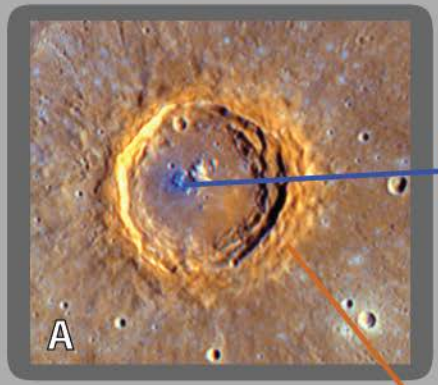
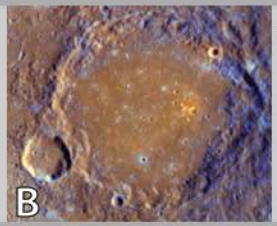
These color images are of features on the other side of this mosaic card. Can you find them?

Name: Calvino
Type: crater
Instrument: Wide Angle Camera (WAC), using 11 filters for this color-enhanced view



What is it? An impact crater created by an asteroid crashing into Mercury's surface.

Name: Rūdaki



These smooth plains are likely hardened volcanic lava that filled an old crater.

What do the colors tell us? Generally, enhanced-color images like this tell us about the distribution of rock types.

BLUE: The impact created a peak in the center of this crater. The peak is composed of material that came from as deep as 10 km below the surface, so crater peaks like this help us learn about what types of rocks are buried in this region of Mercury.

ORANGE: The impact formed the rim around this crater by excavating (digging up and moving) material in a process that exposes rock that would otherwise be buried by the brown rock surrounding the crater.

Are rocks on Mercury really orange and blue? Follow the URL to find out!

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Can you find other examples of overlapping craters on the front of this card and across Mercury?

Name: Schubert Type: Crater

Which came first...? Looking at a picture of Mercury's surface, what do you see? (Hint: CRATERS, and many of them!) Throughout its history, Mercury has been bombarded by meteoroids, asteroids, and comets, many of which formed craters as a result of their explosive impact. Craters and their relationship with other geologic features can help reveal the sequence of events that have shaped Mercury's surface over time. For example, can you tell which crater in the image is oldest?

SUPERPOSITION

Let's say you have a dish of flour with a perfectly smooth surface. Oops, you just dropped a pebble in the flour and look, you made a crater! It has a nice circular rim. (Try it!) Now try dropping another smaller rock on top of your crater near its rim and see what happens. Bam! Hey, the new crater messed up the rim of the first crater just like the picture above. When different geologic events cause successive changes to a planetary surface, you can often tell the order in which the events occurred by the concept of *superposition*. It states that the features on top were created **after** the features they have disturbed. Does this concept tell us exactly how old a features is? No! It only helps us determine whether a feature is younger or older than another feature. And even that is sometimes impossible to determine using this technique. For example, the small craters within the large one must have formed after the large crater, but can you tell which of the small craters formed first?

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Learn how superposition helps reveal the sequence of other geologic processes on Mercury

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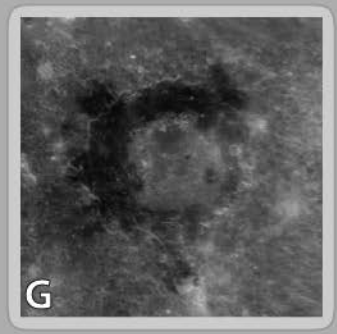
This crater is easy to find on the other side of this card. Can you find it on a global view of Mercury?

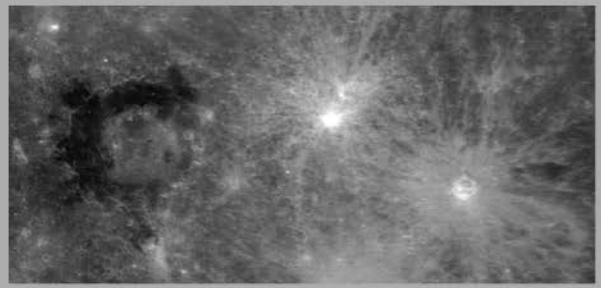
What is it? This crater seems to have a black eye. Is it encircled by shadow, or does it contain uncommonly dark material? Compare the craters in the photo below. Are nearby craters casting similar shadows? Or is this crater truly darker than its neighbors?



Name: Derain

Type: Crater with uncommonly dark material

Instrument: Narrow Angle Camera



Where are the shadows?

MESSENGER captured this image when the Sun was directly overhead, like high noon on Earth, so there are no shadows.

Why are some craters light and some dark?

When an object such as an asteroid, meteoroid, or comet smashes into the surface it causes an explosion. Material is thrown outward from the impact site, exposing subsurface materials. The light-colored rays are fresh or *immature* materials; in time they will darken to match their surroundings. However, the dark material encircling Derain is even darker than Mercury's mature color. Perhaps the explosion from the impact excavated some subsurface material that is different from the surrounding materials.

