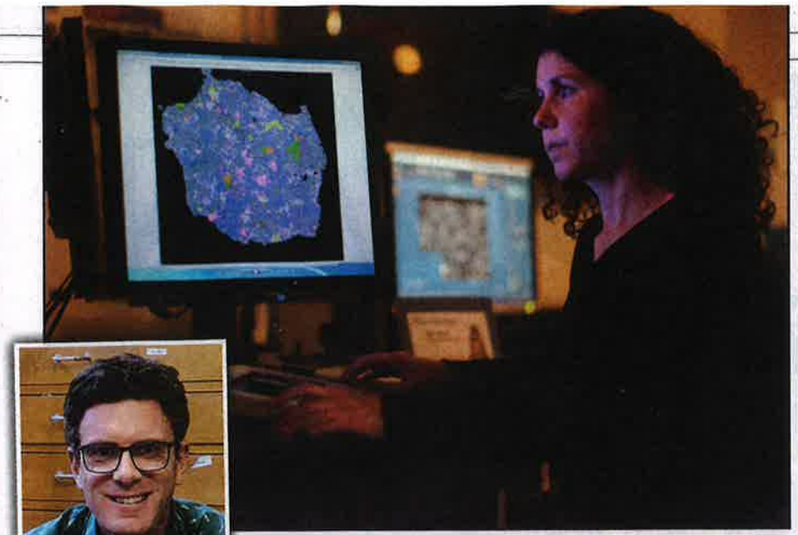
At 9.30am on June 14, 2004, a meteorite weighing in at 1.3kg crashed through the roof of a home in the Auckland suburb of Ellerslie, bounced off the couch, hit the ceiling and came to rest under the television. Fortuitously, it missed the owners and their grandchild, who had been playing there minutes before, but still gave them a heck of a fright.

This incident is the most recent of New Zealand's 10 confirmed meteorite occurrences. All but one of the other nine have been "finds" – meaning they were discovered long after they reached Earth. "Falls" such as the Auckland one are significant because they undergo no breakdown at the Earth's surface and therefore completely preserve their extraterrestrial compositions.

New Zealand's first meteorite was discovered in the Wairarapa in 1863. Weighing 5.8kg, it was found outside a home just south of Masterton.

Our largest is the 54 kg Dunganville, which was discovered by a gold miner in a creek bed near Greymouth in 1976. The most precious New Zealand meteorite is Mokoia, a 1908 fall in Taranaki, which belongs to the rare carbonaceous chondrite meteorite clan and has been studied throughout the world.

Although meteorites are named after a geographical feature close to where they are found, "Ellerslie" had already been assigned to a meteorite in Australia, so the latest New Zealand occurrence was called "Auckland".



Mineral-rich: the University of Otago's Marianne Negrini studies a scanning electron microscope image highlighting the main minerals found in a fragment of the Auckland meteorite. Left, James Scott.

My quest to find Auckland led to the Canterbury Museum, which, as it turns out, was in possession of the couch the meteorite had hit but not the object itself – which was on display in the Auckland War Memorial Museum.

Between coming through the roof and ending its journey under the TV, the meteorite was chipped and a small area of black fusion crust – the beautiful polished surface that forms as a meteorite is melted by friction in the air on its passage through Earth's atmosphere – was removed. This revealed the meteorite had a pale-coloured interior, which meant it wasn't an iron meteorite.

The Auckland meteorite is over 4.5 billion years old, putting our short existence into beautiful perspective.

But what it actually is has remained unknown – until now. The Auckland museum provided several millimetre-sized fragments of the broken surface for examination using a scanning electron microscope at the University of Otago that enables geologists to undertake forensic-style analysis of a rock. This showed that Auckland contained small chondrules, small droplets of melted but now crystallised dust from the early solar system. Chondrules occur only in chondrite meteorites, which are debris about 4.5 billion years old that were never incorporated into one of the larger planets or their moons. The Auckland chondrite, therefore, represents a chemical snapshot of the solar nebula – that is, a rock formed directly from the dust and droplets in the cloud circulating the early sun before the major planets grew.

The Auckland chondrite is probably derived from a small asteroid that formed in the early solar system that lacked sufficient size for radioactive decay to raise the internal temperature and cause separation into the iron-rich core and a silicate mantle characteristic of all planets, large asteroids and large moons.

Comparison with similar chondrite meteorites found in Sweden indicates that the parent asteroid to Auckland was probably destroyed about 470 million years ago during a cataclysmic collision in space with another asteroid. The debris from this event has, since that time, intermittently intercepted Earth's trajectory around the sun.

A high degree of luck is usually needed to find a meteorite; the approximately 9kg Waingaromia iron meteorite was discovered in 1915 when a farmer noticed his sheep kept hitting their feet on a hard rock in a paddock, and the 7.5kg Kimbolton was revealed in 1976 when it became jammed in ploughing equipment.

However, New Zealand's small and sparse population means most falls go unnoticed and there are almost certainly more meteorites to be found.

In any case, we now know that the Auckland meteorite is composed of stardust that is over 4.5 billion years old, which not only is incredible but also helps put our short existence into beautiful perspective.▮

James Scott is an associate professor in geology at the University of Otago.

Know your meteorite

Meteorites are most commonly found in areas of sparse vegetation, so Marianne Negrini of the University of Otago geology department suggests Central Otago could be a good starting point to find one. Try to spot a rock with a dark, smooth, matte surface – the fusion crust formed by melting minerals as the meteorite speeds through the Earth's atmosphere.

Next, because iron and nickel are the main constituents, meteorites are dense and heavy. That may sound like any rock, so this is where a magnet can come in handy to test for magnetic attraction.

Step three involves breaking it open a little with a handy hammer, and the inside colours should be tones of grey, green and blue. Small spherical features called chondrules (see main story) may be seen with the naked eye, but a magnifying glass can make that job easier.

Probably the most important tip, however, is to keep a look out for surrounding craters. The advantage of stumbling into a crater is you can skip the above steps and go straight to collecting that prize meteorite gifted to you from somewhere far, far away.

– *Guy Frederick*

A meteorite found in France yielded evidence of underground water on Mars.

GUY FREDERICK; GETTY IMAGES