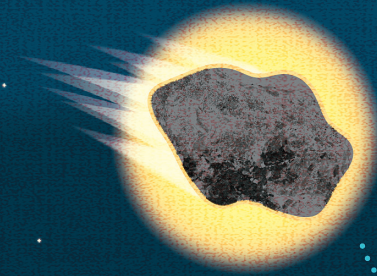


# CERTIFIED FROM SPACE

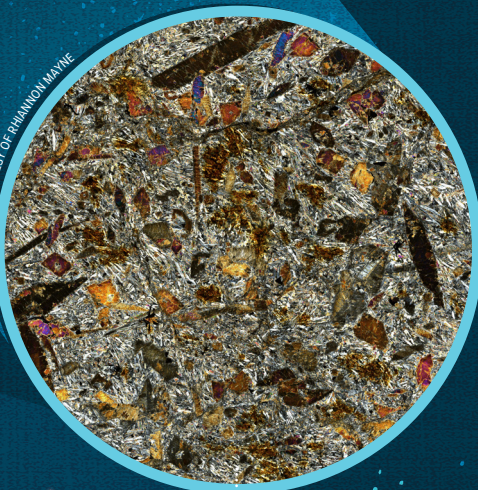
Rhiannon Mayne, the Oscar and Juanita Monnig Endowed Chair of Meteoritics and Planetary Science, knows a meteorite when she sees one. But recognizing the debris from space, which can date back 4.6 billion years, isn't enough to call it a meteorite. Mayne shared five steps for identification plus details on three meteorites she has recently classified.



## 1. Check for meteorite hallmarks:

- Dark brown or black crust
- Heavy for its size
- Usually magnetic
- Irregular shape (not round)
- Regmaglypts, or fingerprint-like pits

COURTESY OF RHIANNON MAYNE

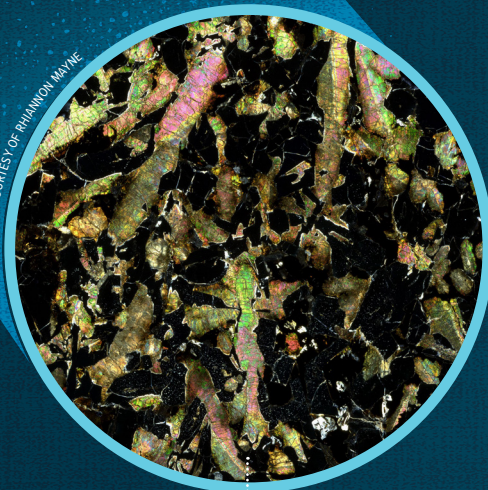


**Meteorite:** NWA 16638, classified by Rhiannon Mayne and Juliane Gross, curation lead for the Artemis internal science team at NASA's Johnson Space Center

**Type:** Eucrite is an igneous rock from an asteroid, likely 4 Vesta, which is the second largest asteroid in the main belt between Mars and Jupiter.

**Notes:** At 4.5 billion years old, this meteorite is anomalous because of the mix of phenocrysts, or large crystals, with finer ones. This unusual texture shows two different cooling rates; the larger grains would have taken much longer to form than the smaller ones.

COURTESY OF RHIANNON MAYNE



**Meteorite:** NWA 16403, classified by Mayne and Gross

**Type:** Gabbroic shergottite, an igneous rock from Mars

**Notes:** This meteorite, like most Martian shergottites, contains plagioclase that has been so shocked — changed by a shockwave that causes sudden, intense pressure and heat after a collision — that it has turned into plagioclase composition glass.



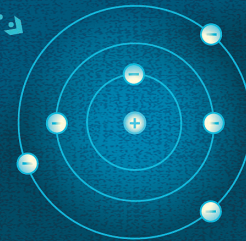
## 2. Slice a thin section:

- Use a diamond-wire saw to cut a section that is about 30 microns, or .03 millimeter, thick.
- Prepare a slide.



## 3. Examine under a microscope:

- Use a digital microscope to observe and photograph which minerals are present and in what abundance; common minerals include pyroxene, olivine and plagioclase.



## 4. Collect additional detail:

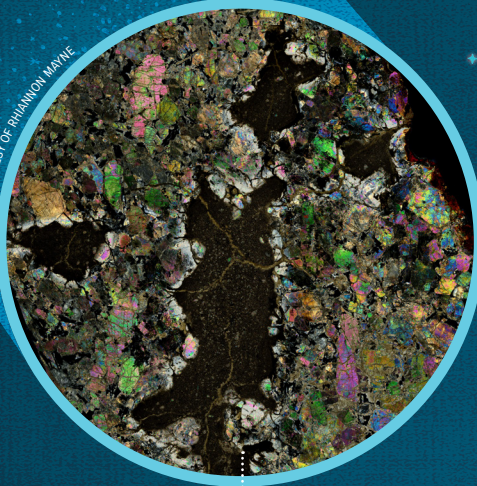
- Use a scanning electron microscope to observe and photograph the textures and compositions of each mineral in greater detail.
- Use an electron microprobe to analyze the composition of all the main mineral phases.

## 5. Submit findings for peer review:

- File the report to a committee of scientists. If accepted, details of the new meteorite are published in an online database.
- A portion of the meteorite — the smaller of 20 grams or 20 percent of the sample — is donated to a scientific repository, like TCU's.



COURTESY OF RHIANNON MAYNE



**Meteorite:** NWA 14904, classified by Mayne and Emily Gackstatter, then a master's student in geology

**Type:** Poikilitic shergottite, an igneous rock from Mars

**Notes:** Altered by an impact event, likely when it was ejected from the surface of Mars, this meteorite shows shock effects like large pockets of melt. This is the only piece of this meteorite known to exist; part of the sample was donated to TCU by Philip and Ann Mani, owners of Radiant Point, Ltd.

## INSIGHT:

“I nearly always relate crystal growth to ice cream. ... The reason it gets icy is because when you refreeze ice cream, the ice crystals have a long time to grow because your freezer is not that cold.

If you've been to Chill-N, the ice cream is super smooth because liquid nitrogen cools it down so quickly no crystals can form. ... Rocks form in almost exactly the same way as ice cream. ... The large crystals here formed a lot more slowly than the fine crystals.”

Rhiannon Mayne