Astronomy

Ron Cowen reports from Washington, D.C., at the World Space Congress

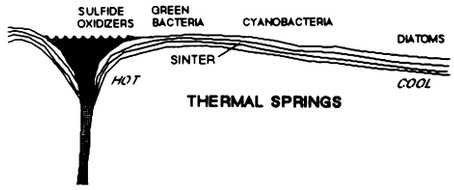
Looking for fossils of Martian life

On Earth, the crusty mineral deposits surrounding such geysers as Yellowstone's Old Faithful are chock full of fossilized bacteria and other simple organisms. Now, two planetary scientists suggest that the regions on Mars likely to have harbored now-extinct geysers or springs represent promising places to look for imprints of life on the Red Planet.

Researchers have speculated that while present conditions on Mars cannot support life, organisms may have existed there in the distant past, when water might have been more plentiful. For example, scientists have suggested that lakes may have covered parts of the planet more than 2 billion years ago; today those regions might hold fossils from that era.

But David J. Des Marais of NASA's Ames Research Center in Mountain View, Calif., and M. R. Walter of Macquarie University in Sydney, Australia, suggest that other places on Mars appear more likely to harbor fossils. They assert that hot springs — created when underground water rises to the surface after flowing through volcanic rock — may once have been common on the planet. Such springs, illuminated by sunlight and enriched in nutrients and minerals from dissolved rock, could have sustained simple organisms, Des Marais says. Moreover, when the springs cooled, silica-rich minerals in the water would have solidified on the Martian surface, trapping organisms in the cooling water. Thus, springs could have served as a nutrient source and preservation agent for primitive life.

Some scientists note that if springs ever existed on Mars, they probably covered fairly small surface areas. Their size might make it difficult to identify sites of extinct springs — and to hunt for fossils. Though NASA's Mars Observer can't search for fossils, it does carry a thermal emission spectrometer that can detect silica-rich mineral deposits just a few kilometers wide, Des Marais says (SN: 9/19/92, p.181). Some of those deposits may represent extinct springs or geysers, he adds. Upcoming missions, Des Marais says, "may open our eyes" to the notion of extensive geysers on the planet.



Des Marais

As underground water flows through Martian rock, it may emerge as a thermal spring. As it cools, the spring may trap organisms in the mineral deposits it forms.

The role of sulfur on Mars

Several bits of evidence, including the composition of meteorites that apparently have fallen to Earth from Mars, hint that the Martian interior may contain relatively high concentrations of sulfur. Heinrich Wänke of the Max Planck Institute for Chemistry in Mainz, Germany, says the high sulfur content could have influenced the evolution of the Red Planet in some intriguing ways.

He suggests that as iron sulfide and water vapor rose to the surface during volcanic eruptions, the sulfide would have reacted with the vapor to form sulfur dioxide, depleting the planet's underground water supply. Wänke thus suggests that the water that may once have flowed on the Martian surface probably originated at shallow depths rather than nearer the planet's core.

He also notes that liquid sulfur dioxide might have carved some of the channels that scar the face of Mars and that are sometimes attributed exclusively to erosion by water. Sulfur dioxide in the Martian atmosphere may also have acted as a greenhouse gas, warming frozen water on the planet's surface so that it could carve the channels, Wänke adds.

Behavior

Brains yield clues to obsession . . .

Two new studies described in the September ARCHIVES OF GENERAL PSYCHIATRY offer a peek at brain activity associated with the intrusive thoughts and ritualized behaviors that characterize obsessive-compulsive disorder (OCD).

In an extension of previous work (SN: 4/11/87, p.236), psychiatrist Lewis R. Baxter Jr. of the University of California, Los Angeles, and his colleagues find that both successful behavior therapy and successful drug therapy for OCD produce substantial drops in energy use by the right caudate nucleus, an inner-brain structure that helps regulate impulses involving sex, aggression, and various objects of disgust. As OCD symptoms improve, metabolism also declines in two related areas, the orbital cortex, which lies just above the eyes, and the thalamus, the scientists report.

These structures may participate in a brain circuit that malfunctions in OCD, allowing obsessive worries to overwhelm attention and control thoughts and behavior, the researchers say. However, they do not know whether problems with the caudate nucleus or any other brain area cause OCD.

The investigators used positron emission tomography (PET) scanners to study the brains of persons in three groups: nine OCD patients before and after 10 weeks of treatment with the antidepressant drug fluoxetine (Prozac), nine OCD patients before and after 10 weeks of behavior therapy consisting of strategies to diminish the force of their impulses, and four healthy controls before and after a 10-week interval. Comparable changes in brain metabolism appeared in the seven patients who improved on fluoxetine and the six whose symptoms abated with behavior therapy.

A second PET study, directed by psychiatrist Susan E. Swedo of the National Institute of Mental Health in Bethesda, Md., also found sharp drops in metabolism in the right orbital cortex among 13 OCD patients who improved after a year of drug therapy. Unlike Baxter's group, however, the NIMH researchers uncovered no changes in the caudate nucleus.

Baxter theorizes that successful OCD treatment first affects the caudate, slowing the unconscious rush of disturbing impulses, and gradually moves to the orbital cortex as conscious strategies to quell symptoms gain strength.

. . . but cerebral secrets persist

Despite these intriguing new findings, the causes of OCD remain largely mysterious, cautions NIMH psychiatrist Thomas R. Insel in a commentary accompanying the two PET scan reports.

Brain imaging studies have yet to demonstrate that a specific biological abnormality sparks OCD symptoms, he notes. Changes in metabolic activity linked with symptom improvement vary in PET studies conducted by Baxter, Swedo, and others, Insel points out. To make matters more complex, OCD patients undoubtedly display individual differences in their biological response to treatment, he asserts.

Moreover, in some brain diseases, areas of intense metabolic activity compensate for regions of sluggish activity that go undetected on PET scans. Thus, brain regions that chew up gobs of energy and light up PET scans are not necessarily the prime biological culprits behind OCD, Insel argues.

Increased orbital cortex metabolism among OCD sufferers, as measured by Swedo's group, may reflect mental attempts to resist disturbing urges and thoughts, Insel suggests; declines in orbital cortex activity with treatment may signal the reduced effort needed to control obsessive thoughts.

Future studies should obtain brain scans while people with OCD perform their rituals — such as washing their hands or rechecking a lock for hours at a time — or during behavior therapy as they attempt to resist inner urges, Insel says.