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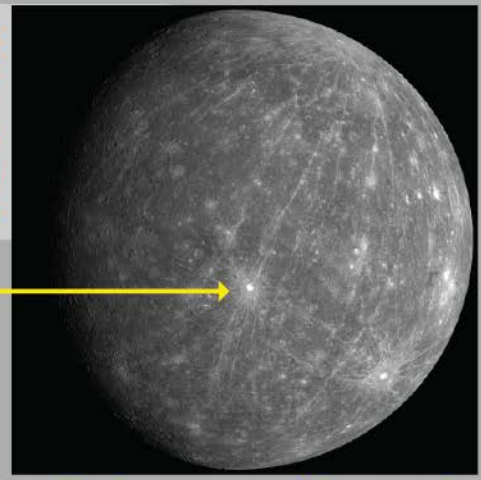
Follow the URL to learn more about rayed craters and mysterious dark craters!

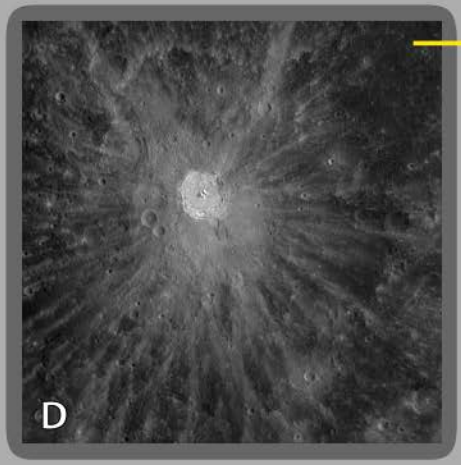
This is a larger view of a feature that is partially visible on the other side of this card. Can you find it?

What is it?

The light circular feature is an impact crater created by a meteoroid crashing into Mercury's surface. The resulting explosion ejected material radially outward, forming the bright rays you see here.

When you look at Mercury, what do you see?





Why are the crater and rays a lighter color?

The meteoroid impact is an explosion which excavates and exposes surface materials (such as rocks) that were previously buried. These fresh materials will darken over time, just like the surrounding materials. This process is called *space weathering*.

Name: Kuiper Type: Rayed crater

Explore more of the rayed craters that highlight the surface of Mercury, and see how they darken over time as they weather at this website:

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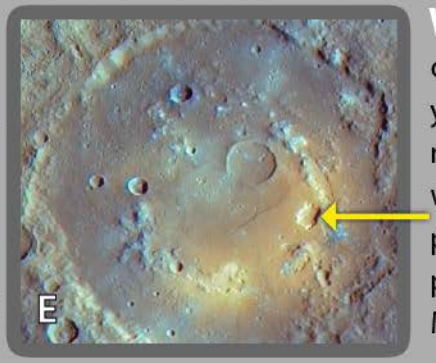
Two of these are close-up images of features from the other side of this card. Can you find them?

Name: Praxiteles
Type: Crater with probable vents and pyroclastic deposits

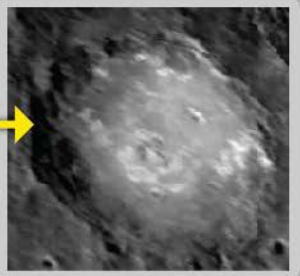
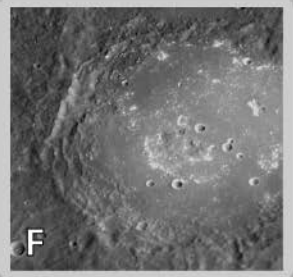


What is it? On the floor of this crater you can see irregularly shaped depressions (arrow). Image processing reveals deposits that appear yellow-orange in this enhanced-color view, indicating they are a type of rock different from the nearby materials. These deposits, when associated with the irregular depressions or vents, are thought to consist of pyroclastic material produced by explosive volcanic activity. Other probable vents and deposits with similar rock types occur elsewhere on Mercury.

Then and Now: Before MESSENGER, NASA's Mariner 10 was the only spacecraft to visit Mercury. That was 1975. Much of what we knew about Mercury came from that mission, with images like this one of the Lermontov crater:

Over three decades later, NASA's MESSENGER spacecraft is returning spectacular views of Mercury (see Lermontov crater, far right) along with other compelling data including surface composition. And this is only the beginning.

Name: Lermontov

What we saw then:	What we see now:
	
Spacecraft: Mariner 10	Spacecraft: MESSENGER

Type: Crater with probable vents and pyroclastic deposits

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What will we see from orbit? Check the URL for updates...

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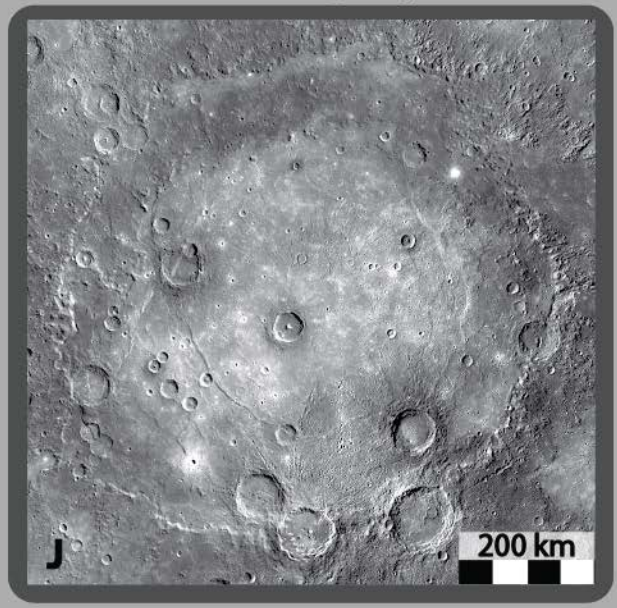
With over 40 large impact basins on Mercury, can you spot any on a global image of the planet?

