that their magnetic field lines become entangled. Eventually, the field lines reconnect into a more relaxed configuration, like twisted rubber bands suddenly unsnapping, and energy is released in a tremendous burst of x-rays, ultraviolet radiation, and visible light.

The nine sunlike stars don't have a close companion, but "a similar interaction could occur with a Jupiter-like planet orbiting the star at close distance," says Rubenstein. Over the last couple of years, many of these "hot Jupiters" have been found around sunlike stars. He says the sun is relatively quiet because Jupiter and Saturn, with their strong fields, orbit at a safe distance.

For the model to work, the superflaring stars should have strong magnetic fields. "We've checked the field strengths for two of them" by studying the stars' spectra, says Schaefer, "and they both turn out to have very strong fields." According to Rubenstein, "the model doesn't need any new physics. We know stars with strong magnetic fields exist. We know hot Jupiters exist. And the model provides a natural explanation for the fact that the sun doesn't have superflares."

Solar flare expert Kees de Jager of Utrecht University in the Netherlands is cautious, however. "It's always easy to come up with a qualitative model," he says. "I'd like to see a quantitative analysis" of whether the interaction of a star's magnetic field with a planet's really could lead to the observed energetic bursts. Rubenstein agrees. "I'll have to work on that before submitting a paper," he says.

Meanwhile, Schaefer thinks that watching for flares could guide searches for extrasolar planets. He proposes building a wide-angle telescope with a dedicated camera, which could scan over a million sunlike stars every night. "Superflaring stars might be the ones planet hunters should pay more attention to," he says. **–G.S.**

Cosmic Expansion, Poco Adagio

An exploding star called Albinoni, shining from when the universe was less than half its present age, is providing astronomers with a fresh handle on a mysterious energy that seems to permeate the cosmos and boost its expansion rate. A preliminary analysis of Albinoni—at roughly 9 billion light-years away the most distant supernova ever seen—hints that at the farthest distances and earliest times yet probed, the expansion may not have been accelerating as it appears to be doing today. That's just what theory predicts, Saul Perlmutter of Lawrence Berkeley National Laboratory in California said at the meeting.

Perlmutter, who leads one of two international teams that discovered the accelerating expansion from less distant explosions (*Science*, 18 December 1998, p. 2156), stressed that "we just have had a chance to look at our discovery image and make a rough estimate of the brightness of the supernova." The apparent brightness of supernovae is a measure of their distance, and therefore of the rate at which cosmic expansion has swept them away over billions of years. The supernovae studied up to now were a little dimmer, and hence farther, than expected, implying that cosmic expansion has sped up since they exploded.

Extremely distant supernovae, shining from well back in cosmic history, should reveal a change in the cosmic push at the earliest times if the background energy, called the cosmological constant, or lambda, is real. That's because the density of this energy throughout space should be constant for all time, so the push it produces to counteract gravity and accelerate expansion is also constant. In the early universe, where the same amount of gravitating matter as today was packed into a smaller volume, gravity would have been strong enough to overwhelm lambda and slow the expansion. Lambda would win out and produce an accelerating universe only in the last few billion years, as gravity's grip weakened.

Albinoni, spotted late last year, seems to be a little brighter—hence nearer—than it would be if the expansion had been accelerating continuously since it exploded. Perlmutter stresses that this conclusion could change with further observations and analysis. But for now, it shows the power of distant supernovae for distinguishing between the cosmological constant and possible confounding factors, such as dust. If a haze of cosmic dust, rather than an accelerating universe, is what dims the nearer supernovae, distant supernovae should also be anomalously dim, not bright, said Robert Kirshner of the Harvard-Smithsonian Center for Astrophysics, a member of the other supernova team who spoke at the same session. "Pushing to bigger [distances] is definitely the way to see the effect of the lambda cosmology as distinct from dust," explained Kirshner, who said that his own team is also chasing remote explosions. **–JAMES GLANZ**

