SCIENCE NEWS of the week

Rocking the Fold: A New Crustal Model

After seven years scrutinizing gnarled rock formations and radar images of the central Appalachian Valley and Ridge province, geologist Howard A. Pohn has come up with an idea. Well, several ideas, really, that tie together into a new model of the geologic structure and evolution of the crust that lies, largely unseen, below the eastern United States.

Pohn's presentation of his model last week at the U.S. Geological Survey in Reston, Va., where he works, piqued the interest of geologists in the audience, but most cautioned that Pohn's ideas are still highly speculative. Nonetheless, if his model pans out, it could change the way geologists think about the tectonics, or crustal movement, of the eastern U.S. thrust belt and even, perhaps, have a bearing on the shape of the Mid-Atlantic Ridge. On the more practical side, Pohn's model could prove a valuable tool in hunting for gas reserves and future earthquake sites.

Geologists believe that the Appalachian Mountains were formed over 250 million years ago when Africa and Europe collided into North America, causing the crust to buckle and fold and fracture. Some of the fractures traveled through the relatively weak layers of shale to form large horizontal faults called decollements. And from these flat decollements sprang up a system of smaller, vertical faults called splays that reach for the surface like tree branches. Pohn reasons that if a decollement formed close to the surface, many of its splays would be strong enough to reach the surface. Splays from deeper-lying decollements would have less of a chance to break ground.

With the help of seismic profiles and field studies of rock outcrops, Pohn saw evidence for the splays coming up to the surface, and for those that did reach that far, he found that they tended to lie between one hill-like fold and the next. This means that where the decollement is shallow and many splay faults reach the surface, the folds will be narrow and closely spaced; deep decollements result in wide folds at greater distances from one another.

In analyzing aerial radar pictures that highlight the topography of the area, Pohn found that the spacing and width of folds changed abruptly from region to region — indicating that the decollement level jumped between regions too. These abrupt changes, he concludes, mark east-west running thrust faults or "lateral ramps." So far, in a study area stretching from New York to Alabama and Georgia, he has found about a dozen such ramps.

Pohn believes that these ramps formed in areas that were weakened by large faults in the older (Precambrian) underlying basement rocks. Moreover, he suggests that the motion of these basement faults controls the movement of the lateral ramps. Until 1964, he says, people thought that the Appalachian folds were rooted all the way down to the basement. Then two geologists, using seismic and drill-hole data, hypothesized "thin skin tectonics" in which folding above the decollements is independent of what occurred below. "What I'm now suggesting is that neither model is exactly right," Pohn says. "We're indeed looking at thin skin tectonics, but it is controlled by what's going on in the basement."

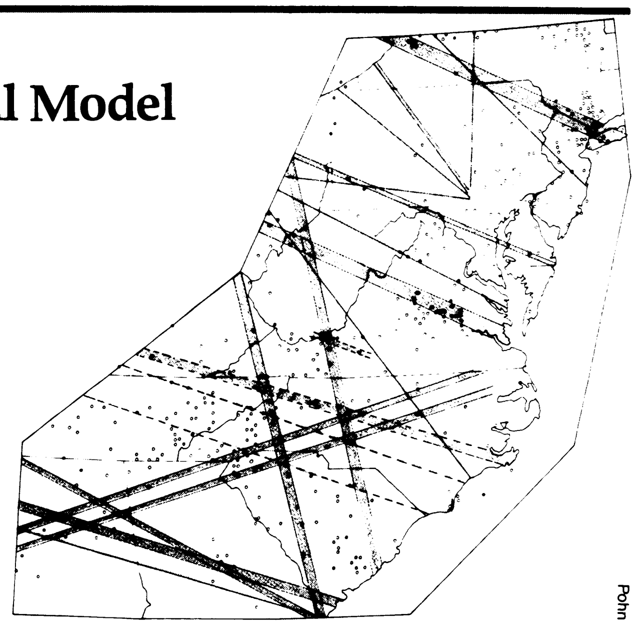
A bit of evidence that Pohn finds consistent with his model is his finding that more than 35 percent (perhaps as high as 50 percent) of modern eastern U.S. earthquakes happened on lateral ramps, which he says account for only 5 to 10 percent of the eastern U.S. land area. However, he has yet to do a rigorous statistical analysis.

Another supporting line of evidence is the fact that few if any gas reserves have been discovered on lateral ramps, while productive fields lie right beside the ramps. Pohn argues that the intense and long history of fault movement in the lateral ramps would make it easy for gas to escape. In the nearby regions, which have been relatively quiet since the Appalachians formed, Pohn suspects that gas reservoirs might be trapped by overlying layers of shale. An extensive scientific drilling project in the Appalachians, such as the planned Continental Drilling Program, would test both Pohn's model and his idea about gas sites. He also says that seismic profiles of the region by oil companies clearly show the lateral ramps. Unfortunately, the data are proprietary, so they can't be judged by other geologists.

Pohn's most exciting and speculative extension of his model is to link the lateral ramps with the transform faults that run through the Atlantic ocean floor from America through the Mid-Atlantic Ridge and on to Europe and Africa. The most popular view is that the transform faults originated at the ridge itself as new seafloor was created. In contrast, Pohn believes his model and data support the idea that the onshore basement faults, which predate the opening of the Atlantic, acted like a mold or template into which the rising magma fit, leaving behind a segmented and disjointed ridge as the continents parted.

Pohn's colleagues appear least sanguine about this last idea. And they emphasize that all of Pohn's proposals require further study. His main contribution, says one geologist, is in identifying places for the ramps and in bringing into focus the possible relationship between surface folds and deeper-lying features in the crust.

"Whether or not every part of his theory is correct," says another, "Pohn has taken the interpretation of structural geology ahead some distance." —*S. Weisburd*



Pohn

In Pohn's model, a series of "lateral ramps" stripe the eastern United States. Dots denote modern earthquakes located over ramps; circles are epicenters in other areas. Pohn thinks that in the southern Appalachians, ramps once pivoted with the upper rock layers from the dashed line direction to a more north-south bearing (solid lines).

Artificial heart No. 3

Physicians at Humana Hospital Audubon in Louisville, Ky., this week gave an upbeat report for Murray P. Haydon, the third recipient of an artificial heart; the heart was implanted Feb. 17. Unlike his predecessor, William J. Schroeder, who needed a second operation to correct massive bleeding shortly after his Nov. 25 heart implant, Haydon, as of Wednesday, had no complications. Doctors say Haydon's chances for a full recovery are good because he was healthier at the time of the implant than the previous two recipients, Schroeder and Barney B. Clark.

By midweek, Schroeder was recovering from an unexplained fever that started about three weeks ago. □