Impact Basins on Mercury:

Mercury has over 40 impact basins that are greater than 300 km in diameter. Rembrandt, the second largest basin, is 715 km in diameter. For comparison, a crater the size of Rembrandt on Earth would span from Boston to Washington D.C. Although Earth has 7 times the surface area of Mercury, it has retained no impact basins as large as Rembrandt. Caloris, the largest impact basin on Mercury, is almost twice the size of Rembrandt.

What is it?

Rembrandt is a huge *impact basin*.



Name: Rembrandt Type: Impact Basin
Instrument: Narrow Angle Camera

An asteroid impact in the Arizona desert formed Meteor Crater 50,000 years ago. On Earth, this is an impressive crater. How does it compare to Rembrandt? Use a ball point pen to make a *tiny* dot on the picture of Rembrandt (left) and you will (*just barely!*) see the two impact features in the same scale!

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Where are the basins on Earth? Why are there so few? Follow the URL to find out!

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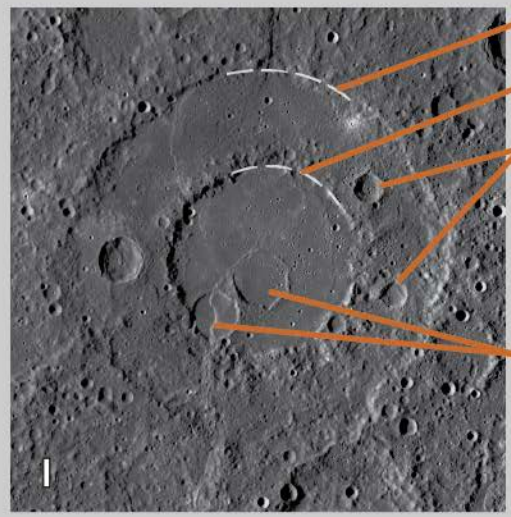
Did you know Mercury has the largest population of peak-ring basins in the inner solar system?

The Anatomy of a Peak-Ring Basin

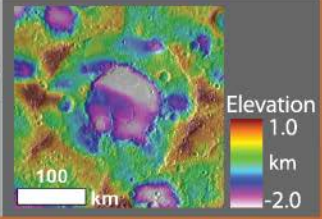


NAME: Renoir TYPE: Peak-ring basin
SCALE: Renoir is ~215 km in diameter
INSTRUMENT: Narrow Angle Camera

Game of darts, anyone? While this may look like a monochromatic bullseye, it is in fact one of over 100 *peak-ring basins* found on Mercury. They form when a 5-15 km diameter meteoroid crashes into the surface of Mercury, creating a basin that is 100 to 300 km in diameter.

How do they form? Great question! Scientists are still learning about how peak-ring basins form. Fortunately, Mercury is helping advance our understanding of this unique formation process with its numerous peak-ring basins to study. Our previous learning laboratory, the Moon, has fewer than 20 peak-ring basins.

Follow the URL to learn more about how they form and to see images that reveal the surface relief or *topography* of peak-ring basins on Mercury, such as this:



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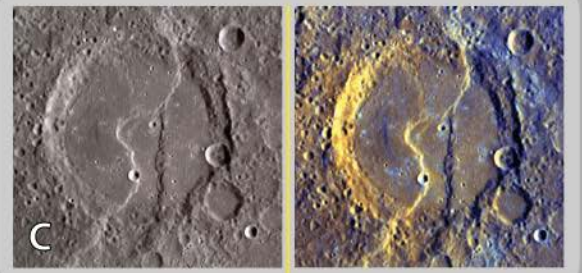
These images are of a prominent feature on the other side of this mosaic card. Can you find it?

Name: Thākur Type: Crater with lobate scarp Instrument: Wide Angle Camera (WAC)

Why are these images different colors?

Different combinations of filters were used to create these two views and highlight different aspects of the same features.



(LEFT) This image shows Mercury's surface as it might be seen by the human eye. There is scarcely any color variation, and the surface appears in shades of gray.

(RIGHT) 11 filters were used to create this enhanced-color image, revealing subtle differences in the composition of the rocks on Mercury's surface.

What is it?

Two cliffs or "scarps" intersect on the floor of the crater. These lobate scarps, as they are called on Mercury, likely formed as the interior of the planet cooled and shrank, thereby causing the outer crust to also contract and fracture. They can be as long as 1,000 km and up to 2 km high. (Perhaps when MESSENGER orbits Mercury in 2011, we will find longer and taller scarps.)

Did you know small lobate scarps are also found on the Moon? Follow the URL to learn more about where and how they form!

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