MEETING AMERICAN GEOPHYSICAL UNION

New Data Hint at Why Earth Hums and Mountains Rise

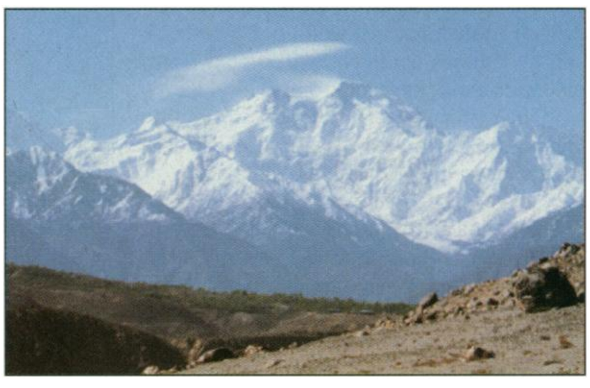
SAN FRANCISCO—Topics ranging from the atmosphere to the inner Earth were served up at the annual fall meeting of the American Geophysical Union here last month. Below, we report two surprising new ideas on how the solid Earth interacts with the atmosphere and with the water on its surface: why Earth hums and how a river may be able to raise a mountain.

Big Rivers May Make Big Mountains

Everyone knows that rivers whittle down mountains, but at the meeting an international team of researchers stood that idea on its head, at least for some of the world's tallest peaks and most powerful rivers. The team concluded that Nanga Parbat, the "killer mountain" of the Himalayas and the sixth highest mountain in the world, reaches its lofty zenith because the nearby Indus River triggers a deep-seated rise in the Earth's crust.

According to a group of geologists and geophysicists led by geochronologist Peter Zeitler of Lehigh University in Bethlehem, Pennsylvania, rapid erosion by the Indus creates a "tectonic aneurysm"—a weak spot in the crust where deep, hot rock bulges upward and carries Nanga Parbat up with it. "They've got a diverse array of evidence that this is real," says geomorphologist Robert Anderson of the University of California, Santa Cruz. "I'm excited about the idea." If the causative link between river and mountain is confirmed, it would be a new way to make the planet's highest ground.

Mountaineers are in awe of Pakistan's 8125-meter-high Nanga Parbat, the last big peak at the western end of the Himalayan chain. And the mighty Indus snaking nearby is a fitting companion. In spring, snowmelt



A river ran it up? Nanga Parbat may owe its towering heights to the Indus River that runs beside it.

CREDIT: P. ZEITLER/LEHIGH UNIVERSITY

over 100,000 square kilometers of high terrain creates monstrous cataracts as the river flows south and falls off the edge of the Tibetan Plateau. The 7-kilometer elevation difference from the top of Nanga Parbat to the Indus 25 kilometers away is the greatest single vertical drop on land.

Not only is Nanga Parbat tall, it seems to be rising at a geologically dizzying pace. Recent rock analyses by the Nanga Parbat Continental Dynamics Project, a collaboration of 26 researchers from the United States, Pakistan, New Zealand, and France, has confirmed that the rock of the mountain rose an average of 3 to 6 millimeters per year during the past 3 million years, for a total rise of 9 to 18 kilometers, although much of the upthrust rock has now been sheared away by erosion. Beneath the mountain, seismic and electromagnetic probing reveals a mass of hot and therefore weak rock. That hot rock fuels Nanga Parbat's unusual hot springs and seismic activity—but one would expect a mountain with such weak underpinnings to sink, rather than rise. Other rapidly rising Himalayan peaks such as Everest, for example, are supported by many kilometers of cold, rigid rock.

To explain Nanga Parbat's incongruous heights, Zeitler and his colleagues propose that the erosive power of the Indus drives a cycle of crustal weakening and uplift. In their scenario, erosion weakens the crust in two ways. First, the Indus cut through the Himalayan crust as rapidly as the collision of India with Asia pushed it up. This erosion thinned and weakened the crust there, much as a groove filed in a piece of glass creates a weak spot. And because the collision of India and Asia is compressing the crust, the weak spot becomes the easiest place for the crust to bulge upward.

In the second weakening process, as the river's erosion removed weight from the upper crust, deeper, hotter crust rose rapidly to replace the missing mass. Hotter rock is weaker, so the crust weakened further and bulged upward even more. As the hot rock rose and the pressure on it was reduced, some of it melted, further weakening the rock in a positive feedback loop that accelerated the swelling of the crust. In a model run by the project's geodynamic modeler, Peter Koons of the University of Otago in New Zealand, the runaway bulging of a tectonic aneurysm takes off when a river removes about 5 kilometers of crust, or about a million years' worth for the Indus. Less powerful rivers can't remove rock fast enough to get the feedback going.

