Where boudins occur in a surface outcrop, they are bounded by ductile faults made of softer material. Do the patterns of earthquake hypocentres in Lister and colleagues' boudin represent analogous faults? That interpretation is supported by the fact that they occur along continuous, near-vertical surfaces. The focal mechanism of each earthquake prescribes two possible fault planes — one nearly vertical and one nearly horizontal, as is typical of intermediate-depth earthquakes. The orientation of the presumed fault surface, including lateral variations along different edges of the boudin, is consistent with the more vertical plane.

In the absence of an observable surface rupture, however, confirming which of the two possible fault planes actually slipped is tricky. For individual earthquakes, seismologists typically identify the fault plane by analysing the rupture direction of the earthquake or by determining with high precision the location of aftershocks. The many large earthquakes beneath the Hindu Kush should supply ample data to perform these types of analyses and so to check Lister and co-authors' inferred fault-plane orientations.

The observed seismicity distribution and inferred fault-plane orientations beneath the Hindu Kush are remarkably different from those in oceanic subduction zones. In subducting oceanic lithosphere, the hypocentres of intermediate-depth earthquakes correspond to the pressure–temperature conditions associated with the dehydration of serpentine — the hydrated version of olivine, which is the main mineral of the oceanic plate — and so the earthquakes are commonly attributed to this dehydration process[6]. Within the subducting oceanic plate, the hypocentres delineate one or two distinct seismic zones (depending on the subduction zone) that are approximately parallel to and near the top surface of the subducting lithosphere (Fig. 1b). These seismic zones — which, in the case of a double seismic zone, converge with increasing depth — do not coincide with the orientation of the fault planes. Instead, the fault planes are approximately horizontal[7,8].

The form of Lister and colleagues' boudin[2], by contrast, indicates that the two seismic zones diverge with increasing depth and represent nearly vertical faults. That in turn suggests that the mechanism generating the earthquakes beneath the Hindu Kush may be different from that in oceanic subduction zones. Indeed, in the Hindu Kush, the subducting lithosphere is probably continental in origin down to a depth of at least 150 km (ref. 9), and is not hydrated as the oceanic lithosphere is. The Hindu Kush earthquakes, rather than marking the location of dehydration reactions, may instead result directly from detachment of the subducting lithosphere to form the boudin.

The observation of an actively detaching slablet raises the question of how the subduction geometry affects this process. Slab detachment by way of a laterally propagating tear has been modelled for longer subduction zones with substantial along-trench extents[10,11]. Starting from a point of weakness, stresses become concentrated at the tip of the tear, allowing the tear to propagate parallel to the trench. Slab detachment beneath the Hindu Kush may initiate in a similar way: a natural point of weakness would be present at the transition from subducting oceanic to continental lithosphere more than 150 km down.

These differences in detachment style and seismicity patterns between the Hindu Kush and oceanic subduction zones could have many causes. Further observations such as those of Lister *et al.*[2] should help us to narrow down what they are, and so close in on a global view of how the processes of subduction work.

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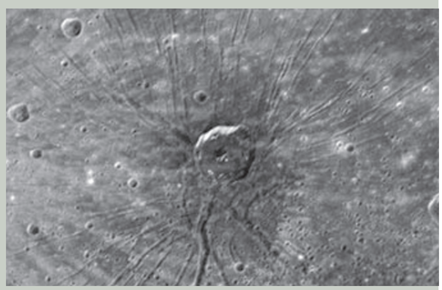
PLANETARY SCIENCE

Message From Mercury

On 14 January 2008, NASA's MESSENGER spacecraft made its closest approach yet to Mercury. After a three and a half year, two billion mile journey to the planet closest to the sun, the spacecraft beamed back high-resolution images that call into question the assumption that Mercury is geologically similar to the Earth's moon.

Planetary scans reveal extensive cliff formations left behind from fault activity early in Mercury's history. Impact structures also show distinct morphological differences from their lunar counterparts. The impact-derived Caloris basin, estimated to be 1,550 kilometres in diameter, has highly reflective interior plains — the opposite of what is seen in lunar craters. The team also discovered a unique feature in the middle of the basin, which they have nicknamed 'The Spider'. This formation consists of over one hundred narrow troughs radiating from a central region, which is marked by a potentially related crater. No similar features have been recorded before, either on the Moon or on Mercury.

MESSENGER is also armed with a complex array of sensors. An onboard magnetometer recorded variations in Mercury's magnetic field, and spectrometers were used to investigate the sodium and hydrogen tails that trail the planet for over 40,000 kilometres. The spectrometers are also expected to provide data about the mineralogical make-up of Mercury's surface.



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Project scientists are eagerly awaiting results from two more scheduled flybys and an intensive orbital mission, which are expected to bring even more surprising findings.

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