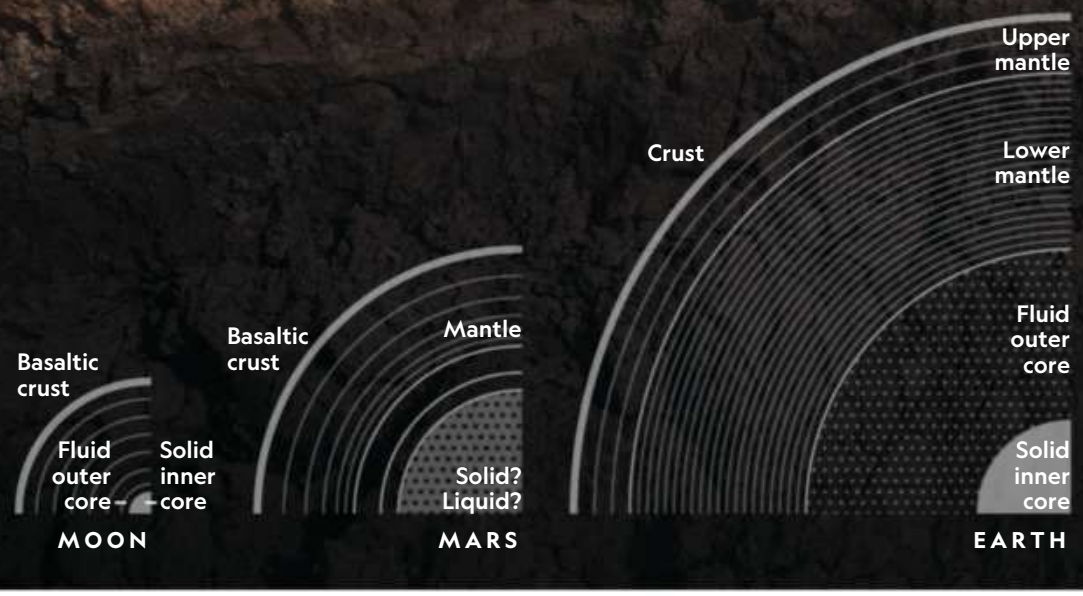
ILLUMINATING THE MYSTERIES—AND WONDERS—ALL AROUND US EVERY DAY

NATIONAL GEOGRAPHIC | VOL. 234 NO. 5

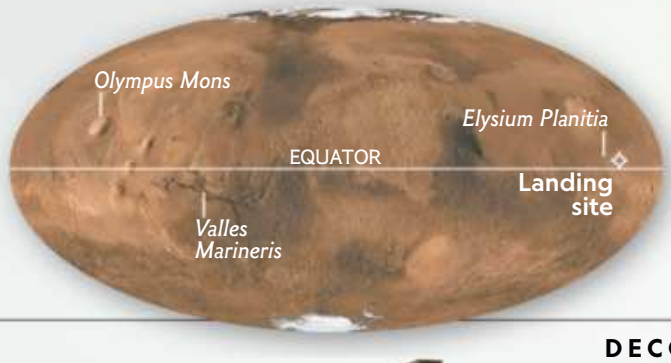
TAKING THE PULSE OF THE RED PLANET

NASA'S INSIGHT LANDER IS EXPECTED to set down along the sunny equator of Mars in late November. Its mission: Study Mars's ancient interior, a task that might shed some light on our own planet. That's because the same plate tectonics that give Earth its mountain ranges—and the conditions for life itself—have over eons transformed our ancient geology. Mars, on the other hand, has had a comparatively uneventful past three billion years, likely because it's too small to produce the energy for history-erasing tectonic shifts. So it might still hold clues to how rocky worlds, like ours, first formed and evolved.

Powering up
Two solar panels, large enough to run the remotely operated craft during a dust storm, unfold just after landing.



CORE QUESTIONS
Using instruments that measure **seismic activity, wobble,** and **internal heat,** the lander seeks to find out what makes up the core of Mars.



PLACE Elysium Planitia

LOCATION Mars

DISTINCTION The landing site is ideal because of its flat surface and low elevation. The site also gets enough light daily to power the lander and keep its electronics from freezing.

DECODER

BY **JASON TREAT**

Robotic arm

Radio transmitters

Solar panel

Prepping for exploration
A robotic arm with a mechanical hand and camera places a seismograph and a heat probe on the Martian surface.

Heat probe

Seismograph

1

Seismic activity
A seismometer will gauge vibrations from meteor impacts and "Marsquakes" caused by shifting rock. This could help determine the depth and composition of the crust, mantle, and core.

2

Wobble
Measuring the reflection of a radio signal sent from Earth to the lander will reveal the rotation of Mars's axis (precession) and the oscillations in that rotation (nutation), within four inches.

If Mars has a liquid core, its nutation will be more pronounced.

3

Internal heat
A probe will burrow into the soil to measure Mars's interior temperature. This could yield information on how heat flows inside Mars and why some rocky planets evolve plate tectonics and others do not.

16 feet below surface

ART: TOMÁŠ MÜLLER. MAP: MATTHEW W. CHWASTYK, NGM STAFF. SOURCE: BRUCE BANERDT, NASA

GENIUS

ABIGAIL ALLWOOD

BY **RACHEL HARTIGAN SHEA** PHOTOGRAPH BY **EMILY SHUR**

If there's ever been life on Mars, she could be the one to find it.

To discover the earliest signs of life on Earth, astrobiologist Abigail Allwood trekked to an isolated Australian desert. Now she's searching for signs of life from a distance, on a planet where she will probably never go.

Allwood works at the Jet Propulsion Laboratory and is a principal investigator for the Mars 2020 rover mission—the first mission, she says, with "the primary objective of searching for evidence of past life on Mars." Allwood's job is to examine the chemical composition of the red planet for evidence of ancient microbes.

For that she designed the planetary instrument for X-ray lithochemistry, PIXL for short. It looks like "a storm trooper's lunch box," she says, but underneath the white cover is the "most complicated instrument ever sent to the surface of another planet." Mounted on the arm of the rover, it will position itself with three pairs of legs, then move across the Martian surface in tiny 100-micron-size steps. As it proceeds, it will analyze the chemical makeup of different areas, mapping the elements distributed there.

Allwood hesitates to say what exactly she hopes to discover: "If you go with preconceived notions of what you need to find, then you'll be blind to what is there." But she is optimistic. "The chances of finding something on Mars that's *interesting* are high," she says. "We will have the ability to figure out what it is, one way or another."