"It's a very interesting idea," says Anderson. "The localization of [the Nanga Parbat uplift] is quite dramatic; I don't think it's a coincidence" that it lies next to an equally dramatic downcutting by the Indus. But not everyone is ready to believe that rivers can lift mountains. "Big rivers don't make big mountains everywhere they go, [and] there are other 8-kilometer mountains without rivers," notes geologist Lincoln Hollister of Princeton University.

Hollister thinks that crustal weakness and uplift at Nanga Parbat instead largely stem from a broader regional cause, namely the India-Asia collision itself. The peak sits at a narrow corner of the Indian plate, where compressional forces are intensified. They may be shoving lower crust upward more strongly in that spot, he says, leading to melting and runaway weakening.

Zeitler and his colleagues respond that they have identified a similar juxtaposition of big mountain and big river—Namche Barwa massif and the Tsangpo River—at the eastern corner of the Indian plate, where the geometry is different and there's no reason to suspect that tectonic surging is at work. Resolving the question, says Zeitler, may require determining whether, as the tectonic aneurysm mechanism would predict, Nanga Parbat and Namche Barwa first popped up at the same time as their rivers began spilling off the plateau.

CREDIT: TERRY E. SMITH

Earth Seems To Hum Along With the Wind

Last year some seismologists pricked up their ears to an odd sound. The whole planet vibrates with a deep, soft hum, they said, far below the range of human sensation and imperceptible to all but the most sensitive seismographs. The claim was met with some surprise, especially because no one knew what could be prompting such a steady, whole-Earth oscillation; the big earthquakes that can set Earth clanging like a bell are too rare. But at the meeting, it was clear that seismologists now accept the reality of the hum, and one group presented data suggesting that the winds of the atmosphere, rather than something within Earth, excite the hum.

Seismologists have been recording Earth's bouts of ringing ever since the great Chilean earthquake of 1960 (magnitude 9.5) set the entire planet vibrating for days on end with oscillations that moved the ground up and down as much as a centimeter. Even quakes as small as magnitude 6 can set Earth ringing, albeit far more quietly. But generating the low hum detected last year, which has periods of 3 to 8 minutes, would require a continual string of magnitude 5.8 earthquakes, according to seismologist Göran Ekström of Harvard University. Such quakes strike on average only every few days—but Earth keeps humming day in and day out, with only occasional dips in intensity, according to Ekström's analysis.

Because the hum had no obvious cause, researchers were at first skeptical, but acceptance grew as more and more credible observations came in late last year. And because known earthquakes seemed unable to power it—all the world's smaller earthquakes summed together still seemed too weak—some seismologists suggested that small undetected quakes, perhaps in the ocean floor, might be at work. Others looked to wind, ocean currents, or even lurching tectonic plates.

At the meeting, seismologist Naoki Suda of Nagoya University in Japan and his colleagues reported a hint that winds are responsible. They summed 50 to 80 days of seismic records at four especially quiet sites around the globe, removed background noise, and found that the hum tended to wax and wane throughout the day with a global rhythm. Wherever the site—Europe, South Africa, or central Asia—the hum was strongest from noon to 8:00 p.m. Greenwich time and weakest from midnight to 6:00 a.m. That's the same pattern of activity followed by the sum of the world's thunderstorms, notes Suda: Overall, storm activity on Earth tends to increase as the sun stokes storms over Africa and southeast Asia and decrease as night falls on those particularly intense centers of storm activity. The correlation is preliminary, he adds, but it supports the idea that the turbulent winds of thunderstorms striking the surface are setting up the seismic hum.

Although "everybody now agrees that these [oscillations] are real," says seismologist Guy Masters of the Scripps Institution of Oceanography in La Jolla, California, "I don't think the wind-stress mechanism has been proved." He and others want to see more daily records from more sites processed in other ways before they give up on an Earth-based mechanism. Of course, these seismologists have their own biases. Says one: "I'm hoping it's something internal to Earth, because that's more interesting."

–RICHARD A. KERR